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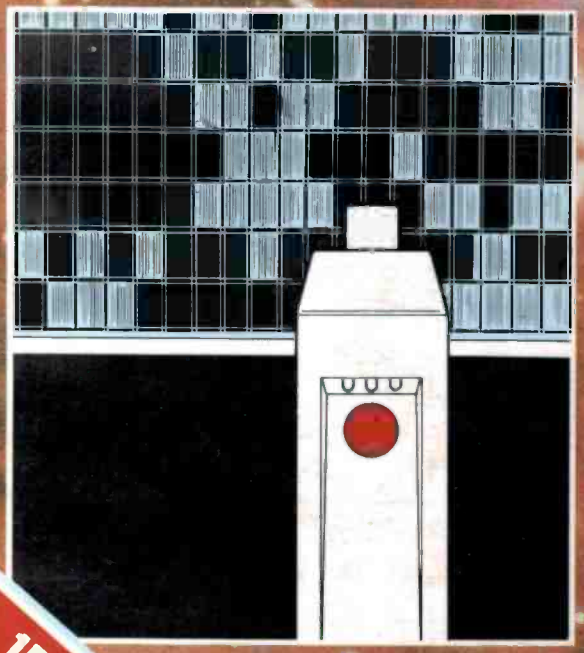
eti ELECTRONICS TODAY INTERNATIONAL

7 HIP STEREOS REVIEWED

HITCH-HIKER'S GUIDE TO THE INFRARED GALAXY

LIGHT PEN FOR THE MICROBEE



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THE PRINTER PEOPLE' SPECIALS

NEW CP-80 PRINTER

SPECIFICATIONS

Functional Specifications

Printing method — Serial impact dot matrix
Printing format — Alpha-numeric — 7 x 8 in 8 x 9 dot matrix field. Semi-graphic (character graphic) — 7 x 8 dot matrix. Bit image graphic — Vertical 8 dots parallal. horizontal. 640 dots serial/line
Character size — 2.1mm (0.083")-W x 2.4mm (0.09")-H/7 x 8 dot matrix
Character set — 228 ASCII characters; Normal and italic alpha-numeric fonts, symbols and semi-graphics
Printing speed — 80 CPS, 640 dots/line per second
Line feed time — Approximately 200 msec at 4.23mm (1/6") line feed.
Printing direction — Normal — Bidirectional, logic seeking. Superscript and bit image graphics — Unidirectional, left to right
Dot graphics intensity — Normal — 640 dots/190.5mm (7.5") line horizontal. Compressed characters — 1.280 dots/190mm (7.5") line horizontal
Line spacing — Normal — 4.23mm (1/6"). Programmable in increments of 0.35mm (1/72") and 0.118mm (1/216")
Columns/line — Normal size — 80 columns. Double width — 40 columns. Compressed print — 142 columns. Compressed/double width — 71 columns. The aboves can be mixed in a line.
Paper feed — Adjustable sprocket feed and friction feed.
Paper type — Fanfold. Single sheet. Thickness — 0.05mm (0.002") to 0.25mm (0.01"). Paper width — 101.6mm (4") to 254mm (10").
Number of copies — Original plus 3 copies by normal thickness paper.

Mechanical Specifications

Ribbon — Cartridge ribbon (exclusive use), black
MTBF — 5 million lines (excluding print head life)
Print head life — Approximately 30 million characters (replaceable).
Dimensions — 377mm (14.8") -W x 295mm (11.6") -D x 125mm (4.9")-H incl. sprocket cover.

Parallel CP80 $495 plus tax **Serial CP80 $595 plus tax**

STAR PRINTER

SPECIFICATIONS

Printing system — Impact dot matrix
Interface — Centronics standardized parallel Interface (TTL level) built in printer
Matrix — Character mode: 9 x 7 matrix. Graphic mode: 6 x 6 matrix
Printing direction — Character mode: Bi-directional printing with logical seeking function. Graphic mode: Uni-directional printing from left to right
Number of characters per line — 80/96/131 (40/48/66 for double-width characters)
Printing speed — 80 characters/sec
Character set — JIS 160 codes/ASCII 96 codes + International character codes 64 graphics patternms
Character size — 2.0 (W) x 2.6 (H) in mm In case of 80 columns/line
Character space — 2.54mm (1/10 inch) In case of 80 columns/line
Line space — 1/6, 1/8 or 1/12 inch
Paper feed system — Friction type: Friction feed. Tractor type: Variable sprocket feed or friction feed
Line feed speed — 7.5 lines/sec at 1/8 spacing. 10 lines/sec at 1/8 inch spacing
Buffer capacity — 2K bytes
Other important functions — Form feed. Diagnostic printing. No-paper detection. Buzzer

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M4854

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COMMENT

IT SEEMS the age of the 'personal robot' is virtually upon us. It was but five scant years ago that the 'personal computer' made its debut — and just look what happened! It's now a multi-billion dollar industry on a worldwide scale. What the ultimate social and industrial effects of the computer 'boom' will be, we are yet to see. The implications for us with a similar boom in robotics are difficult to contemplate.

But, just as the personal computer is now well and truly a fact of everyday life, robots — at all sorts of levels, right down to the personal robot — seem set to develop along parallel lines. With personal computers it has already reached the stage where they are made and marketed virtually as 'toys'.

Industrial robots have long been with us, and their rate of increase and application proceeds apace. Tertiary institutes in this country are turning their attention more and more to the subject, and at least one has set up a department of robotics.

Just as personal computers advanced the march of computers into everyday life, so personal robots are being introduced to do the same job. The number of US companies making and marketing personal robots a year or so ago could be numbered on one hand. It seems there are now five or six times that many — and the growth rate is accelerating.

Will robotics enrich our working environment and advance our sophistication, are they job destroyers — or are they going to become more "... toys for a bored consumer society"?

The next 12-24 months will tell.

Roger Harrison
Editor

Roger Harrison

NEXT MONTH

FET COOKBOOK
Another 32-page cookbook chock full of data and circuits on VFETs, MOSFETs, JFETs and BiMOS and BiFET op-amps. Not to be missed!

VIDEO DISTRIBUTION AMPLIFIER
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20 MHz HANDHELD DIGITAL FREQUENCY METER
This project features a 4½-digit liquid crystal display and is completely portable as it's battery powered. It counts to 20 MHz in four ranges — 2 kHz, 20 khz, 2 MHz and 20 MHz — and features the Intersil ICM7224IPL CMOS counter chip.

SIX COMPACT DISC PLAYERS REVIEWED ▲
Is digital audio all it's cracked up to be, or are the players letting the side down? The first full technical review in Australia of six top brands shows some surprising results!

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Print weather maps on your computer using our 'Picture Plucker' decoder project. This simple project, similar to our popular Radioteletype to computer decoder, connects between the audio output of a shortwave receiver and the 8-bit port of a Microbee or other computer.

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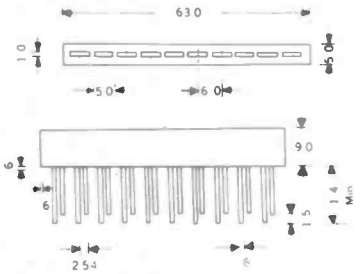

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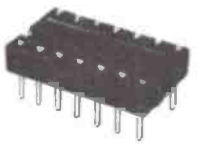

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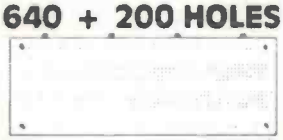

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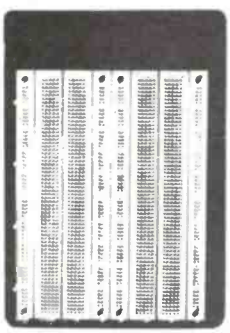

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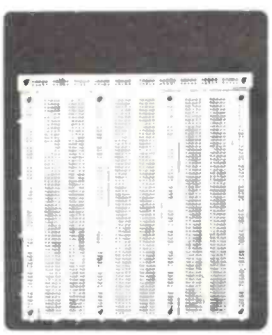

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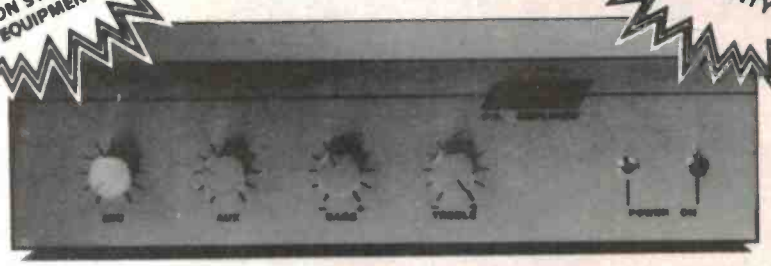

The AS-20 is a rugged, reliable general purpose public address amplifier. Designed and manufactured in Australia this amp is suitable for use by schools, sporting clubs, function centres and in professional installations (paging systems, background music).

INPUT CONNECTORS MIC . . . 5 pin DIN
AUX . . . RCA

- Balanced Low Z mic input
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- Mic muting function (mutes program music with PA announcement)
- 4-16 OHM output ☆ AUX Treble and Bass controls
- 100V Balanced line output
- Full 20 Watts RMS into 8 OHMS
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- Less than 1% Distortion.

WHY PAY OVER $200.00 FOR AN INFERIOR UNIT?

A2000 . . . . . Amazing Low Price **$149.00**

PROFESSIONAL

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BOTH MODELS FULLY WEATHER PROOF

NOW IN USE WITH THE WEST AUSTRALIAN EDUCATION DEPT AND PWD

30 WATT WITH LINE TRANSFORMER

Multitap inbuilt line transformer allows taps 330/30W, 660/15W, 1000/10W, 2000/5W. Universal swivel mounting bracket supplied.

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15 WATT WITH LINE TRANSFORMER

Multitap inbuilt line transformer allows Z taps 660/15W, 1K/10W, 2K/5W, 4K/2.5W. Mounting bracket clears line T X allowing rear wall mounting.

C2030 . . . . . **$59.95**
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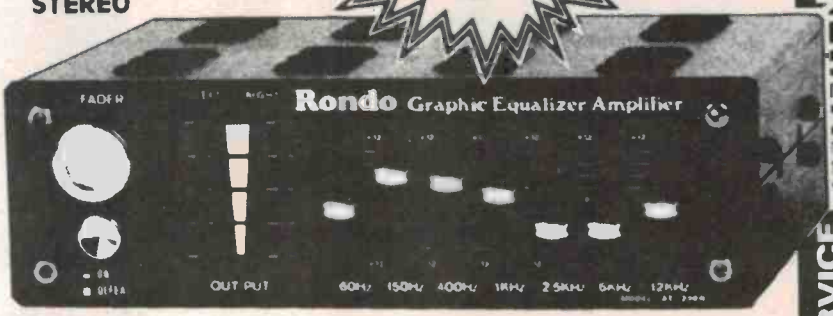
7 BAND GRAPHIC EQUALIZER

C9132 $49.50

30W + 30W STEREO



Hi Fidelity sound reproduction is difficult to achieve in the acoustic environment known as the car, mechanical and road noise combined with large expanses of glass and hollow panels don't provide for the ideal sound. This powerful 30W + 30W stereo equalizer enables electronic **accoustic compensation of both resonances and deficiencies in quality. The sheer power overcomes all noise problems.**

Features ☆ Led power indicator ☆ Seven frequency bands ☆ Front-rear fader.

Output Power	30W + 30W
Distortion at 1 kHz	0.5% Max.
Frequency Response	35 Hz — 25 kHz
Tone Control	7 control 60 Hz, 150 Hz, 400 Hz, 1 kHz, 2.5 kHz, 6 kHz, 12 kHz
Control Range	± 12 dB Min.
Crosstalk	41 dB Min.
Power Source	(DC 11V — 16 V)
Dimensions	155W x 45H x 140D

Well designed circuitry — easily obtain smooth bass and crisp top end.

Suitable for negative ground vehicles.

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Over 1200 pages covering 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.
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MOTOROLA MEMORY DATA
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An absolute must for the microprocessor buff. This is the latest reprint of Motorola's famous Memory Data Manual and includes all the latest specifications and design application data on TTL RAM, TTL PROM, MECL MEMORY, MECL RAM, MECL PROM, MOS dynamic RAM, MOS static RAM, MOS EPROM, MOS EE PROM and MOS ROM.
Worth many dollars more!

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Essential reference for the enthusiast and engineer alike. Designing, building and servicing digital circuitry is an absorbing pastime. Data for the LS, ALS and FAST families along with design considerations and circuit characteristic are logically presented in this manual, making it quick and easy to use.

FOR DESPATCH P&P CHARGES AND ADDRESS DETAILS PLEASE REFER TO OUR AD. ON PAGE 83

Judge urges more communication by scientists

Computerists should be learning to communicate with the rest of society, according to Mr Justice Kirby, the chairman of the Australian Law Reform Commission.

Addressing the International Conference on Tertiary Education for the Age of Communications, held at the Royal Melbourne Institute of Technology, Mr Justice Kirby said the impact of computerisation on Australian tertiary education was proceeding "in isolation and in an unco-ordinated fashion." This was largely due to insufficient communication between different faculties and departments.

Computers should be thought of "as electricity was at the beginning of this century — its implications for every aspect of life will be just as profound."

He called for computer technologists to play an active part in opening up dialogue between different faculties in Australia's tertiary institutions.

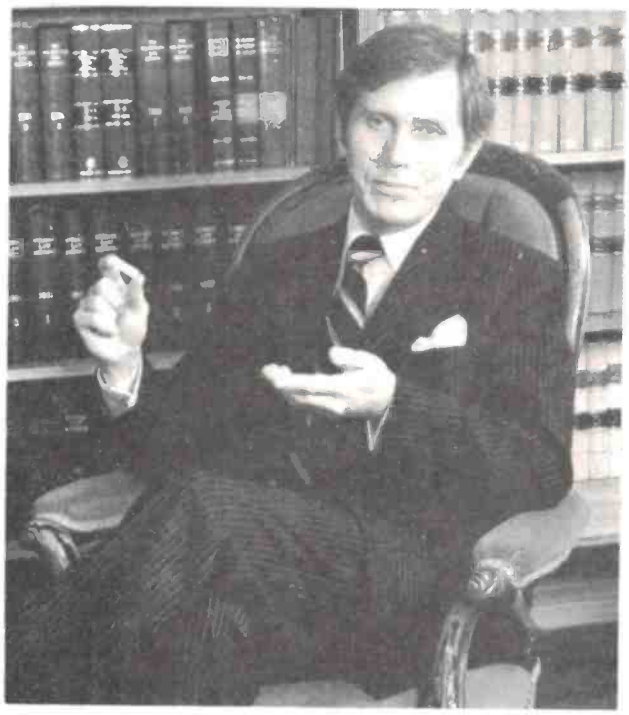
"I hope that the universality of communications technology will result in an acceptance by communications scientists and technologists of their obligation of dialogue," Mr Justice Kirby told the conference.

"We must break down the barriers between the faculties. We must remove the walls between the departments and the schools.

"The new information and communication technology will facilitate a return to the universe of knowledge. And in doing this, it may provide an explosion of lateral thinking and interdisciplinary creativity, muted by more than a century of living separately and apart under the same roof.

"In the age of reconciliation, let the disciplines be reconciled."

Mr Justice Kirby also urged provision of adequate funding for computing departments to meet, in times of 'no growth', community and market pressures for computer graduates.



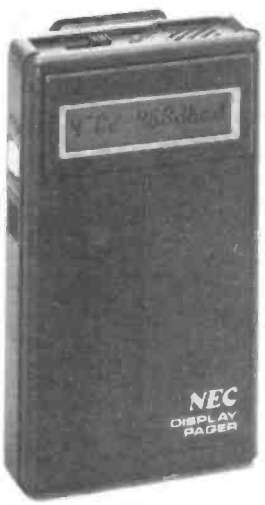
Pocket pagers display words

A pocket pager which displays sentences on a small LCD screen should be available in Australia by the end of the year.

NEC already markets an advanced, microprocessor-controlled display pager, which comes in low-band R1D3-1B and high-band R3D3-1B models. This pager, which weighs 120 g, can store up to 40 digital characters, comprising numbers and the letters a, b, c and d, in its memory.

However, the new pager, now being developed for NEC, will have both numerals and the complete 26-letter alphabet.

On the existing model, the 40 characters can be screened up to 20 per message on the LCD screen, in the form of telephone numbers to be called by the user. Up to four separate phone numbers can be stored in the mo memory, and the a, b, c and d is used to code the numbers in order of importance.



Invention earns Government grant

A signal sampling and conversion system has earned a $3310 grant from the Federal Department of Science and Technology's Assistance to Inventors Scheme.

David Spalding, of Castle Hill (NSW), has designed an electron-beam system that processes and analyses complex and fast electronic signals.

Announcing the grant, the Minister for Science and Technology, Mr Barry Jones, said the invention could have important applications in advanced computer and communication fields.

The grant will be used to fund the design and manufacture of optical photodiode arrays and integrated circuits for the system.

Jobs for the boys

Basic skills in electronics are being taught to young people at Sydney's Strathfield Technical College, as part of a Transition Education Programme to assist unemployed youth to find work in electronics.

The Strathfield Technical College courses, which are geared to the employment needs of the 15-19 age group, are full-time and run from 12 to 18 weeks.

Those participating receive a transition allowance which is equivalent to the unemployment benefit plus $6 a week, as well as travel and health-benefit concessions, a $30 book allowance and a living-away-from-home allowance.

The Transition Education Programme is a joint effort by the Federal and State Governments.

$10 million up for grabs

Jendell Consultants, a Sydney-based firm that specialises in assisting companies to apply for government grants, has revealed that the Federal Government's Industrial Research-and-Development Incentive Scheme is "flush with funds and looking for projects".

One of the last acts of the Fraser Government, unseated in March's federal election, was to inject $10 million into the scheme. However, Jendell Consultants says thousands of manufacurers have missed out on grants through ignorance, lack of time or an obstructive public service.

The grants are provided by the Australian Industrial Research and Development Incentive Board to foster the growth of Australian industry, new systems and technology, and, ultimately, the export of Australian products and technology.

In theory, any manufacturer engaged in research that leads to the development of new products or technology is eligible for a grant.

Funds are available through two different types of grant. The lower level grant, called a Commencement Grant, can give manufacturers $40,000 per annum, on the basis of 50 cents in the dollar, toward their research-and-development costs. Commencement Grants are paid for work carried out in the preceding financial year. Applications must be lodged by September 1983.

The second type is a Project Grant, payable at up to $750,000 per annum. The rate is a minimum of 50 cents in the dollar. Applications may be made at any time, but only expenditure which is incurred after application is eligible. Grants may be paid before the research-and-development work is carried out.

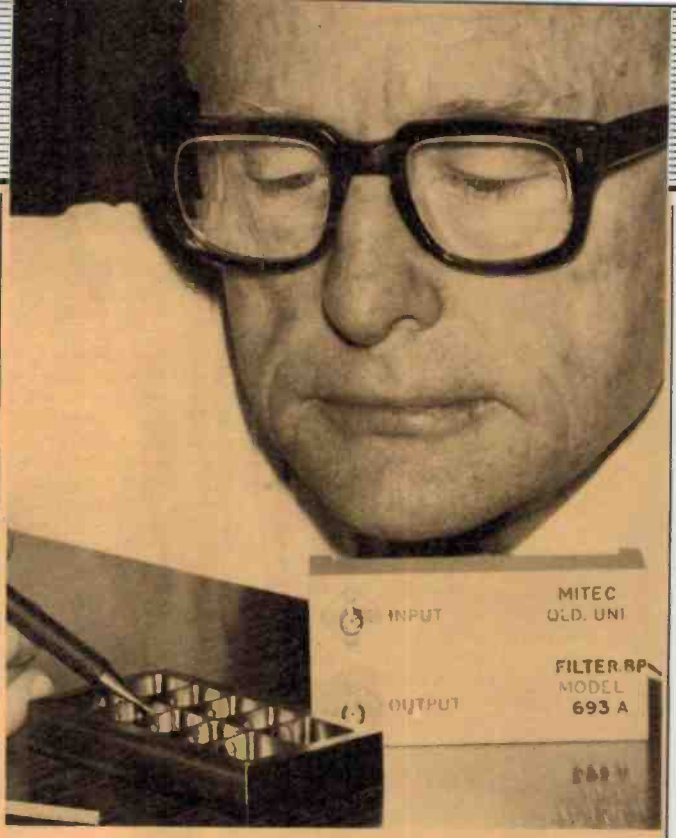
"The time that it takes to identify the area of eligible expenditure, draft the application, avoid all the pot holes and prepare for the hearing of the application can be lengthy," Dell Jenner-Hillard, of Jendell Consultants, told ETI.

"To puruse an application requires considerable perseverance or an intimate knowledge of the Act and the workings of the board.

"For companies that have spent, or plan to spend, money on research-and-development work, now is the time to plan applications. Leaving them until later can spoil the chances of getting much-needed funds. Make no mistake, the government has funds available now."

Generally, Industrial Research-and-Development Incentive Scheme grants cover salaries, plant materials, direct labour, contract labour, overheads and technical information.

For further details, contact **Jendell Consultants, 194 Miller Street, North Sydney NSW 2060. (02)929-4311.**



Microwave centre chases $200,000 contracts

Contracts for more than $200,000 are expected to be written in the coming year by the Microwave Technology Development Centre (MITEC), which was established two years ago by the University of Queensland and the Federal Department of Science and Technology.

The aim was to make university expertise available to Australian industry for research, design and development work in microwave technology. The main efforts of MITEC, up to the present, have been concerned with microwave communication systems for civilian, defence and satellite applications.

The centre's director, Professor Morris Gunn, says he believes MITEC will be fully estabished and self-supporting by 1986. To get the operation started, the Federal Government had provided an initial grant of $700,000 for three years.

"Progress so far has been most encouraging," Professor Gunn said. "We've estabished useful and productive links between industry, government and the tertiary sector, and we fully expect that these will be maintained and developed."

The centre, which is based on the University of Queensland's St Lucia (Brisbane) campus, has a full-time staff of four professional engineers and technicians.

One of the centre's most notable successes in the past two years has been a new shorthaul microwave communications system.

The system was designed to meet the needs of those requiring information transfer within a specified area, such as office to office or base to headquarters, and operates by line-of-sight over a maximum of 10 kilometres. It has low-power requirements and can function on 8 V provided by either conventional energy sources or solar power cells.

Systems battery range enlarged

Chloride's Exide family of 6 and 12 V RELB batteries for use in systems — either under standby duty or for heavy cycling — has gained a 4 V, 3 Ah model.

The lightweight Exide RE4-3 measures 90 x 33 x 60 mm. The 3 Ah capacity is at the 20-hour rating.

The addition makes the RE series the most comprehensive RELB — recombination electrolyte lead battery — range available in Australia.

The RE4-3 has no holes, vents or screwtops. It does not need topping up, and cannot spill, seep, gas or corrode.

For further information, contact **Chloride Batteries Australia, 147-149 Woodpark Road, Smithfield NSW 2164. (02)604-0522.**

AS changes: the buck stops here

The Energy Authority of New South Wales has warned manufacturers and importers that recent amendments to the AS 3100 and AS 3300 series of Approval and Test Specifications apply to all equipment already on the market, as well as new equipment.

The amendments, issued by the Australian Standards Association, included limits on the allowable direct current flowing in the equipment neutral.

Similar limits were also imposed in specifications AS 3159 and AS 3250, for electronic sound and vision equipment.

The Energy Authority has pointed out that it is the responsibility of each individual manufacturer or importer of articles for sale in Australia to ensure that its equipment complies with the amended requirements.

A STAR IS BORN

A star forms because of a local dense area in a dust and gas cloud. The inner regions of the knot grow denser and denser until nuclear burning is triggered and a star is born.

At that instant the pattern of the dust cloud is disturbed. Material that had been falling unimpeded towards the centre, under the influence of gravity, now encounters a new force. Newly created photons, hurrying on their outward pilgrimage, bump into the inward-migrating dust grains, halting them and even reversing their motion.

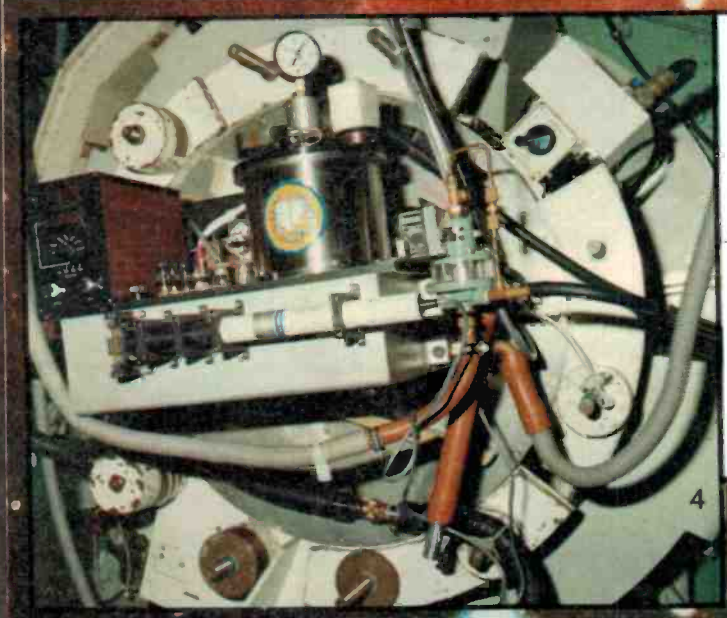
Young stars radiate strongly in the infrared because of the dust clouds that envelope them. As the star evolves it may adjust its weight by throwing off some extra material in the form of dust, prolonging the dust cloud phase. This dust, however, disperses long before the stars take on the adolescent responsibilities of the 'main sequence'.

The HII regions are areas in which stars may form and usually contain young clusters. Astronomers expect some infrared signal from them as they consist of gas and dust in a ratio of about 100:1 by weight.

The large and small Magellanic clouds are the two galaxies closest to our own. To us they look like two fuzzy, cloud-like patches in the southern sky. Even though they are regions where stars are starting to form, astronomers have found that they are very empty with no dust or gas. The mechanisms of star formation are not completely understood.

Carbon stars are intense sources of infrared radiation as they are very cool. They are fairly rare and rich in carbon and oxygen. They have reached a stage in their evolution where they are obese and, in order to lose some of their outer layers, put out soot! ■

1 The Cone Nebula is part of an enormous cloud of gas and dust. Within and around this cloud are many recently formed stars.



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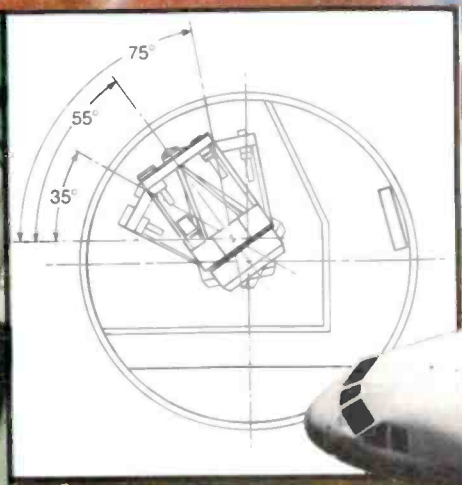


3

THE INFRARED REGION

Infrared can be thought of as radiant heat; it is the energy radiated by cool objects.

When a molecule is hit by an atom or electron it emits an infrared quantum of radiation; this means that the molecule radiates only at well-defined wavelengths. The specific wavelengths of the spectral lines are characteristic for each molecule, like a fingerprint, enabling the molecule in space to be uniquely identified.

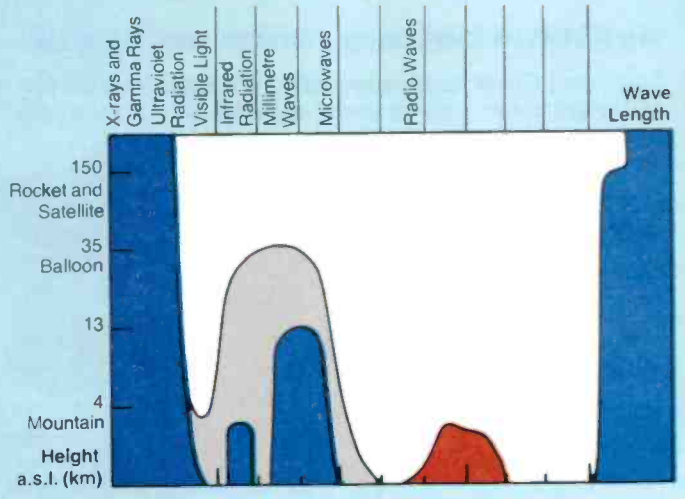
The width of the lines is a measure of turbulent velocities in the gas, and their relative intensities provide an identification of gas densities in space. Temperature and chemical information can also be learnt.

The infrared portion of the spectrum was discovered at the end of the eighteenth century by Sir William Herschel, opening up the electromagnetic spectrum beyond the visible region.

The infrared region lies between 1.1 um (1.1 microns) and 1 mm. At the long wavelength end of this region the detection techniques of radio astronomy are more suitable.

Ultraviolet and optical astronomy deal mainly with stars and nebulae whose temperatures equal or exceed the surface temperature of the sun, about 6000° K.

Infrared astronomy is most powerful in observing sources whose temperatures range from 3° K to 3000° K: interstellar dust clouds and giant dusty galaxies; regions in which stars appear to be forming; and dying stars enshrouded by dust. ■



Hitchhiker's guide to the infrared galaxy

Jennie Whyte

If Galileo had lived long enough to collaborate with Leonardo da Vinci, no doubt they would have invented the airborne observatory. However, the task was largely left to the efforts of a United States astronomer, Gerard P. Kuiper, who pioneered airborne observations in the 1960s, for whom the latest NASA-run airborne observatory is named. This is the story of its recent Australian expedition.

ONE CLEAR, COLD NIGHT, 13 km over South-East Australia, I met Lupis, the Chaemeleon and the Coalsack amid the roar of four jet engines and the chit-chat of their long-time familiars.

These three 'characters' are not some jet-age hitchhikers who stole aboard a transport, but celestial objects being investigated by a group of astronomers from here and half the world away.

I was a passenger, for eight hours, on the Gerard P. Kuiper Airborne Observatory (KAO), an astronomical research facility operated by the National Aeronautics and Space Administration's Ames Research Centre.

On board is an open-port infrared telescope which has an aperture with a diameter of 910 mm (36 inches). With its associated control and computer equipment it permits scientists to precisely measure the infrared (heat) radiation from planets, stars and galaxies.

Studying the infrared radiation from celestial objects has given astronomers a great deal of new information about how stars are formed out of gas and dust clouds in space, and how stars decay in their old age.

The flying telescope was recently in Australia for seven weeks of astronomy research. It was based at the Royal Australian Air Force base at Richmond, New South Wales, operating under the joint auspices of the Australian Department of Science and Technology and NASA.

Two Australian and seven American astronomers, with their respective research teams, were involved in the programme in May and June.

The KAO made 12 research flights over Australia, logging about 70 hours of flying time. However, the results won't be known for at least six months as it will take that long to process all the information.

This was the second working trip to Australia for the NASA facility. During its first trip, in March 1977, on a flight out of Perth, the astronomers on board the KAO made the unexpected discovery that there are at least five rings around Uranus, the seventh planet from the sun in our solar system.

Kuiper Airborne Observatory

The KAO is a highly modified version of the Lockheed C-141A military cargo transport. The fuselage is 44 metres (145 feet) long, the wingspan is 50 metres (160 feet) and the total take off weight is about 150 tonnes. The plane is packed full of electronic equipment which, with the telescope, takes up most of the room.

The telescope is stabilised by a system that includes four vibration isolators, an air bearing, three gyros and a video star tracker. The pointing stability of the telescope during a mission is three seconds of arc (about 0.001°).

Since the first flights with the KAO early in 1974, more than 370 research missions have been flown. Now it is making about 80 research flights a year.

Each year, about 20 different experimental teams from various universities or research agencies use the facility to conduct research in infrared astronomy. Each experiment may require two to six research flights to collect all the information.

There are usually at least 12 people on board during a research flight: the flight crew (pilot, co-pilot and flight engineer), five observatory staff members, three or more members of the experiment team and a meteorologist.

The KAO flies at altitudes of 12 to 13.5 km (39 000 to 45 000 feet); it is then above 99 percent of the obscuring water vapour in the atmosphere. In winter these altitudes are in the lower part of the stratosphere at mid and high latitudes.

Most of the infrared radiation from celestial objects cannot be observed at the earth's surface because it is absorbed by the atmosphere, particularly water vapour. This is why astronomers must take their equipment above the lowest 12 km of air.

Understanding astrophysical phenomena often requires an astronomer to obtain data at several different wavelengths, so the KAO and other observatories work in with each other, sharing information. ▶

2 The Kuiper Airborne Observatory is a modified version of the Lockheed C-141A military cargo transport and carries an open-port telescope which detects infrared radiation through a hatch in the roof of the plane.

3 The infrared telescope has an aperture of 910 mm (36 inch) and during a mission has a pointing stability of three seconds of arc.

4 There is no direct access to the telescope during a flight except via its control equipment. The tracking system keeps the telescope on target and the plane moves around it, controlled by the Inertial Navigation System.

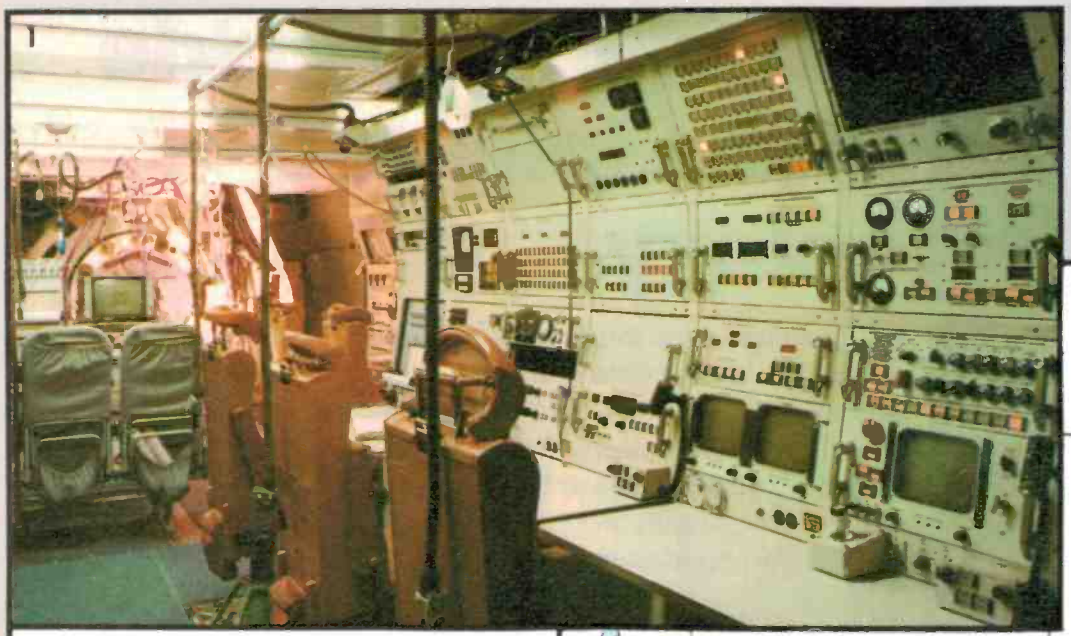
◀ KEY

Most

Many

Few

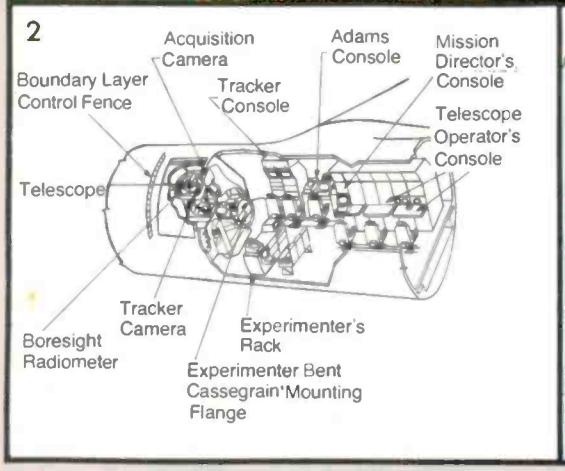
Altitudes at which astronomical observations are possible

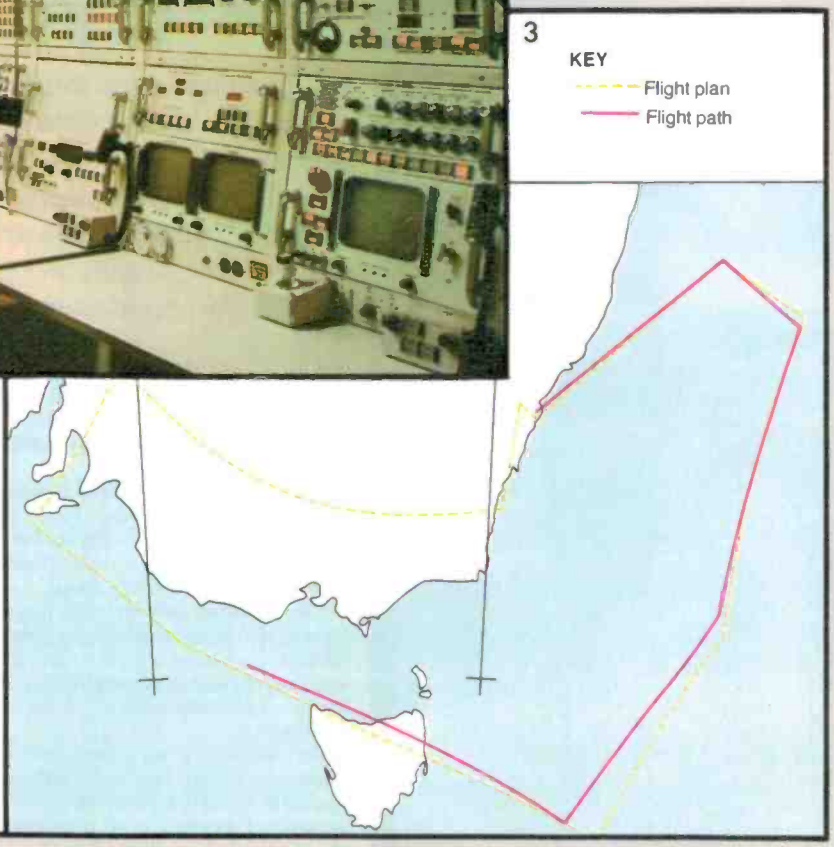


1 An inside view of the KAO shows a section of the vast array of electronic equipment used by the scientists.

2 Cutaway view of the above.

3 The original flight plan was altered during the latter part of the flight to increase the observation time of the source known as W33A.





DETECTION TECHNIQUES

The pioneer infrared astronomers detected radiation from celestial bodies with a thermopile which is no more than a number of thermocouple junctions united in one cell.

An early discovery showed that the moon was covered, not with rocks, but with fine powdery dust. At the time it was a controversial finding but it demonstrated that infrared astronomy was a powerful tool.

These astronomers didn't know anything about the spectrum beyond 10 um. Based on the ground, their detectors couldn't penetrate the atmospheric layer which effectively blocks the radiation from penetrating to ground level. And that's not the only problem introduced by the atmosphere; the sky emits strongly in the infrared and is particularly intense in the 10 um band. So astronomers have to be able to discriminate the radiation of a star from that of the sky.

The first 20 um observation was of the sun in 1942. There was a breakthrough in 1947 when Golay published details of a subtle pneumatic detector for infrared radiation.

In general, any optical telescope which relies entirely on reflecting surfaces can be used for infrared photometry. As water vapour is the main cause of the atmosphere's absorption and thermal radiation, telescopes at high-altitude sites in very dry climates are usually the best for infrared work. Cassegrain focus is usually selected because of its convenience.

All infrared photometry uses a procedure known as chopping. Two neighbouring patches of sky (beams) are presented alternately to the detector and their difference is taken electronically by synchronous rectification. The frequency of chopping between the two beams is chosen to suit the response time of the detector and may be anywhere between about one and 1000 Hz.

The chopping frequency of the telescope on board the KAO is 42 Hz. The chopping component is the Cassegrain secondary mirror which is tilted back and forth. Introducing a wobbling secondary into the light path has the effect of moving the focal plane of the telescope back and forth in front of the detector.

Chopping is used because it is much easier to stably amplify an alternating than a direct current and considers the fact that the response of the detector may vary if the incident flux does not change. Chopping also provides the necessary discrimination against a bright sky.

The portion of an infrared astronomer's equipment which is attached to the telescope comprises two basic items: a photometer and a Dewar.

The photometer contains the chopping mechanism and the eye pieces. It is bolted onto the mounting plate of the telescope immediately behind the primary mirror, and light enters directly from the secondary.

The Dewar contains liquid helium which cools all the instruments to 4.2° K. The Dewar is fitted with a small transparent window which can withstand the vacuum behind it and through which the detector 'sees'.

On-board the KAO, a pumped liquid helium Dewar system cools all the spectrometers and photometers to 1.2° K. (Man, that's cold!)

The photometers measure the total brightness without going into spectral resolution. They consist of a doped germanium bolometer detector which measures temperatures in the range of 10° K to 200° K.

These photometers are effectively a thermometer which absorbs infrared radiation, causing the temperature of the element to rise. The electrical resistance changes with temperature and the sensitivity is 10^{-15} watts in one second of integration time. Filters are used to determine the wavelength.

Spectrometers are capable of better sensitivities than photometers, using the same detector. 5×10^{-17} watts per second sensitivity can be achieved by directly converting the infrared radiation to electrical current.

A spectrometer comprises a broadband detector preceded by a narrow band filter. The spectral lines at specific wavelengths allow identification of atoms and molecules.

For example, several ground-based radio astronomers use the KAO to get data at the shorter wavelengths in the submillimeter region; others use both the KAO and the joint NASA/UK International Ultraviolet Explorer (IUE) satellite to obtain relevant data. Many astronomers complement their airborne work with an observing programme at the NASA Infrared Telescope Facility (IRTF) on Mauna Kea in Hawaii.

Flying high

Having heard about the plane and its mission I wanted to find out more about the research that had been planned for the Southern Hemisphere. So when Roger and I were asked if we would like to 'hitch a ride' on a flight one night we jumped at the opportunity.

We arrived at the RAAF base at Richmond at 5.30 pm, in time to meet the crew and scientists, hear a briefing on the flight and be fitted with oxygen masks.

This converted military cargo transport plane is not your typical comfortable passenger airliner with stewardesses to explain what to do, in the case of an emergency, when an oxygen mask drops down to dangle in front of your face.

They had a bit of trouble getting an oxygen mask to fit me as they don't usually have to cope with the shape of a woman's face; the masks are cumbersome contraptions which must fit tightly with a seal around the mouth and nose, otherwise the oxygen can escape. But eventually it was sorted out to everyone's satisfaction.

We boarded the plane at 6.20 pm. Roger and I were allocated seats at the back of the plane, behind the air compressors and radiometer control equipment; on this plane the scientific equipment has the priority. Our oxygen masks were attached to the gas supply lines and we were given a headset each and shown how to use it.

The headset has two functions: Fitting snugly over the ears it keeps out most of the engine noise — if you took the headset off it was almost impossible to hear anyone speak; it also allows you to hear conversations, when you are plugged into one of the communication lines, and talk back through the microphone which is just in front of your mouth. But you must remember that the microphone must be moved out of the way when putting your sandwich into your mouth; sprouts hanging off the microphone are very unbecoming.

The idea is that you keep the headset on all the time. Once the plane is airborne you can walk around, plugging into the nearest available communication line. One channel was strictly for the astronomers to talk on; listening in was interesting but you couldn't ask questions. However, the instrument panel in front of each scientist had the facility to switch to a private channel so it was possible to talk individually to some of them.

Take off was at 7.06 pm with 18 people on board. We headed in a north easterly direction over the ocean. As soon as I saw the scientists out of their seats, setting up their equipment, I moved closer to the action where I could see what was happening on the instrument panel monitors.

A little toy koala bear was tied to one of the control panels; a mascot they had acquired on their first flight to Australia.

We climbed to an altitude of 13 km (41 500 feet) and stayed at that height for the entire flight. I had dressed warmly, prepared for a cold night, but I still found it pretty cool underfoot as I walked around on the metal floor. What could you expect when the temperature outside the plane was −25°C?

I was a bit disappointed that I couldn't see the stars very well. At that height, away from the city lights, I had thought that the stars would be brilliant, sparkling against a clear, dark sky.

The problem was to find a window to observe them, the entire plane being geared up for infrared observations through the telescope. There were two small windows but they were behind the wings with their flashing lights.

The only other windows were around the cockpit; so I spent quite a bit of time crammed into a corner of the cockpit, peering out the window, trying to recognise different constellations.

This was one time when I wished that the moon hadn't been there, in all its shining glory. It was almost full, a beautiful sight; reflecting off the clouds below, it lit up the sky. And the stars faded away.

We had been heading in a north-easterly direction, over the ocean for the first part of the flight. Then about an hour after take off, on the third leg of the flight, the telescope was locked on to Saturn, which appeared on the instrument panel television monitors as a solid ball of light.

Saturn is used as a calibration source. Its temperature can be calculated fairly easily and is well known. Accurate information has been obtained from satellites flying close to this planet. By checking the known temperature against the reading obtained by the infrared telescope, the astronomers are able to calculate the accuracy of their equipment. This calibration is done twice on each flight.

Mars is also a good calibration source, so all is not lost if Saturn isn't up. The telescope was locked on to Saturn for 15 minutes and then the flight path was altered for a more southerly direction.

The flight plan had been carefully worked out before the KAO left the ground, the path based on the stars the astronomers wanted to investigate. The ground speed of the plane was calculated, varying on each leg to give the scientists optimum time for their observations.

By this time I had been given a seat at the main telescope control console, between the mission director and the telescope operator. There I had a good view of the monitors displaying the scene through the acquisition camera and the tracking camera. But to the uninitiated the sight wasn't particularly earth-shattering; just different patterns of white blobs on the screen. Not something to keep one fascinated for hours.

The acquisition camera has a zoom lens. It enables one to look at a fairly large fraction of the sky, then zoom in to look at the small region of interest.

The scientist operating these cameras must have an extremely good knowledge of the stars and galaxies and their relative positions. This person is responsible for locking the telescope on to the source that the astronomers want to investigate. Once the acquisition camera has pin-pointed the area the tracking camera is brought into action.

The tracking camera is on an offset guider, attached underneath the telescope and just below the instruments, such as the photometers. The light coming through the telescope is picked up by the tracking camera. A guide star is selected and, using the light from that star, the telescope is locked on to the auto-guider system. If turbulence causes the plane to deviate slightly off course the tracking system will maintain the telescope on target and adjust the attitude of the aircraft via the Inertial Navigation System (INS).

Heading in a southerly direction on the fourth leg of the flight, the telescope was locked on to Lupis for one hour. Lupis is a young star and the astronomers had expected to find copious amounts of radiation coming from the cool dust; but they didn't find any, according to Dr A. Hyland, an Australian astronomer at the Mount Stromlo and Siding Springs Observatories and one of the principal investigators on the KAO's Australian expedition. "Perhaps this means that our ideas of how stars form in dust have to be revised", Dr Hyland said.

At 9.20 pm the course of the plane was changed slightly, to more of a south-westerly direction, still way out over the ocean, south-east of Australia. The astronomers were investigating a region known by the code-name RCW 108; an obscured region of ionised hydrogen. It was actually found only two weeks earlier by the Infrared Astronomical Satellite (IRAS).

The astronomers were trying to map this region in an effort to determine its structure and find out more about the dense cloud of dust. Their work will be followed up with ground-based operations, perhaps using the Anglo-Australian Observatory telescope at Siding Springs in north-west NSW.

Just after 10 pm the KAO made a 90-degree turn on a course which took it over the north-east tip of Tasmania, heading towards Western Australia. For the next 100 minutes the telescope was pointed at Chaemeleon 53083, a nearby dark cloud region of star formation in our galaxy. It is approximately 450 light years away which is close, in astronomical terms.

The purpose of the investigation was to find out how the small, low mass stars being formed in the region are heating the thick dust out of which they are formed. When the dust is heated by the stars, to a temperature of less than 100° K, it re-emits radiation. The astronomers were measuring the energy that was emitted, at wavelengths of 50 um and 100 um.

The Coalsack, a region close to the Southern Cross, was the next infrared source studied by the scientists. To us it looks like a black patch in the sky or a hole, hence its name. It's really an area of clouds of dust and gas between us and the Milky Way, completely obscuring a region of ▶

The infrared galaxy

stars. However, using the techniques of infrared astronomy scientists can see into and right through the Coalsack to the Milky Way beyond.

After 40 minutes of looking through this 'hole in the sky' another change of course was ordered and the KAO turned to the right, heading over Port Pirie in South Australia. It was 12.20 am and the telescope was again locked on to Saturn, allowing more calibrations to be made and the accuracy of the equipment checked.

While all the calibrations were in progress I was talking to the flight crew in the cockpit. It was very comfortable there, in the dim lighting. The profusion of lights on the vast instrument panel glowed and blinked and outside, the moon light, reflecting off the glowing clouds way below us.

It was warm in the cockpit, compared to the rest of the plane. The temperature seemed to decrease rapidly as I walked from the nose to the tail. And it was quiet there, so the headset wasn't needed to keep the noise level down.

Apart from all these obvious attractions to the front of the plane, it was interesting talking to the flight crew, getting a different perspective on what this mission to Australia meant to them.

Once the plane had been set on its course, at the beginning of each new flight leg, and the automatic pilot programmed, the pilot, Warren Hall, and the co-pilot, Tom McMurtry, were able to relax and talk to any visitors in the cockpit.

For Warren Hall, research pilot with NASA, flying the KAO was a very routine, mundane task. But this particular mission to the Southern Hemisphere had attracted him as it was a chance to visit Australia. In the United States he would normally be test flying some strange and unusual aircraft. It sounds as if science fiction predictions for flying craft of the future are rapidly materialising.

At 12.50 am the flight crew went into action again. We made a sharp turn to the east, above South Australia, and we were then heading back towards New South Wales.

With the astronomers again, drinking my fourth cup of coffee, I was looking at more white blobs on the monitors. It was a very large region of ionised hydrogen in our galaxy, code-named W33A. Paul Harvey was particularly interested in this source.

Principal investigators on the KAO's Australian missions

Dr Paul Harvey, of the University of Texas, has spent several years in the United States working on his project. He was using a six-detector array photometer at the Cassegrain focus, measuring the spectrum between 40 um and 200 um, to collect more data to complete his work.

W33A was not the only infrared source he was interested in. On his Australian flights he was mapping regions of star formation in the Magellanic Clouds and HII regions in our own galaxy. He was observing, in the continuum, the same HII regions that Dr John Storey was observing in the far-infrared excited state CO emission.

Dr Storey, an Australian astronomer with the Anglo-Australian Observatory, was using Dr Charles Townes' cooled Fabry-Perot high resolution scanning spectrometer. He was looking at excited state CO emission and far-infrared fine structure lines to probe southern HII regions and Magellanic Clouds.

Dr Martin Cohen, who works in the Astrophysical Experiments Branch of the NASA/Ames Research Centre, was also using Paul Harvey's infrared array photometer to study temperature and density conditions in the clouds of gas and dust around certain southern planetary nebulae.

The Harvey photometer was the instrument used by the other Australian principal investigator on this KAO mission. Dr A.R. (Harry) Hyland, of the Mount Stromlo and Siding Springs Observatories, was extending observations of Southern Hemisphere objects to longer wavelengths, around 200 um. Previous photometry of these sources had been limited to ground-based atmospheric windows.

Dr Charles Townes, of the Physics Department at the University of California, was studying wavelengths between 50 um and 135 um with his cooled Fabry-Perot scanning spectrometer. Using fine structure lines as a probe of excited atomic gas in warm neutral or partially ionised clouds, he was particularly interested in investigating and detecting molecular lines. Ground-based supporting work has been done at the Very Large Array (VLA) telescope complex in Mexico and also at the Infrared Telescope Facility (IRTF), using a 3 m mirror, on Mauna Kea in Hawaii.

Dr Townes' Fabry-Perot spectrometer was also used by Dr Michael Werner, of the Astrophysical Experiments Branch, NASA/Ames Research Centre, to do far-infrared spectrometry of the 63 um line in the spiral arm of the HII regions. He was doing similar observations at 52 um, 57 um and 88 um in planetary nebulae and HII regions.

The data that is obtained from measuring the intensities of wavelengths emitted from ions and molecules gives information about the electron density, the gas temperature and abundance of each atomic species in and around distant astronomical objects.

Dr James Elliot, from the Department of Earth and Planetary Sciences at the Massachusetts Institute of Technology, is the planetary astronomer whose team discovered the Uranus rings in 1977. Using a three-channel occultation photometer, measuring at wavelengths between 0.3 um and 1.2 um, he was looking for a ring system around Neptune, the eighth planet from our sun.

The event that he was particularly interested in observing, an occultation, occurred on June 14 and was visible only for a couple of hours in a limited region of the Southern Hemisphere. The airborne telescope had to be flown to the optimum point for these observations. It was one of the rare times when the Kuiper Airborne Observatory was used for visible observations.

An occultation occurs when a planet, in this case Neptune, passes exactly in front of a fairly bright star. With the telescope locked on to the star, measurements could be made as Neptune passed in front. Any rings around the planet would have blocked out the light coming from the star.

By carefully timing and measuring the characterisitcs of the star-light as Neptune moved between the earth and the bright star, the diameter and ellipticity of the planet could be measured. Information on Neptune's atmosphere and its range of densities could be gained from measurements when the planet's atmosphere passed in front of the star.

Several ground-based telescopes in Australia and Hawaii were also observing the occultation, but no one found any rings. However, we'll have to wait until the results of the KAO's observations are published before we know definitely one way or the other.

Dr Harvey Moseley, from the NASA/Goddard Space Flight Centre, was observing Neptune and Uranus in an effort to understand why Neptune has an internal heat source (radiates more than twice the absorbed solar flux) while Uranus apparently re-radiates only about the same energy that it receives from the sun.

Using a six-channel grating spectrophotometer, Dr Moseley was also studying Neptune, Uranus and Saturn to obtain accurate data in the 28 um to 53 um region for cross calibration with IRAS data. As well, he was observing both Magellanic Clouds, with an emphasis on dust studies by measuring the 30 um carbon star emission.

Dr Al Harper, from the University of Chicago's Yerkes Observatory, was studying the large and small Magellanic Clouds and other external galaxies (in particular, Centaurus A and M83) to map star formation regions. Measurements were made with helium-cooled array photometers at wavelengths between 100 um and 300 um.

Return flight leg

South of Sydney, at 2.30 am, we set our course for Richmond. At the end of the tenth leg of the flight we were actually further south of Sydney than the original flight plan had intended. The course had been altered in mid-flight to extend the observation time of W33A.

For the first time ever, I was right up front for the landing. Sitting behind the pilot I had an excellent view of the runway lights zooming up to meet us. With the headset on I was also listening to the landing instructions. It was, of course, a perfect landing.

At 3 am, when we stepped on to planet Earth, it was exactly eight hours since we had taken off; we'd flown 3132 nautical miles.

My feet may have been on the ground but my head was still up there with the stars.

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Technics "World Standard Series" Hi-fi Systems.

Technics have been leaders in audio technology for many years. With innovations and developments such as New Class A amplifiers, Honeycomb Disc Speakers, dbx cassette decks, direct-drive turntables and, of course, their unique World Standard Plug-in Cartridge System.

One by one, these exciting features have been brought to audiophiles in Technics' superb separate components. But now Technics have incorporated them in carefully selected and matched systems.

So if you've been thinking of getting a sound system, you can now choose from a range containing some of the finest hi-fi developments of the past decade.

And should you be wondering why Technics have called their range the "World Standard Series", the reason is quite logical.

Because every Technics system now includes the plug-in cartridge system that has been adopted as a standard by hi-fi manufacturers worldwide.

Technics' sophisticated technology benefits the hi-fi industry as well as you, the hi-fi listener.

Take a look below at one of Technics' "World Standard Series" – the V6555 and you'll see what we mean.

Plug-in cartridge.

One-screw fixing, no tracking weight or bias adjustment needed. Cartridges from Shure, Ortofon, Audio Technica, Technics and others can be fitted or compared – in seconds.

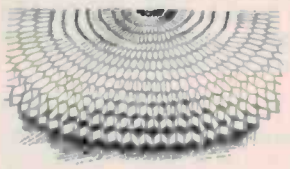
new class A synchro-bias

New Class A amplifiers.

When you see this sign on any Technics amplifier, it means it includes New Class A circuitry that totally eliminates crossover and switching distortion.

Direct-drive turntables.

Thousands of Technics direct-drive turntables can be found in studios and radio stations worldwide. It's a tribute to the years of work Technics have put into perfecting their accuracy and durability.



Honeycomb speakers.

Technics cleverly eliminate the problems of cone-shaped speakers by simply eliminating the cone! Honeycomb speakers are flat to avoid cone-induced cavity effects. The sound is superb.

New Class A amplifier SU-Z65: 55 watts per channel. Features LED input indicators, main/remote speaker switching, tape dub capability, dual-range FL power meters, subsonic/high filters.

Quartz-synthesizer tuner ST-Z45: 16-station random access memory auto-scan tuning, auto memory and dual function FL display.

Semi-auto SL-D21 turntable: Direct-drive operation, auto-return and shut-off, ultra-low rumble, wow and flutter. Low mass tonearm with plug-in cartridge connection.

Metal Tape cassette deck RS-M216: Sofi-touch controls, new dot-pattern 18-segment FL meters, peak hold, rewind auto-play, cue and review, MX rec/PB head, Dolby noise reduction.

Graphic equalizer SH8015: Select either 12dB or 3dB ranges for boosting or cutting on any of 5 audio bands on each channel.

Bass-reflex speakers SB2155: Impressive, 3-way linear-phase speakers with bass reflex porting for improved low end performance. Removable front covers and easy speaker cable connection.

Warranty: All these brilliant components, housed in a stylish horizontal rack with double glass doors, are covered by a full two-year warranty backed by the reputation of Technics.

Visit your stockist and listen to the superb sound of the V6555 and other great Technics Systems.

Technics

National Panasonic (Australia) Pty Ltd

Expanding the music experience.

Dailey/NPA 208

Compact-disc sales boom

World sales of compact-disc players have exceeded expectations and are now predicted to be between 600 000 and 700 000 units up to the end of 1983, divided mainly between Japan and Europe.

Total worldwide production capacity is expected to reach around 800 000 players at the end of the year, by which time the United States market will have started to play a part.

These revised figures, which represent a signficant increase on initial predictions, have followed the highly successful European market launch of the compact-disc player.

The European market has initially been dominated by Philips, Marantz, Sony and Hitachi, but dealer shipments have recently been started by Denon, Sanyo, Sharp, Thomson and Toshiba, and it is expected that around 20 brands will be represented in Europe by October.

Manufacturers report that consumer and dealer demand for compact-disc players far exceeded all expectations in Europe. Both players and discs sold out quickly at virtually all locations, despite relatively high levels of supply to dealers.

Polygram at present controls almost the entire compact-disc market in Europe, with Japanese labels accounting for less than 10 per cent of sales up to the end of June. The worldwide pressing capacity of compact discs is expected to reach 10 million discs by the end of 1983.

Feedback received from "compact-disc club" cards, returned by buyers of compact-disc players, has shown that, on average, European consumers have purchased seven or eight discs at the same time as their players, compared with 9-10 discs per player in Japan.

The cards also show that around two-thirds of buyers are in the 25-45 age group, with 99 per cent of sales being separate players for addition to existing hi-fi systems.

Combination video enhancer and stabiliser

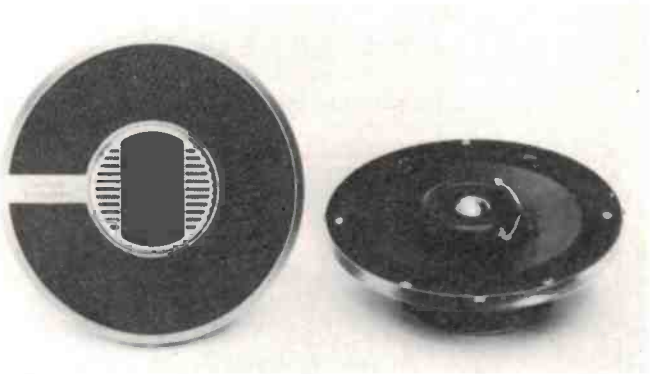
A combination video image enhancer, stabiliser and distribution amplifier especially designed for the PAL television system, the MFJ-1421 (PAL) has been released in Australia.

Manufactured in the United States by MFJ Enterprises, the unit is unique in a number of areas, including its built-in noise cancel control. This control overcomes the problem of increased picture noise as enhancement is heightened.

It also features a built-in sync stabiliser, for improving video with poor synchronisation, and a video gain control.

Price of the MFJ-1412 (PAL) is $224, plus freight.

For more information, contact the Australian distributor, **GFS Electronic Imports, 15 McKeon Road, Mitcham Vic. 3132. (03)873-3939.**



Waterproof radio waves

Pioneer Electronics has added four models to its GF cone series of water-resistant car stereo speakers.

They are the TS 465 (10 x 15 cm, 30 W, dual cone, $65), TS 1044 (10 cm, 30 W, two-way co-axial, $79), TS 1633 (16 cm, 60 W, two-way co-axial, $99) and TS 1655 (16 cm, 90 W, three-way, $145).

Pioneer claims the speakers, which do not require water-jacket protection when fitted to car doors, overcome all water and humidity problems. They feature Pioneer's GF cone paper, a combination of wood fibre, glass-fibre and epoxy resin which provides low distortion, flat frequency response and clear sound.

The four new speakers boost the GS cone range of car stereo speakers to seven models — the TS 1222 (13 cm, 20 W, dual cone), TS 1622 (16 cm, 25 W) and TS 1644 (16 cm, 25 W) were released late last year.

For more details, contact **Pioneer Electronics Australia, 178-184 Boundary Rd, Braeside Vic 3195. (03) 580-9911.**

The pure chrome advantage

Pure chromium dioxide video tape stands up better to repeated playings than non-chrome tape, according to one of the world's leading video engineers.

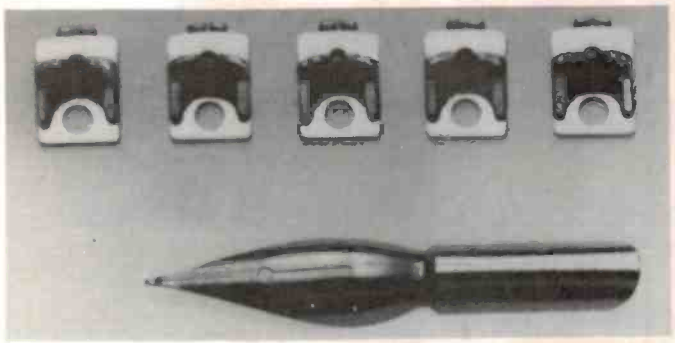
Ontje Arpe, BASF's chief engineer of video applications, said tests showed that after 100 passes of the video head, the pure chrome tape had a 1.5 dB to 2.0 dB advantage in playback over cobalt-doped ferric oxide video tapes.

On a recent visit to Australia from West Germany, Herr Arpe said the other advantages of pure chrome tape included clearer colours and greater stability over a wider range of temperatures.

However, ferric oxide tapes continue to set the pace in the audio market: BASF has just released the latest in audio tape technology, the LH Extra 1, which replaces the highly successful BASF LH/SM audio tape.

BASF says the LH Extra 1, a 90-minute cassette tape, features a greatly improved dynamic range, particularly in the high-frequency region.

For more details contact **BASF Australia, 55 Flemington Rd, North Melbourne Vic 3051. (03) 320-6555.**



Sanyo's amorphous head

Sanyo has announced the development of a unique 'amorphous head' for playing high-density video tapes.

The development makes use of amorphous ribbon, allowing a narrow gap and track with high precision. The amorphous head also enables efficient recording on metal tapes as it possesses a high coercive force, comparable to a ferrite head.

As a result of the development, Sanyo claims it is now possible to have a recording density twice as high as that produced with conventional video-cassette recorder heads.

The video market has seen a rapid improvement in the density of video tapes and this has created a demand for magnetic heads to match the high-performance tapes.

The amorphous head research programmes followed hard on the heels of Sanyo's release, last year, of its sendust head for metal tapes.

The amorphous head is capable of working with both evaporation-coating tapes and chrome tapes, and can also be used as an 8 mm video or vertical magnetic recording head.

Sanyo has not yet announced when the amorphous head will go into full-scale production.

ILP's power-booster amplifier

England's ILP Electronics has introduced the C1515, a stereo version of its 15 W mono power-booster amplifier, the C15.

Both models are designed to increase the output of low wattage car radio-cassette players, overcoming road and engine noise without introducing distortion.

Compact and robust, and in encapsulated modular form, the units have such features as easy two-hole fixing, screw terminal connection blocks for uncomplicated wiring-up, automatic supply on switch-on, selectable input level facility and output protection circuitry.

For additional details contact **ILP Electronics, Graham Bell House, Roper Close, Canterbury, Kent CT2 7EP, United Kingdom (telex 965780).**

The new Voice of the Theatre

For the first time in more than a decade, a new Altec Lansing loudspeaker system has been added to the Californian company's Voice of the Theatre loudspeaker family.

The new Voice of the Theatre Model A6A matches a very compact, optimally tuned, dual-woofer enclosure with Altec's newly developed mid-size Mantaray II constant directivity horns.

Altec engineers designed the new system to produce essentially the same body, punch and volume levels in the theatre or cinema as the Model A4 system, which has 10 times the cubic volume of the Model A6A.

Overall, the Model A6A is less than 50 cm deep. Its twin woofers each measure just over 40 cm.

For further information contact the **Altec Lansing Corporation, 1515 South Manchester Avenue, California 92803, United States.**

Hills updates Telesat system

The South Australian-based electronics company Hills Industries has slashed the cost and increased the efficiency of its Telesat television-receiving system.

The Telesat system, which brings television within the reach of people living in remote areas of Australia, was introduced in 1981.

Hills Industries has now developed a 3.7 m glass-fibre parabolic dish antenna, which replaces the reflector panel and horn assembly of the original system.

"The glass-fibre dish is cheaper, lighter, more efficient on a size-for-size basis, and it doesn't require trained crews to install, as was the case with the earlier reflector panels," said Ralph Aston, Hills Industries' assistant managing director.

Originally, the Telesat system cost about $7000 installed in outback locations. However, the new model will sell for $4500 on an 'install-it-yourself' basis.

The glass-fibre dish has been designed for the 4 GHz frequency of Intelsat Four-A, but as it can accept frequencies up to 12 GHz, it will be able to receive signals from the Australian domestic satellite, which is scheduled to go into operation in 1985-86.

For further information, contact **Hills Industries, P.O. Box 78, Clarence Gardens SA 5039. (08) 297-3888.**

Seven hip stereo cassette players reviewed

AIWA HS-P02 ● AKAI PM-06E ● KLH SOLO S-200 ● NATIONAL WAY RQ-WJ1 ● SANYO M-G12
SONY WALKMAN F2 ● TOSHIBA KT-AS1

Mae West would have loved hip stereo players: "Is that a cassette player in your pocket, or are you just pleased to see me?" Hullo, hullo, did anybody hear me?

Louis Challis

IT IS NOW approximately three years since I first saw a Sony Walkman cassette player in Japan. That unit was being touted by a member of a group of international reviewers with whom I had the good fortune to be travelling on the famous Japanese Bullet Train.

The Canadian reviewer was quite excited about his new Walkman. Apart from its obvious ergonomic advantages, this particular unit was the first of the Japanese units to feature a supra-aural set of head phones with extremely good quality sound.

As we all know, in a little less than two years, the popularity of these 'hip stereo' players has mushroomed and a new market has developed for the high fidelity industry. They are in great demand with the majority of the sales being to young people, people working at sedentary occupations and people on the move.

The best example that I have seen of how these players have revolutionised personal listening can be seen in the drawing office of one of the busiest firms of architects in Canberra. There, more than three-quarters of the staff of 100 architects and draughtsmen are either listening to a personal portable cassette recorder or have one beside their desk ready to listen to as soon as they are able.

The problem facing the intending purchaser of a hip stereo player is the bewildering array of new and exciting models available in the market place. Nowhere has this been more of a problem than for yours truly and the editor. We had to decide which units to select for this review and what criteria should be applied to that selection.

Rather than choosing a group of units based on comparable price, comparable features or similar appearance, the editor selected a sample from the units available. They are representative of those on sale, offering a wide range of prices and a wide range of features. When I was first advised of these intentions, I must admit my jaw dropped. However, in retrospect I believe the editor was right and that this is what the readers will most appreciate.

Many readers may not be aware of the peculiarities of the terminology and meaning of the objective test results that we present. So I shall explain, in as simple a manner as possible, the terminology and criteria of acceptability. Then, it will be possible for you to understand the advantages, disadvantages and idiosyncrasies of each of the units that will be described here.

Terminology

The most important term used to evaluate the technical performance of a hip stereo player is 'frequency response'. This describes the usable frequency range of the device, based on a standard testing procedure, indicating the upper and lower bounds of acceptability.

By international agreement the bounds of acceptability are normally plus or minus three decibels (which is usually abbreviated to read ± 3 dB) or plus or minus six decibels (± 6 dB). This magazine, following a commonly accepted practice, has always used ± 3 dB limits for electrical measurements and ± 6 dB for loudspeaker and acoustical measurements.

A good frequency response for a cassette player's electrical output would be from 40 Hz to 9 kHz ± 3 dB or better. A good electro acoustic frequency response (measured at the headphone output) would be 80 Hz to 6 kHz or better.

The next important parameter is the signal-to-noise ratio, sometimes abbreviated as S/N ratio. This is expressed in terms of being either weighted or unweighted. An unweighted (linear or Lin) figure ignores the effects of audible perception. Where the weighted figure is stated the weighting used is the (A) scale weighting network which corresponds to the acoustical weighting scale used in most sound level meters to produce an objective measurement similar to that provided by the human ear.

A good linear, or unweighted, signal-to-noise ratio for the players would be 48 dB; a good (A) weighted signal-to-noise ratio would be typically 53 dB (A). Some of you will realise that these figures, and particularly the (A) weighted figures, are not very good. Most people would desire (A) weighted signal-to-noise figures for high fidelity systems which are better than 58 dB and preferably up to 68 dB (A).

AIWA HS-P02
Manufacturer: AIWA in Japan
Distributor: AIWA (Aust) Pty Ltd, 14 Gertrude St, Arncliffe NSW 2205. (02) 597-2388.

AKAI PM-06E
Manufacturer: Akai in Tokyo, Japan
Distributor: Akai Australia Pty Ltd, Unit 11, Eden Park, 31 Waterloo Rd, North Ryde NSW 2113. (02) 887-2311.

KLH SOLO S-200
Manufacturer: Cybernat Electronics Corp, Tokyo, Japan
Distributor: Concept Audio Pty Ltd, 22 Wattle Rd, Brookvale NSW 2100. (02) 938-3700.

NATIONAL WAY RQ-WJ1
Manufacturer: Matsushita Electric Trading Co, Osaka, Japan
Distributor: National Panasonic (Aust) Pty Ltd, 95 Epping Rd, North Ryde NSW 2113. (02) 887-5333.

SANYO M-G12
Manufacturer: Sanyo Electric Trading Co Ltd, Osaka, Japan
Distributor: Sanyo Aust Pty Ltd, 225 Miller St, North Sydney NSW 2060. (02) 428-5822.

SONY WALKMAN F-2
Manufacturer: Hi-fi audio division of Sony Corp, Japan
Distributor: Sony, 453 Kent St, Sydney NSW 2000. (02) 266-0655.

TOSHIBA KT-AS1
Manufacturer: Toshiba Corp, Tokyo, Japan
Distributor: Toshiba (Aust) Pty Ltd, Cnr Talavera and Alma Rds, North Ryde NSW 2113. (02) 887-3322.

These sorts of figures can be provided by many of the noise reduction systems available.

The most common and universal noise reducing system is the Dolby B system which most of the larger cassette players and a significant number of the hip stereo players now incorporate. Where a Dolby B system is incorporated, the signal-to-noise figures tabulated are typically 9 dB (A) better than the simple A-weighted figure where the Dolby B system is not used with a Dolby encoded cassette tape. With the Dolby system activated when using a Dolby encoded tape, the quality of the sound is enhanced by the reduction of hiss.

The next important parameters that we measure are 'wow' and 'flutter' which are two separate sets of measurements of the tape speed variation resulting in audible fluctuations in the uniformity of sound. The 'wow' is the measure of very low speed fluctuations in speed stability. The 'flutter' is a measure of the high speed fluctuations in speed stability.

Both of these parameters can be expressed in terms of either a 'peak-to-peak' or a 'RMS' value. The peak-to-peak value refers to the absolute maximum excursions while the RMS value refers to the weighted, averaged value of the fluctuations.

Again by convention, this magazine always refers to wow in terms of the peak-to-peak value as we believe that this is the most appropriate description. Flutter is referred to in terms of the weighted RMS value which is now also the industry standard. Good values of wow for a hip stereo player are 0.05% peak-to-peak; good values of flutter are 0.2% RMS or less.

While wow and flutter figures are obviously relevant to stationary equipment, they are even more relevant to hip stereo players where the user may be jogging at 10 or 15 kilometres per hour. The dynamic stresses and strains on the unit may manifest themselves as movement-induced fluctuations in the sound.

The Sony Corporation produced the first of its dynamic rolling mechanisms in the early seventies to counteract this problem. Many other manufacturers have followed suit, but obviously not all. We studied this problem as part of the testing programme and it produced some exciting results as you will see later.

Another important parameter that the user really needs to know about is the pressure applied by the headphones. With supra-aural headphones of the type now utilised by all the hip stereo players, this is not as critical as it was with the conventional heavy muff-type headphones. However, this parameter still needs to be determined. The units of force used for measuring the clamping force are Newtons and typical values should be in the range of two to three Newtons in order to avoid a feeling of pressurisation which many of the early muff-type headphones produced.

Other parameters which are important are the weight, the battery life, particularly where you only have two AA cells, and last but not least, the maximum sound pressure level before the onset of significant distortion.

Obviously, the ability to produce transients without significant distortion is important; intermittent peaks should be able to be heard without gross distortion. However, this particular parameter has become a very vexing one for both the National Acoustic Laboratories and us. This is since we have become aware of a number of instances where young people, and specifically children under the age of fifteen, have suffered significant loss of hearing as a result of extended listening to hip stereo units at sound levels which you or I would classify as extreme.

Extended listening to these players, with the average sound levels exceeding 90 dB, is likely to result in premature and irrevocable loss of hearing. I find this situation particularly disturbing.

Because of my long-standing concern and involvement with the reduction of the intrusive levels of entertainment sound (for a variety of reasons), I must caution you to avoid long periods of high level listening. If you are a parent you must make sure that your children do not become 'hooked' on such practices which can be particularly dangerous for their hearing.

Objective testing

We certainly had a considerable number of parameters which we could have tested to evaluate each machine. We even had to develop some new testing procedures, to the best of our ability, as for some there are neither international nor national testing standards.

We decided to base the objective testing on the evaluation of the following parameters.

The replay frequency response was tested, although the Sony Walkman unit also provides a record facility as well. The replay test was performed at levels of 0, −10 and −20 VU, using a gamma-ferric-oxide replay test tape with recorded sine wave frequency response data extending from 10 Hz to 20 kHz.

This particular test not only evaluates the frequency response of the player, but is also affected by the azimuth alignment of the replay heads which, as the results show, has a significant impact on the overall performance of each unit. Until all the manufacturers follow exactly the same azimuth standards, we will continue to strike this problem which, regrettably, affects your audible pleasure.

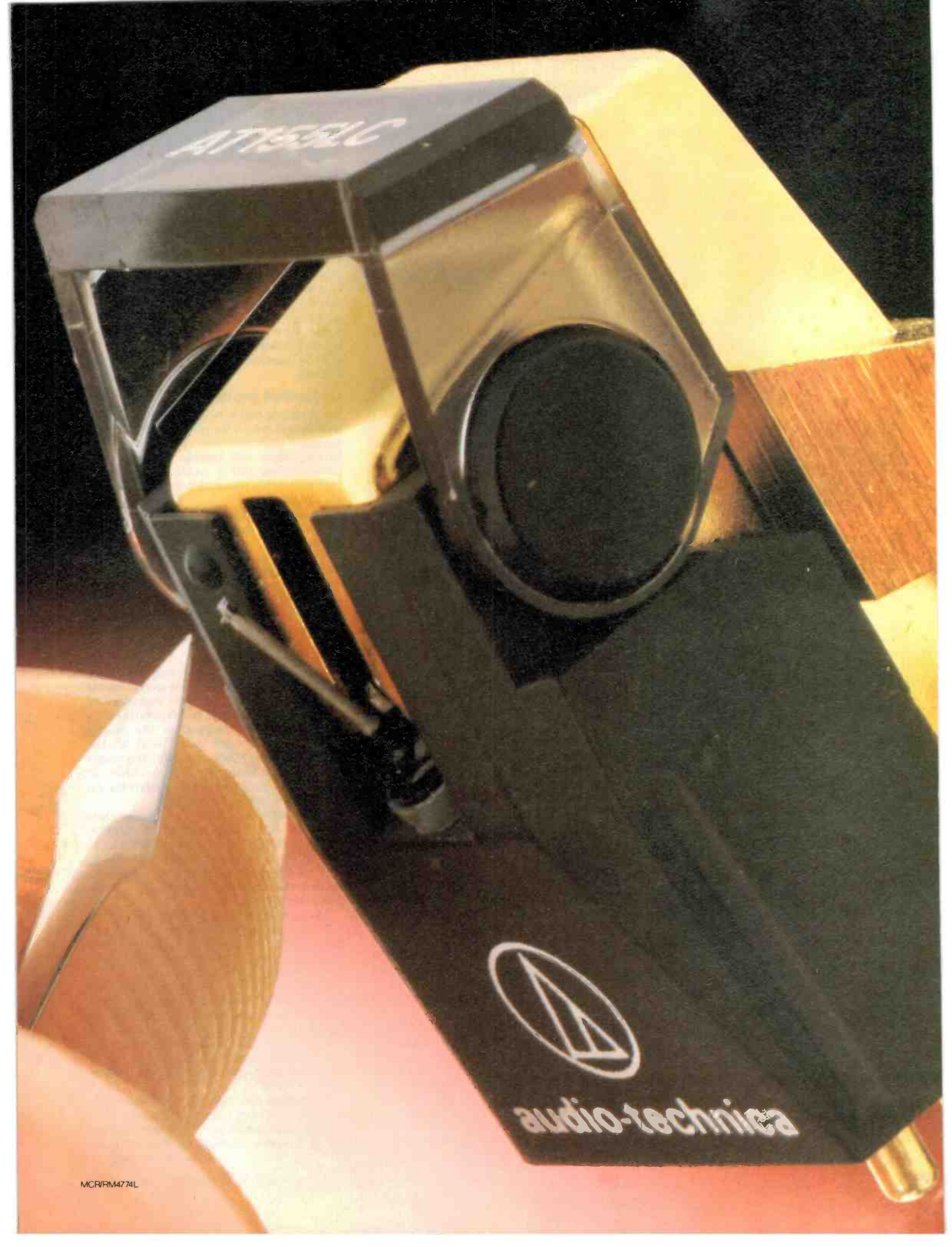
The electrical output response was recorded on three individual graphs, clearly showing the frequency response at each of the three replay levels. The results at −20 dB are basically unchanged at lower levels and are representative of the unit's best performance.

The acoustical output was measured at −20 VU on an artificial ear, Bruel and Kjaer type 4153, with the supra-aural headphones mounted on a plate on top of the microphone assembly.

For each unit the measured frequency responses fall short of the electrical signal capabilities of the cassette player, indicating that the manufacturers' choice of headphones is not necessarily up to the standards of those evaluated by us in the 1983 Headphone Review (see April issue of ETI).

Your ears can tell the difference, although obviously your subjective frequency assessment will be determined by the programme content on your cassette

Continued on page 22 ▶



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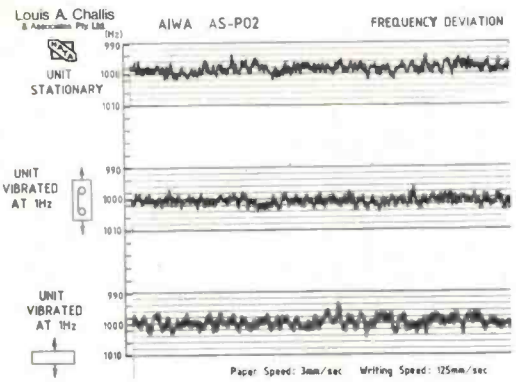
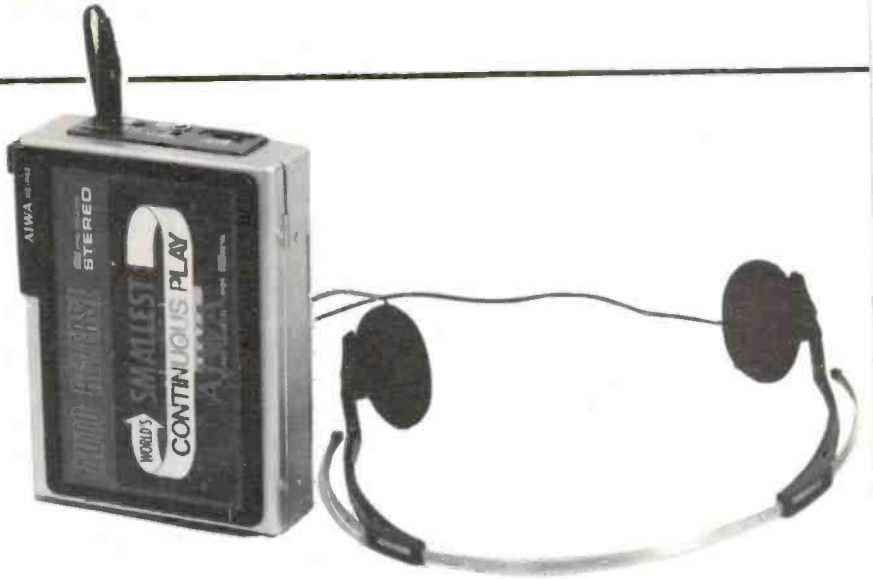
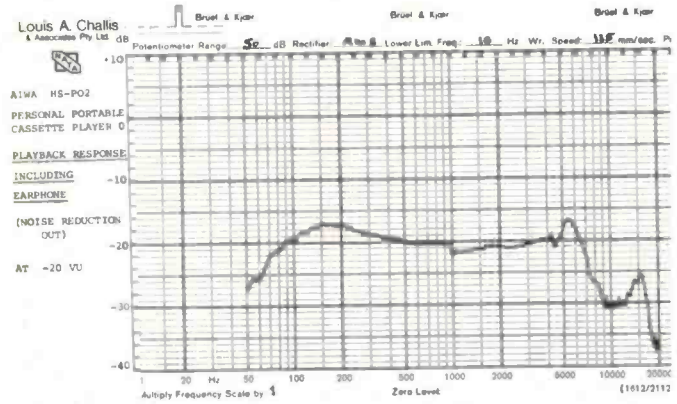
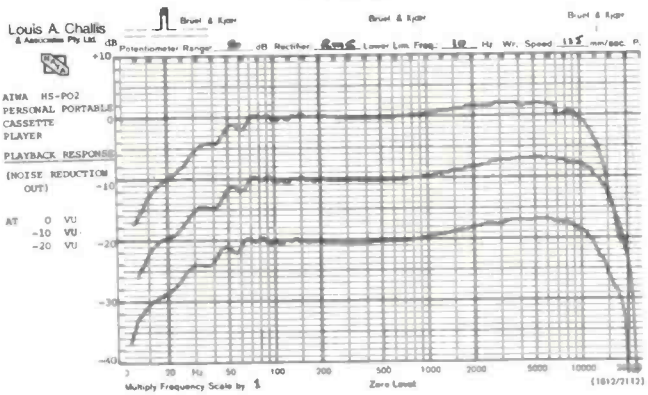
AIWA HS-P02









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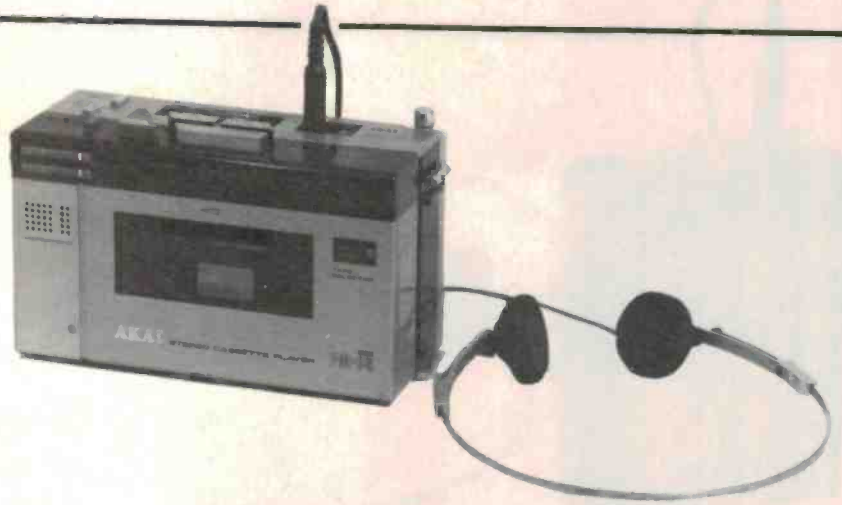
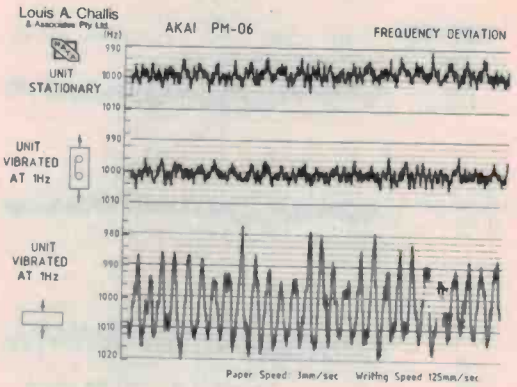
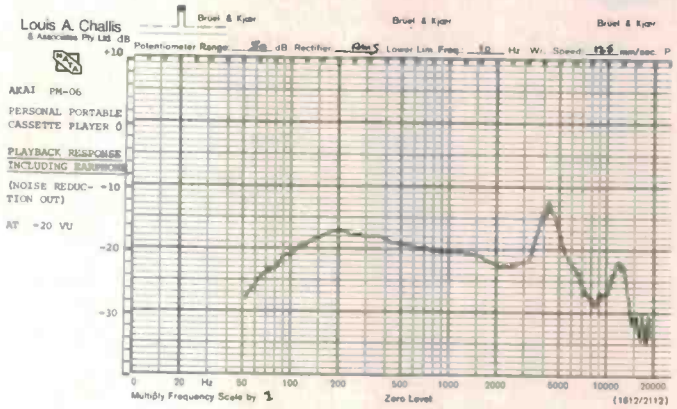
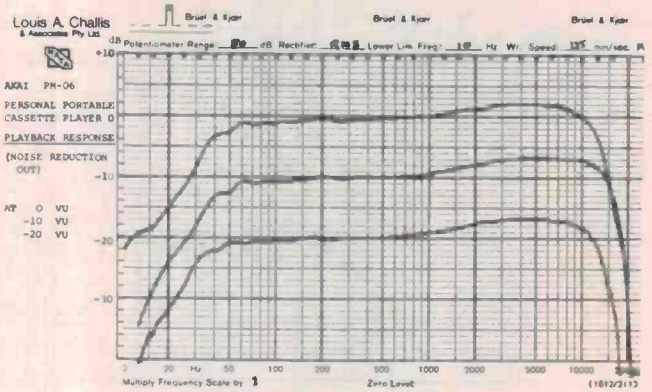








tapes. This is, in itself, a vexed question as without the use of Dolby noise reduction what you become aware of at the highest frequencies tends to be only hiss.

The artificial ear closely replicates, but does not exactly duplicate, the frequency response characteristics of a real human ear. In each case, the headphones modified the electrical output of the player. It is apparent that better headphones could further improve the audible response as can be seen by comparing the electrical output level recordings.

Realising the importance of wow and flutter we did more testing than normal. A conventional 'static' wow and flutter test tells you a great deal about the machine's performance. However, it was our belief that it was equally essential to provide a more realistic test of the same parameters when each of the machines was moving cyclically up and down.

With this aim in mind, we set up a simple mass-spring system utilising a daisy chain of elastic bands which was then used to support a small tray in which each of the cassette players could be placed. This was then oscillated up and down to provide an amplitude of vibration of ± 150 mm at a frequency of 1 Hz. While subjected to this motion the output of the cassette player was monitored to show how each tape player would perform when being subjected to a 'stylised' jogging-type motion.

Some of the results of this testing were, to say the least, surprising and the graphical results highlight the need to purchase a hip stereo player designed to cope with motion if you really do intend to use it that way.

Many of the cassette players incorporated special features such as plug-in optional FM or AM/FM cassette modules, special integrated external power amplifiers, external speakers, record facilities and even separate battery chargers. However, we did not separately evaluate or test these features, although we did note their presence.

What we have done is to provide accurate and detailed testing of the cassette replay characteristics of each of the seven machines. We evaluated what we regard as the most important technical and ergonomic features, presenting them as a direct tabulation.

With this tabulation, you can intercompare the important primary features of each unit. This will be expanded with further discussion in our subjective assessment, following listening tests with a series of reference tapes.

Subjective testing

The subjective assessment of the seven cassette players was no easy task. I was confronted with such a wide range of features and different conceptual approaches to the basic design that at first I thought I might be biting off much more than I could chew. My fears, however, were soon dispelled as the attributes and limitations of each of the cassette players were easily discernible during the subjective assessment using pre-recorded cassettes.

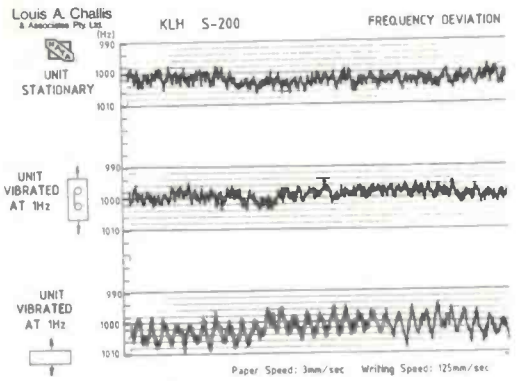
I selected three pre-recorded tapes for the assessment. The first was produced by Nakamichi, pre-recorded in Dolby B on metal tape described as 'metalloy sound', catalogue number S004; the second was a Mobile Fidelity pre-recorded original Master Recording, 'The Power and the Majesty', catalogue number NFSL C004; the third was an older pre-recorded tape without Dolby 'In Touch with Peter and Gordon', World Cassette Stereo TCS-4891.

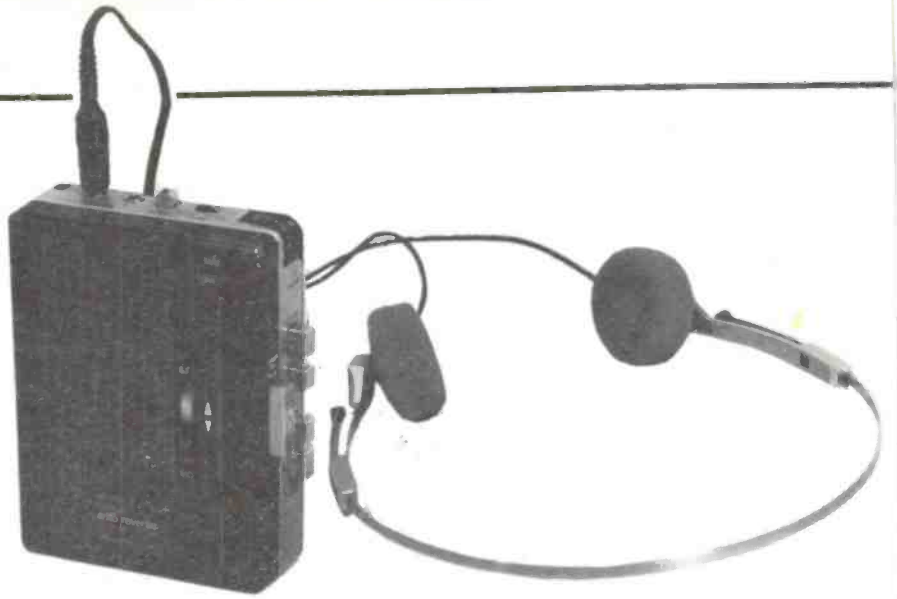
These three tapes provide adequate signal-to-noise ratios, a very wide frequency response and quiet passages suitable for assessing the impact of tape hiss with Dolby or noise reduction either on or off, as the case may be. Each of the machines was evaluated individually and certain features soon became apparent.

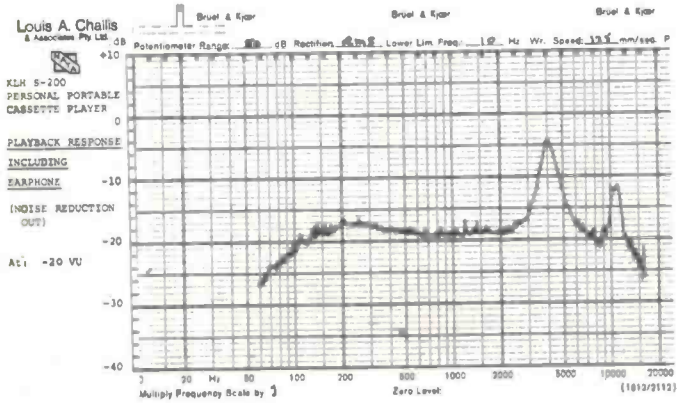
The **AIWA HS-P02** is billed by the manufacturer as being the world's smallest continuous player. I could not agree with that accolade as two of the other players were marginally smaller. The noise reduction system incorporated is not Dolby B, although it is quite effective and achieves worthwhile results.

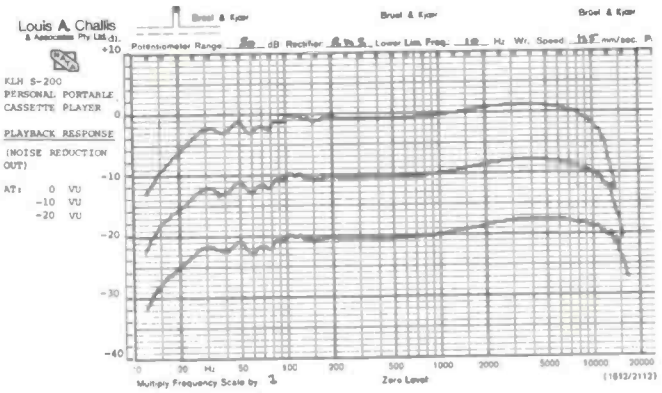
This machine has many attributes, including a strongly made lightweight metal case, excellent fidelity, excellent ergonomic controls, extremely simple loading and unloading of tapes and one feature that I believe is essential for hip stereo players that will be used by people on the move, namely auto-reverse. Added to this, ▶

KLH SOLO S-200









the unit achieves commendable signal-to-noise ratios, a good frequency response, low distortion and has a low weight suitable for a jogger.

The overall performance could really only be bettered by a small improvement in the high frequency response of the headphones. My personal assessment of this unit is that it warrants a five-star rating and it sets the pace for some of the other units evaluated.

With the **Akai PM-06** cassette player the quality of sound when playing through the integrated amplifier and loudspeakers is substantially better than it is with the headphones. While this machine is capable of being used in a mobile mode, I would not recommend it for that purpose, nor do I believe that the designers seriously considered that as being its forte.

One should consider the price of the unit and what is provided by way of additional components and functions. This is particularly important for a younger person as this may constitute their first real sound system so Akai must be complimented for its ability to provide so much hardware for what is in effect so little money.

The only feature of this machine that I did not like was the extremely high wow and flutter (tape speed variation) when subjected to vertical excitation of the type that would be produced when running, jogging or when moving in a car on a rough road. This unit could not really be classified as a good example of a hip stereo player, although it has other attributes which will endear it to many other situations and users. Overall this unit still warrants a three-star rating for its marketing potential and for its wide range of domestic features and possible uses.

The **KLH Solo S-200** is a good example of how a small cassette player can be effective. This unit achieved an exceptional frequency response in terms of its electrical output. It is 18 Hz to 17 kHz which many mains operated machines would be hard pressed to equal.

It was one of the more expensive units tested, although it should be noted that it also contains an FM cartridge which extends its range of possible uses. The unit also features auto-reverse, which I believe is an essential attribute for the best hip stereo players and is well engineered, as well as being extremely small in size.

The only factors that really let this unit down are the moderate level of peak wow and the frequency response achieved by the headphones, which are not quite up to the other parameters that the machine provides.

Given a change of headphones (comparable with any of the better units reviewed in the April issue of ETI), the performance of this machine would be brilliant and most probably better than any of the other machines tested. Based on the parameters measured however, the machine still warrants a four star rating and its good design is capable of being simply upgraded but at additional cost.

The **National Way** cassette player appears to constitute particularly good value for money. It is the second least expensive of all of the units evaluated while also being the lightest weight unit of all of those tested.

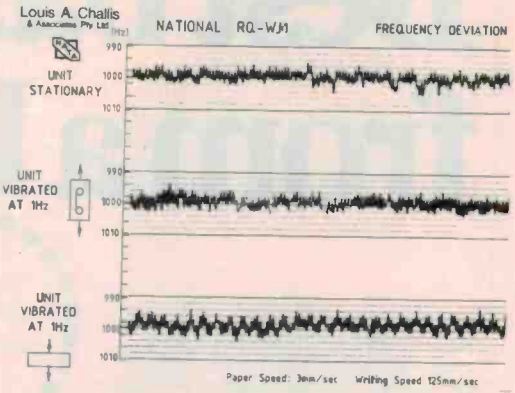
The ergonomic design features provided for fast forward and reverse and are deceivingly simple, yet incredibly effective. Although it lacks many of the frills and some of the thrills of the other units, it provides a good compromise between cost and performance, although the first unit that we saw exhibited higher wow and flutter than most people would consider acceptable.

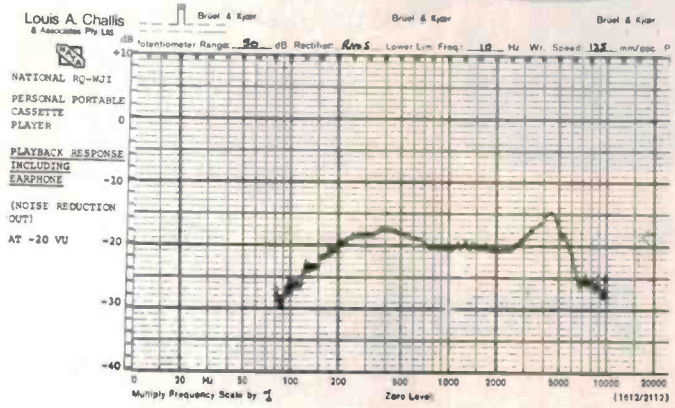
This unit, like all of the others, would benefit greatly from better headphones and there is an obvious message there for all of the manufacturers to pull up their socks and face the problem of headphone quality fairly and squarely. This unit still warrants a three-star rating because of its good mix of ergonomic attributes and reasonable performance.

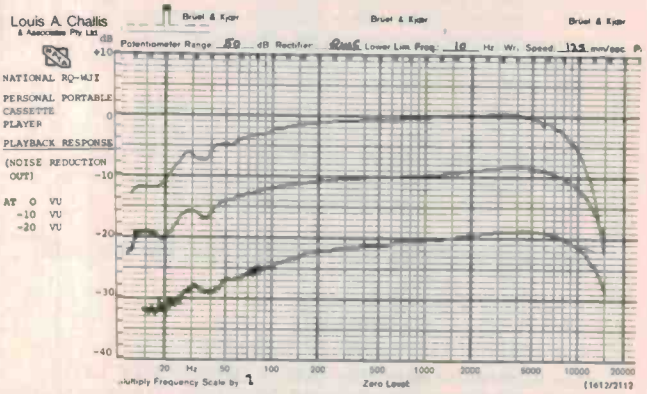
The **Sanyo M-G12** was the cheapest unit evaluated. It provides acceptable performance at almost one third of the cost of the most expensive unit. Sanyo does produce better models, with unquestionably better performance.

Notwithstanding, Sanyo has tended to be a price leader in the bottom end of the market and the M-G12 shows how it achieves it. It has even managed to put in rechargeable batteries and a battery charger at the incredibly low recommended retail price of $77.

NATIONAL WAY RQ-WJ1







Even though it is the least expensive of the units, its wow figures are as low as any of the units tested, although its flutter was as high as the highest measured. The frequency response on replay through electrical output and headphones is still reasonably good.

Although its performance is not outstanding, when you take into account the price, and the fact that it will cost so little to run, this unit must still warrant a three-star rating.

The **Sony Walkman F2** is an excellent unit. It contains a built-in FM receiver, a tape counter and has a generally good ergonomic design. Although it should be noted that the tape transport controls are located on the opposite side from the cassette well.

The unit features a plastic and metal casing but regrettably does not incorporate an auto-reverse function which I now believe to be an absolutely essential feature in the best hip stereo players. This unit, it must be stated, is best suited for your desk top or bedside table. However, it will function extremely well when attached to your waistband or placed in your shirt pocket.

The dynamic wow and flutter figures are low and are only really bettered by one other machine. The only factor detracting from the performance of this unit are the headphones, which do not appear to have been as well engineered as the rest of the unit. The high frequency replay performance on this unit also suffers a little because of a slight imperfection of the azimuth alignment.

It is the most expensive unit of the seven tested, however, it does incorporate recording facilities by which the output of a stereo microphone can be recorded. This makes the unit one of the smallest and lightest stereo recorders available in the market place. The unit is well engineered, well conceived and certainly warrants a four-star rating.

The last unit to be evaluated is the **Toshiba KT-AS1** which contains most of the features that outdoor audiophiles really want. As well as auto-reverse, it also incorporates an AM/FM cassette (surprisingly the only unit tested that does, the tendency being to provide FM only). It contains a Dolby B noise reduction circuit that works well to achieve an effective 60 dB (A) noise reduction with Dolby pre-recorded tapes. It also has equalisation for metal and normal gamma-ferric-oxide tapes and dimensions that are as small as any of the units tested.

The simplified controls, particularly the fast forward and rewind buttons, are mirrored in part by the National Way. However, that unit does not offer such a good performance, particularly in terms of the excellent wow and flutter figures. The Toshiba's low wow and flutter figures are particularly evident in the dynamic vibration mode. Other good design features noted are folding headphones and an external battery pack for longer listening.

Even the frequency response on replay of 70 Hz to 8 kHz gives the unit a reasonably notable performance. The Dolby noise reduction system makes it possible to hear the highest frequencies in the relative absence of hiss. This feature makes the Toshiba KT-AS1 a particularly good unit and helps it to earn an unquestioned five-star rating.

Conclusions

Surprisingly, all of the units tested had a wide range of attributes with very few of them having any totally unacceptable or disturbing operational features. You should not consider that these are the only good hip stereo units in the market place.

When selecting your purchase you must evaluate each unit's objective and subjective features. In particular, the usability of the controls and the most likely way in which you will make use of those controls must form the basis for your own personal assessment.

When you start to talk to the retailer intent on selling you one or more of his preferred brands, draw up your own list of pre-requisites and tick off the pros and contras before making your purchase.

Continued on page 29▶

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MARANTZ (Australia) Pty. Limited Inc. in NSW, 19 Chard Rd., Brookvale. NSW 2100. Sydney (02) 9391900, Melbourne (03) 544 2011, Brisbane (07) 44 6477, Adelaide (08) 223 2699, Perth (09) 276 3706, Townsville (077) 72 2011.

SONY
THE ONE AND ONLY

The Sony CDP101
The magic of digital audio becomes a magnificent reality.

Digital Audio is a revolution. The greatest advance in home music reproduction since the gramophone record. As you'd expect, Sony is the leader of this revolution with its magnificent CDP-101 player that offers you original studio master quality at home.

For the technically minded, the specifications read more convincingly than any superlatives • flat frequency response over the entire audible range • dynamic range and signal to noise ratio over 90dB • perfect channel separation • immeasurable wow and flutter • negligible distortion.

Sony's CDP-101 uses an optical laser pick-up (incorporating three micro processors), it is easier to use than a conventional turntable and connects easily to your existing system.

Other features include • fully automatic linear skate front disc loading • automatic music sensor • dual function digital readout of playtime • audible fast forward and reverse • 10 function wireless remote control.

Compact Discs Last Forever

Just 12 cms in diameter, the Compact Disc plays up to 60 minutes of music. It's protected from scratches, dust and finger prints by a plastic coating; and because the pick-up is a laser beam, deterioration is non-existent. Reproduction remains perfect virtually forever.

Hundreds of titles will be available with many more to follow from major companies such as CBS.

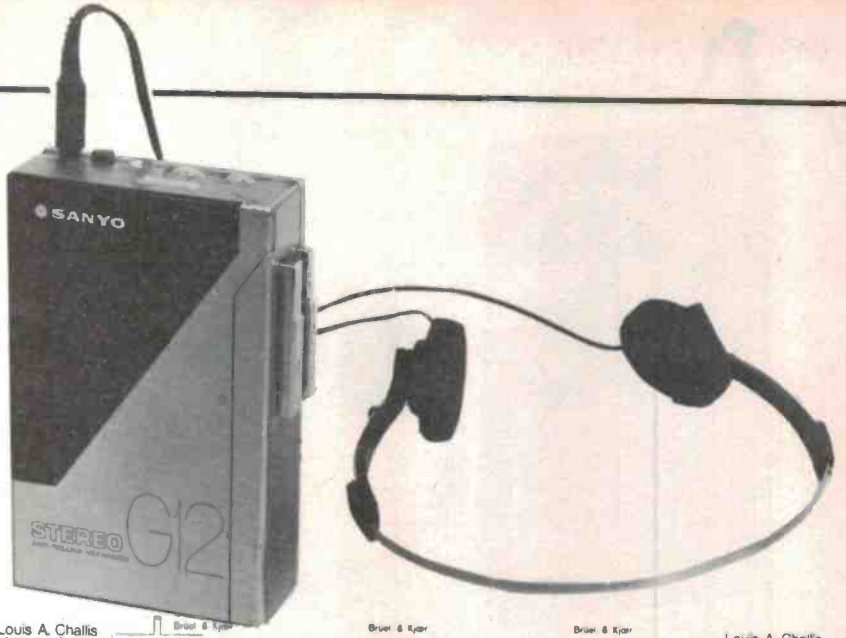
CDP-101 Specifications

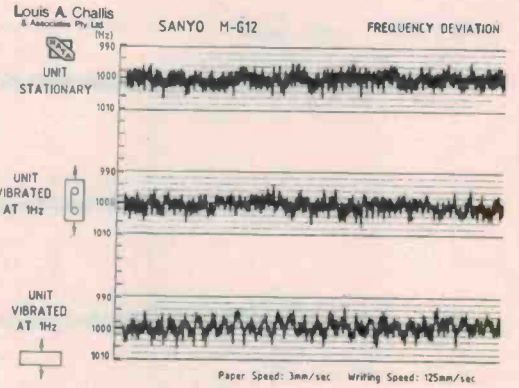
Frequency Range	5Hz-20kHz ± 0.5dB
Dynamic Range	more than 90dB
S/N	more than 90dB
Channel Separation	more than 90dB (at 1kHz)
Harmonic Distortion	less than 0.004% (at 1kHz)
Wow and Flutter	immeasurable

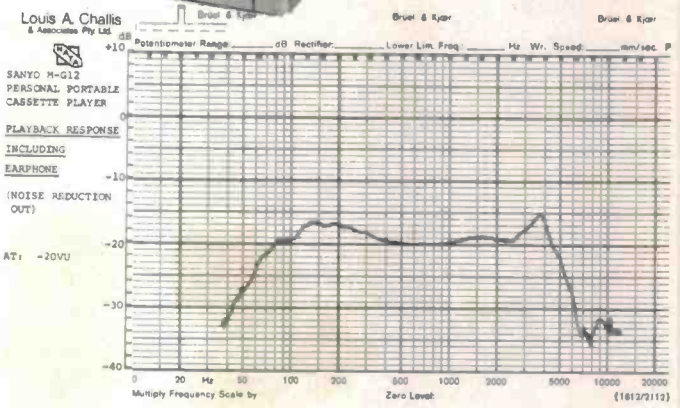
Contact Sony for the name of your nearest dealer.
Sydney (02) 266 0655, Adelaide and N.T. (08) 212 2877, Brisbane (07) 44 6554, Perth (09) 323 8686,
Melbourne (03) 419 3133, Launceston (003) 44 3078, Wollongong (042) 71 5777.

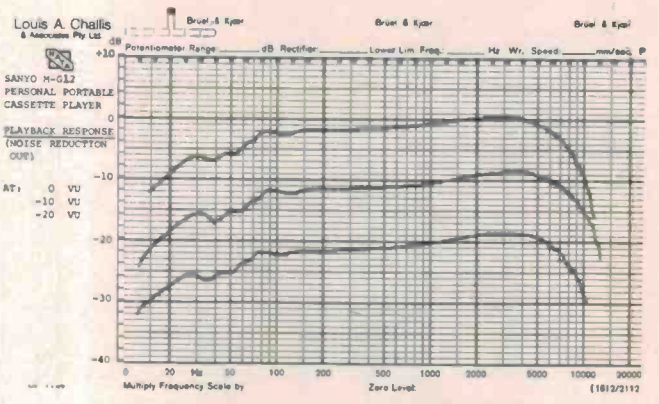
AUD0378

SANYO M-G12



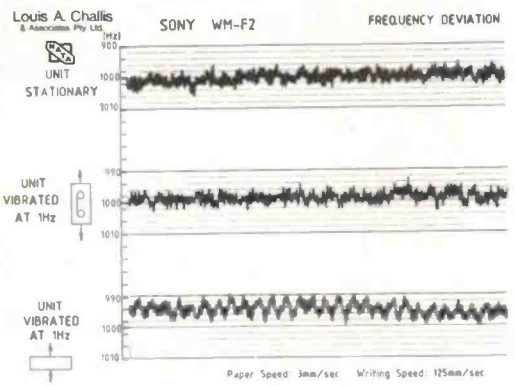


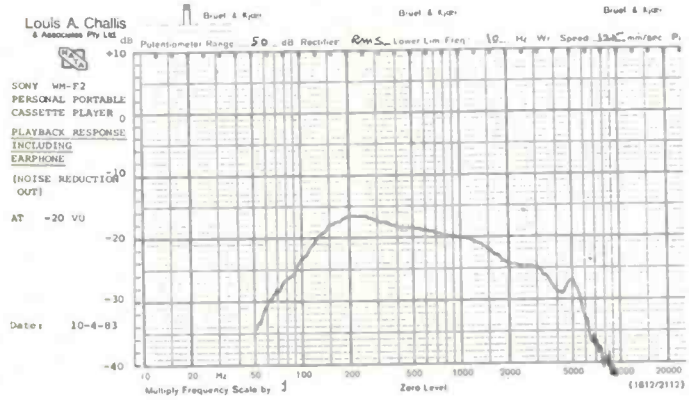


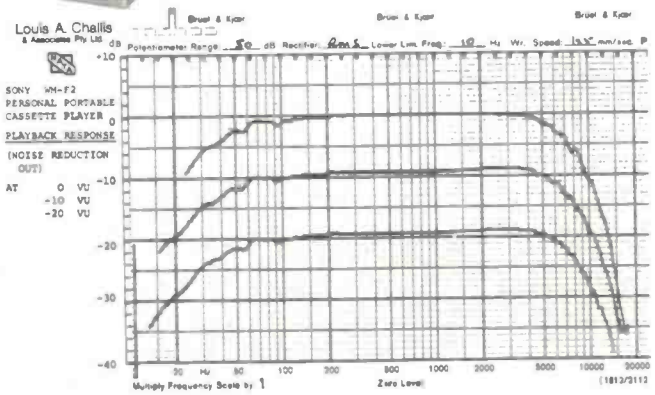


Make and Model	Recom. Retail Price	Dimensions & Weight	Construction Material	Strip Cradle or Carrying Case	Headphone Cord Length & Band Size	Head-phone Weight	Number of Headphone Sockets
AIWA HS-P02	$179	88 x 111 x 31 mm 310 g	Metal & plastic	Case. Shoulder strap. Belt hanger.	1300 mm Excellent	40 g	2
AKAI PM-06E	$179	100 x 158 x 36 mm 560 g	Plastic	Plastic case. Shoulder strap. Belt clip. Cassette pouch.	1300 mm Reasonable	45 g	2
KLH SOLO S-200	$225	87 x 115 x 33 mm 350 g	Plastic	Case*. Belt attachment. Shoulder strap. Wrist strap. Cassette pouch.	1100 mm Reasonable	40 g	2
NATIONAL WAY RQ-WJ1	$139	75 x 110 x 28 mm 223 g	Plastic	Plastic screw on belt cradle. Shoulder strap.	1600 mm Reasonable	54 g	2
SANYO M-G12	$77	92 x 140 x 35 mm 399 g	Plastic	Case*. Strap.	1200 mm Good	60 g	1
SONY WALKMAN F2	$239	80 x 140 x 34 mm 370 g	Plastic & metal	Plastic case*. Belt attachment.	1250 mm Good	45 g	2
TOSHIBA KT-AS1	$199	80.5 x 108 x 29 mm 290 g	Plastic	Plastic belt cradle. No restriction. * Must remove to eject cassette	1600 mm Good folding headband	50 g	2

SONY WALKMAN F-2

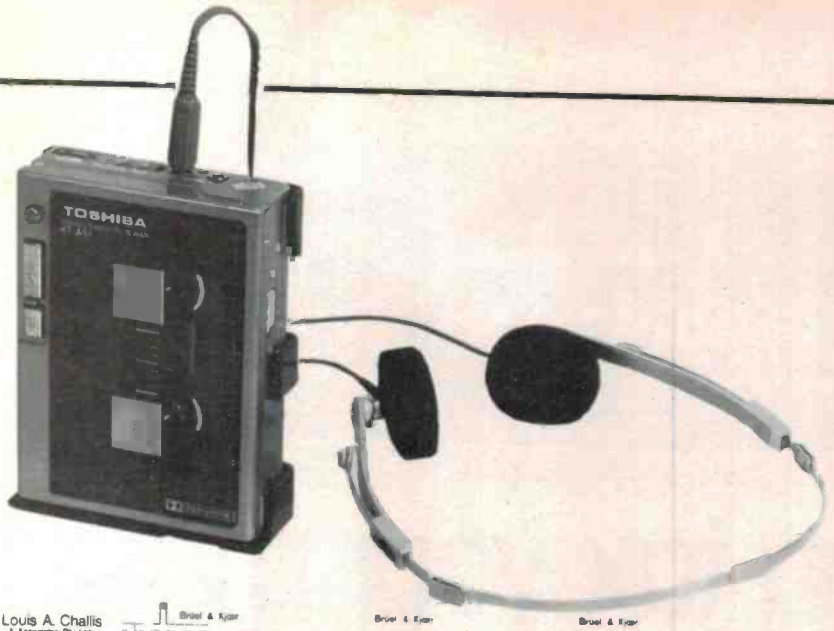


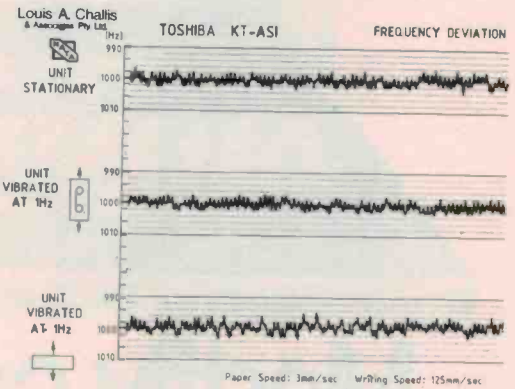


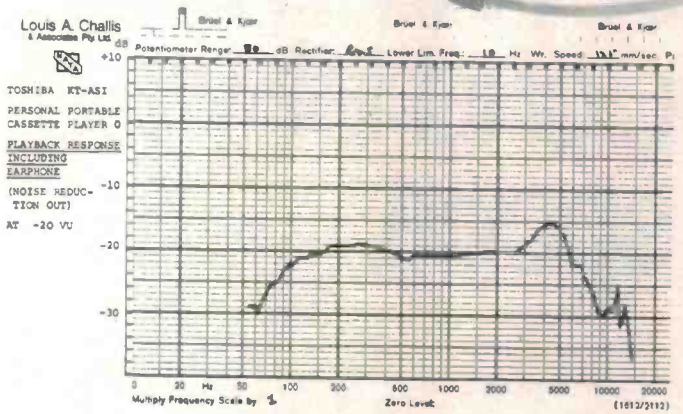


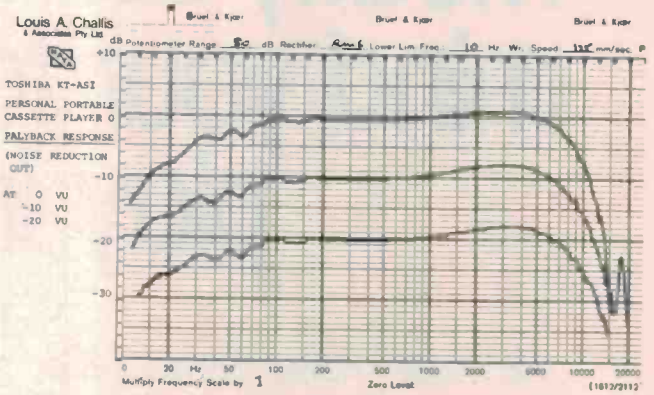
Make and Model	Tape Transport Controls	Provision of Pause or Mute	Tape Counter	Auto Reverse	Demonstration or Blank Tape	Extra Features FM Cassettes (Not Tested)	Batteries	Battery Condition Indication	Dolby B Noise Reductio
AIWA HS-P02	Very good Has eject	Pause	No	Yes	—	Pause control Reverse pushbutton Stop/eject button	3V 2 x AA	Yes	Yes
AKAI PM-06E	Good Has eject	Mute	No	No	—	Microphone External amplifier Speakers, Cassette pouch, FM cassette Battery eliminator	6V 4 x AA + Ext. socket	Yes	No
KLH SOLO S-200	Good	Mute	No	Yes	—	FM cassette tuner	3V 2 x AA + Ext. socket	Yes	No
NATIONAL WAY RQ-WJ1	Very good	Pause	No	No	Yes	External battery case for 2 D-cells to attach to belt	3V 2 x AA + Ext. socket	Yes	No
SANYO M-G12	Good	Mute	No	No	Blank tape	Rechargeable batteries + Battery charger (Folding), Mute, Tone. Balance	4.8V 4 x AA Ni-Cd supplied or 4 x AA normal + Ext. socket	Yes (rechargeable cells)	No
SONY WALKMAN F2	Very good	Pause	Yes	No	Yes	Microphone jack Internal FM stereo	3V 2 x AA + Ext. socket	Yes	No
TOSHIBA KT-AS1	Very good	Mute	No	Yes	—	External battery pack to attach to belt. Folding headphones FM/AM cassette	3V 2 x AA	Yes	Yes

TOSHIBA KT-AS1









Ferric Oxide or Metal	Frequency Response Hz at Socket re 1 kHz	Frequency Response Hz at Headphones (± 6 dB)	P to P Wow and RMS Flutter	Audible Wow and Flutter	Signal to Noise re 0 VU (dB)	Orchestral Fidelity	Maximum SPL dB @ 1 kHz	Overall Rating
Ferric oxide or metal	25 Hz-12 kHz	55 Hz-7.5 kHz	0.05% 0.14%	Not audible	−47.5 Lin −52(A)	Good. Audible hiss. Noise reducn. effective.	117.5	*****
Ferric oxide or metal	30 Hz-14 kHz 4.5 kHz-7 kHz	55 Hz-4 kHz	1% 0.3%	Low when stationary, pronounced when moving.	−47 Lin −52(A)	Fair. Hiss not pronounced.	116	***
Ferric oxide or metal	18 Hz-17 kHz	65 Hz-3.2 kHz 5 kHz-10 kHz	0.2% 0.25%	Not audible	−46 Lin −51(A)	Good. Audible hiss.	110	****
Ferric oxide or metal	70 Hz-13 kHz	100 Hz-6.5 kHz	0.05% 0.25%	Just audible	−48 Lin −53(A)	Fair. Audible hiss.	114	***
Ferric oxide	40 Hz-9 kHz	55 Hz-5.5 kHz	.05% 0.3%	Not audible	−46 Lin −50(A)	Fair. Audible hiss.	116	***
Ferric oxide	28 Hz-8.6 kHz	90 Hz-3.2 kHz	0.1% 0.2%	Not audible	−45 Lin −50(A)	Very good. Audible hiss.	115	****
Ferric oxide	20 Hz-10.5 kHz	70 Hz-8 kHz	.06% 0.13%	Not audible	−46.5 Lin −51(A) −60(A) with Dolby	Very good. Dolby hiss reduction.	116	*****

Medfly can tax your mind, mind your tax, and let you play in space.

The Medfly home computer is compatible with the largest library of software available today. What this opens up to you and your family is simply amazing.

For your children — education packages on Algebra, Spelling, Mathematics, Vocabulary — making your Medfly virtually a home coach or tutor.

For personal and business use — you get access to Time Management, Business Systems, Accounting Packages and Financial Broadsheets.

For family entertainment — you'll be able to share the fun of Action Games, Strategy Games and Adventure Games, which you can plug straight in to your home TV screen.

Medfly is a thinking machine to expand young minds; a working machine for home or business accounting; a games machine for family fun. And above all, Medfly is a value machine, with quality electronics by Siemens and with more features, capabilities and add-on potential than many costlier microcomputers.

The basic Medfly microcomputer system — alpha/numeric keyboard and processor — is available now for just $1,995 including sales tax.

MED FLY

putting the value buzz into home computing

VICTORIA:
Medfly Basis (Vic.) Pty. Ltd. 43 Atherton Rd. OAKLEIGH, VIC. 3166 PH: 569 0169.

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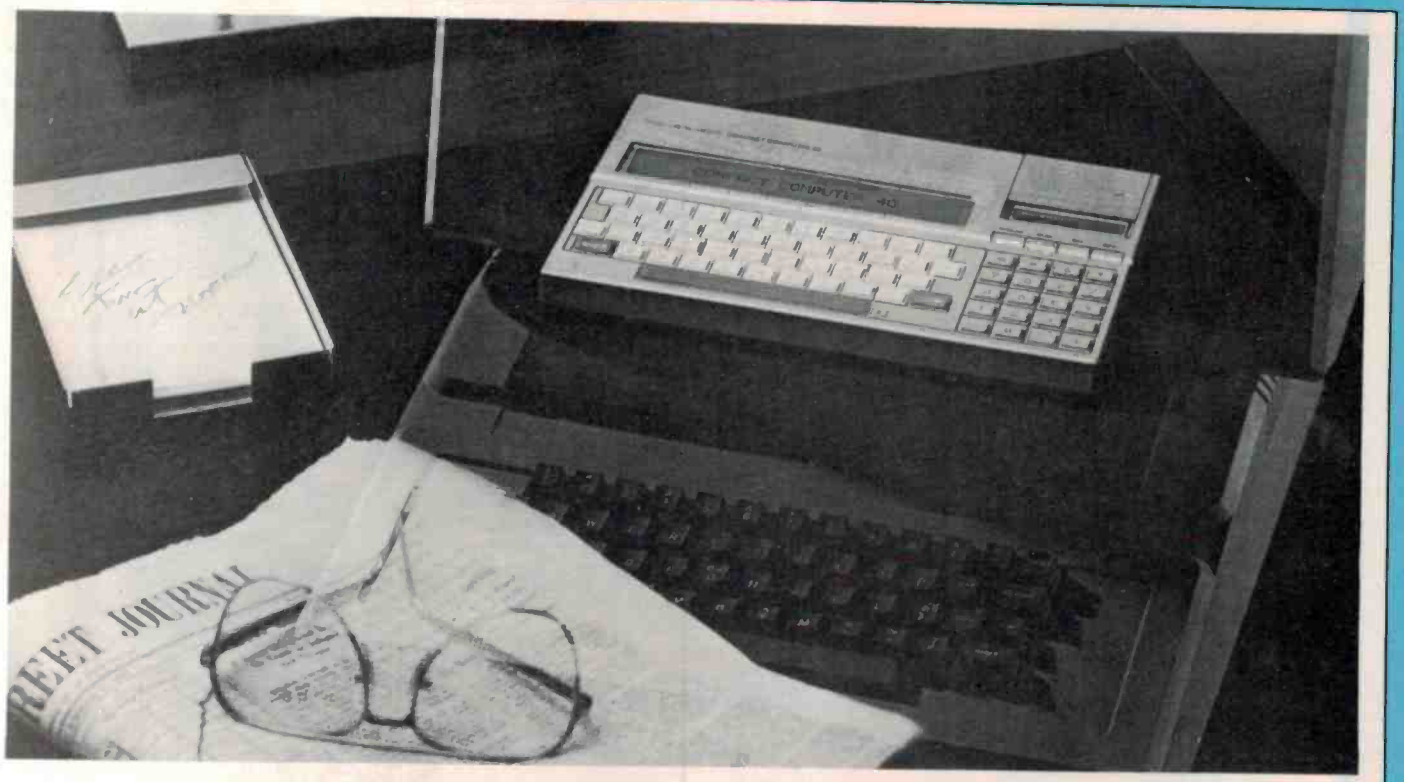
COMPUTING TODAY



Just say "... CC ..."

Small enough to be carried in a briefcase, Texas Instruments' new CC-40 — CC for 'compact computer' — has an integrated LCD display, is programmable in Enhanced BASIC, and can run preprogrammed applications software loaded from either plug-in-solid-state cartridges or from small tape cartridges.

The battery-operated system is designed to be used as a small, desktop, cordless computer and for data communications. Launched this month, the CC-40 has a suggested Australian retail price of $350.

It contains 6K of user-addressable RAM and can be expanded to 18K.

The CC-40 console is 242 x 146 x 26 mm and weighs 720 g. The display is a scrollable 31-character LCD capable of displaying both upper- and lower-case characters. In addition, there are 18 built-in indicators for user feedback, including shift, control, function, degrees, radians, grads, input/output in progress, upper-case lock, error, low battery, left and right scroll flags, and six user-settable flags.

The keyboard has a staggered QWERTY key arrangement with a numeric keypad. Key spacing allows for easy key entry without making the unit excessively large. A tilt stand is built into the back of the console to provide an optimum viewing and keying angle.

Four AA alkaline batteries provide power to the console for up to 200 hours. Memory contents are retained even when the unit is turned off. The unit may also be connected to a standard 240 V ac power outlet using an optional ac adaptor.

For more details, contact **Texas Instruments Australia, 6-10 Talavera Road, North Ryde NSW 2113. (02)887-1122.**

Macpro and the Peter Principle

Macpro Computers Australia has launched a range of locally manufactured microcomputer systems aimed at the business community.

The result of more than two years research and prototyping by Peter McRae and Peter Paprota, the systems have been designed to offer high performance and reliability at a competitive price.

Both Peters are development engineers and they say their main aim in launching Macpro was to prove the concept of total modularity and produce a viable range of products that would grow with the user's needs.

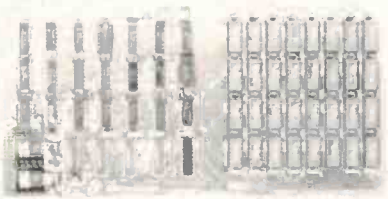
The entry level in the Macpro range is the System 250, a Z80A-based single terminal with a clear upgrade path to a 16-bit system. To be sold in Australia and overseas, the system consists of the central processing unit, a 30 cm CRT, a detachable keyboard and dual 20 cm floppy-disk drives with 2.5M capacity. The basic model is priced under $11,000.

Maximum configuration at this stage is 16 terminals and printers, nearly 40M of hard-disk storage and RAM expandable in 256K stages.

For additional details, contact **Macpro Computers Australia, 183 Bank Street, South Melbourne Vic. 3205. (03)699-3100.**

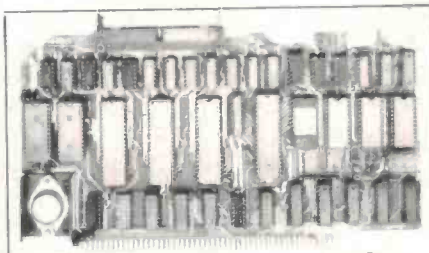
K-NAR COMPUTER CARDS
S100 Z80 System Card Specialists

CP/M3



CP/M3 USERS
DRC-II. The board for multi-user installations. 256K dynamic RAM card, bank select, fast 4 Mhz operation, on-board memory prom, dip-switch selectable boundaries, bank mode allows up to 2 boards on bus, hidden refresh, phantom disable. List Price $995.

$795 OUR PRICE

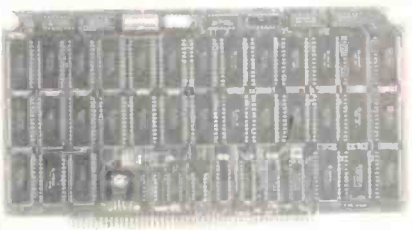


CRC-64. Fool-proof memory system. State-of-the-art 64K CMOS memory card with memory protection, on board battery back-up, compatible with DRC-II, write protection enable/disable. List Price $675.

$565 OUR PRICE

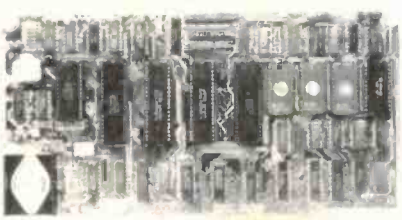
FDC-II. Enhanced floppy disk controller, IBM 3740 compatible, operates 5" & 8" and single/d. density drives, handles up to 4 drives, runs multi-density CP/M2.2 & MP/M 2. Vectored interrupt operation optional. List Price $465.

$370 OUR PRICE



MPC-6 Dartbaud. Z-80 based six channel intelligent RS232 I/O card for Multiple-User type systems. Independant programmable baud rates, on board 6K battery backed Memory, and user programmable features for system tailoring.

$425 UNBEATABLE VALUE



SBC-800. 4 Mhz Z-80 CPU, two serial RS232 ports, software programmable Baud rate gen., Centronics parallel port, 22 prog. I/O lines, real time clock (battery backed), 2K CMOS RAM, power on reset/power fail detect, battery backed as standard, etc. List Price $495.

$395 OUR PRICE

Please send me product data sheets. (I enclose 4 stamps).

I wish to order .....

My cheque/order form for .. is enclosed

Please debit my Bankcard No. .....

Name .....

Address .....

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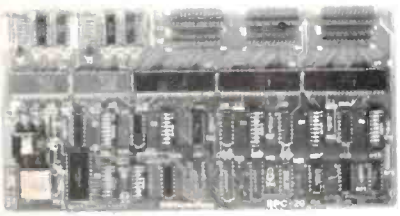
Signature .....

Please include me on your new product mailing list. I am mainly interest in systems for ☐ Hobby, ☐ Industrial use, ☐ Education, ☐ Business, ☐ Process control, ☐ Other.

KN 541



SPC-29. High performance dual serial & 9 parallel port I/O CARD, with full I/O address decoding. Switch selectable baud rates. Link patch area, programmable modes for strobed/latched I/O. List Price $295.

$235 OUR PRICE

MINI CARD CAGE.
Compact card cage frame with 5-slot motherboard plated through hole. Five edge connectors. Was $150.

$125 OUR PRICE

S-100 WIRE WRAP CARD. Gold-plated edge connectors, through hole plating, provisions for four regulators, distributed power rails, I/O connector provision on top of card.

$33 OUR PRICE

DIGITAL PANEL METER
Analogue Devices 4½ digit LED Panel Meters. Brand new in original boxes. Originally $300.

$75 OUR PRICE

(Limited Stocks)

K-NAR COMPUTER CARDS

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Authorised distributor of SME Systems products.

* Prices subject to change without notice. All prices excluding tax. For retail prices add 20%.
All boards fully assembled and tested and backed by 90-day guarantee.

Imagic backs video games

A leading Australian distributor has scoffed at reports that the video computer-game market faces imminent collapse.

"The Australian market will certainly continue a healthy growth pattern," Imagic Australasia's director of marketing, Mark Bollinger, said on his return from the Consumer Electronics Show in Chicago.

"Some United States market analysts were plucking figures from the air after the initial explosion in hardware and software. The result was that almost a hundred manufacturers rushed the market, each targeting for 5-10% penetration. Something had to give.

"The shake-out that followed has meant the survival of the fittest and, equally important, better products all round.

"Consumers are as keen to purchase games software as ever, but they're demanding a level of sophistication that the 'cheapie' manufacturer can't produce." This was because only the major software companies could afford to employ the design talent and technical expertise that was essential to produce a successful game program.

"American retailers report that cheap Asian imports just aren't making it, despite prices as low as $5," Mr Bollinger said. "Gone are the days when almost anything that moved on a screen could be called a game and be expected to sell.

"The Australian market has the advantage of learning from the American experience, and those retailers who are on the ball will avoid many of the obvious problems ahead."

Video monitor

A new budget priced video display is available from AED Microcomputer products.

The display offers 22 MHz video bandwidth which AED claims is an improvement over competing products. The display has a swivel and tilt facility which can be easily modified by the operator.

The monitor can be used on any computer system that produces a one volt peak-to-peak video signal or any computer that uses a descreat video card.

There is considerable space in the monitor for a 270 mm x 320 mm printed circuit board as well as a suitable power supply which allows the monitor to be turned into a complete stand alone computer or terminal.

The display is capable of 80 character x 24 line format as well as 64 x 16 or 32 format.

For further information contact **AED Microcomputer Products, 130 Military Rd, Guildford NSW 2161. (02)681-4966.**

Master the microprocessor

The Australian School of Electronics, which has the practical LernaKit course in basic electronics, is now offering a new, 'hands-on' practical course on the fundamentals of microprocessors, incorporating a built-up, ready to use microprocessor.

The training program has been designed and produced by the computer technology division of the British National Radio and Electronics School.

The course, which can be studied at home in your own time, provides the necessary basic information to enable the student to understand the functioning of microprocessors and their supporting circuitry. You'll be shown how to program in machine code and given an understanding of how Assembler and higher level languages relate to this. Provision is made for BASIC programming if required.

No previous knowledge of computers is necessary, though a little basic knowledge of electronics plus digital and logic circuits will be helpful. A special introductory short course is available to provide this background information, if required by a student doing the course, with no extra charge.

The fees cover all hardware and software required for the course, and special rates are available for groups sponsored by firms. A specially monitored Industrial Training Program is offered to companies.

Further details of these courses are available from **The Registrar, P.O. Box 108, Glen Iris Vic. 3146. (03)523-5622.**

Fast, intelligent digital plotters

Two new National digital plotters are now available from Scientific Devices.

The VP-6802A is an A-3 type digital plotter with eight-colour graphics and a plotting speed of 450 mm/s.

The VP-6801A is an A-4 type digital plotter with six-colour graphics and a plotting speed of 400 mm/s.

Eight-bit parallel, RS232-C and GP-IB interfaces are optional with the VP-6802A and VP-6801A, allowing these plotters to be used as computer graphics devices.

More information can be obtained about these plotters from **Scientific Devices Australia Pty Ltd, 2 Jacks Rd, South Oakleigh Vic. 3167. (03)579-3622.**

Commodore redesigns the Rat Race

Rat Race is the latest game released by Commodore Computer for its VIC-20 microcomputer.

In Rat Race, the player becomes a mouse and the objective is to eat 10 cheeses, dotted around a maze, before time runs out or the chasing rats catch up.

To move around the maze, the player can use either the VIC-20 keyboard or the joystick.

Available on either cartridge or tape, Rat Race is distributed by **Video Classics Computer Games, 286 Pacific Highway, North Sydney NSW 2060. (02)438-4866.**

Fully encoded Preh keyboard

Preh's keyboard division has introduced the Preh Commander, a programmable intelligent keyboard built around a single-chip EPROM microprocessor.

The keyboard's electronics allow a number of software changes to be made by the user, including parallel or serial output, positive or negative strobe pulse, seven baud rates (150 to 9600 baud), one or two stop bits, auto-repeat and caps-lock on or off, and data-release line.

All up, more than 200 internal characteristics can be defined.

The Preh Commander's dimensions are 446 x 190 x 30 mm.

For further information, contact **Mayer Kreig, 246-248 Angas Street, Adelaide SA 5000. (08)223-6766.**

EPROM programmer

The CRC-80 is a new, low cost programmer which can program several types of EPROMs as well as emulating these PROMs in the actual custom system.

EPROMs which may be programmed are 2708, 2758, 2716, 2516, 2732, 2532. An additional module is available to allow it to also do the 2764 and 2564 EPROMs. Another personality module allows programming of the 8741, 8748 and 8749 series of single chip microcomputers.

The programmer comes with an in-built serial interface that may be configured to be RS-232, TTL or 20 mA current loop. This allows it to operate with a terminal or from a host computer.

A cassette interface allows the user to store and retrieve PROM data from an ordinary audio cassette recorder.

Emulation probes allow Z80 or 8085 microprocessors to be in-circuit debugged.

More information is available from **Alfatron Pty Ltd, 1761 Ferntree Gully Rd, Ferntree Gully Vic. 3156. (03)758-9551.**

Scoop: A program what can tell where youse come from but

An experimental artificial intelligence (AI) program being conducted at IBM's American research facility may lead to machine recognition of social class.

According to a 167-page research report from International Resource Development, a United States market-research firm, the IBM program can evaluate the style of a letter, document or memo and can critique the writing style, syntax and construction.

Though IBM's immediate application for this technology is to highlight 'inappropriate style' in documents being prepared by managers, the IRD researchers see the program being applied to determine the social origins, politeness and general character of the writer.

The experimental IBM system is named Epistle (Evaluation, Preparation and Interpretation System for Text and Language Entities). Its long-range objective — to provide office workers with intelligent applications for natural-text processing, particularly related to business correspondence — is directed primarily toward aiding middle-level managers.

Eventually, the project is expected to diverge into two major classes of applications. The first would address incoming textual material, providing such services as preparing a synopsis of letter contents, highlighting items known to be of interest to the particular manager involved, and automatically generating indexing terms for future document retrieval.

The second class of applications, which is currently receiving most of the attention, will apply to critiquing documents being prepared by the manager. Critique outputs from Epistle would initially be referred to draft documents, and would comment on 'inappropriate style' (phrases which are overworked, outdated, stilted, too lengthy, too formal, obscure or otherwise likely to be found objectionable by the recipient), and syntactical error correction (improper verb forms, structural disagreements between subject and verb, and so on).

However, the program is not likely to stop there, according to the IRD report: "The heuristic self-teaching capability of the artificial-intelligence system will enable the system to learn and recognise which style or pattern of writing originated in the Bronx, which in Harlem, and which in San Diego."

The report says that the style of the letter will, in many cases, permit the program to deduce the level of intelligence, assertiveness and refinement — and certainly the writer's sex and age. This capability enables the Epistle program to respond to a letter in a mode appropriate to the writer and the occasion. For example, having ascertained that a letter had been sent by a 55-year-old lady of Armenian background, Epistle would help a manager to respond to the letter in terms to which the lady would directly relate.

Further details on the US$1650 report, which is entitled *Artificial Intelligence*, including a free description and table of contents, are available by writing to **International Resource Development, 30 High Street, Norwalk, CT 06851, United States. Telex 643452.**

Flex Electronics expands

Flex Electronics has been appointed the Victorian agent for Energy Control, a Brisbane based firm.

Flex Electronics has a broad range of 68xx and 65xx family components and modules from manufacturers such as Synertec, Rockwell, The Computerist and others.

Also available from Flex Electronics is a single board computer capable of running FLEX9. The board, manufactured by The Computerist, is known as the Flexi-plus and features 56K static RAM, a monitor program, cassette interface, floppy disk controller, RS-232 port, IEEE-488 buss interface and two parallel ports.

A broad range of software is available to run on the board. For details contact **Flex Electronics, P.O. Box 75, Camberwell Vic. 3124. (03)830-1668.**

Webster's mighty mux attracts $1 million American orders

Australian computer manufacturer D.D. Webster Electronics has received more than $1 million in United States export orders for its asynchronous eight-line multiplexer, launched last February.

Designated the SZV11, the multiplexer was developed by the Melbourne-based company to plug terminals and printers into Webster Electronics' locally designed Spectrum 11 range of minicomputers. However, it was also intended as a stand-alone product, targeted to the computer Q-bus market in general.

Like all Spectrum products, the SZV11 is compatible with the internationally popular PDP-11 systems of the giant Digital Equipment Corporation. As a result, the SZV11 has proved to be an efficient eight-terminal interface to DEC LSI-11-based computers.

This compatibility is the basis of the American orders, deliveries of which are already underway to Webster Electronics' United States distributor, Saturn Systems, of Minnesota.

At 14 cm high, the SZV11 is half the size of DEC's popular DZV11 multiplexer, yet it offers eight lines compared to the DEC unit's four.

A single SZV11 sells in Australia for $1150.

For further details, contact **D.D. Webster Electronics, 17 Malvern Street, Bayswater Vic. 3153. (03)729-8444.**

Show business

The second annual Australian Personal Computer Show is to be staged at Sydney's Centrepoint complex from March 14-17 next year.

The event, to be held over four days, has drawn an immediate response from previous exhibitors — IBM, Digital Equipment, Apple, Tandy, Commodore and NEC have already booked prime sites. Further details can be obtained from **Australian Exhibition Services, 1250 Malvern Road, Malvern Vic. 3144. (03) 20-1208.**

MicroBee budgetting package

After extensive debugging and rewrites, Allsoft Computer Services has released its first software on to the Australian market — a home budgetting package for the MicroBee.

The $28.90 package, which is available from MicroBee software dealers, consists of two independent programs, BACCS for Home Accounting and BPLAN for Budget Planning. A comprehensive user manual is included.

For further information, contact **Allsoft Computer Services, P.O. Box 78, Charnwood ACT 2615. (062)58-6864.**

How can I write better software, faster? Write it in BASIC/Z!

BASIC/Z. A new standard in compilers for the CP/M system. BASIC/Z is the most powerful implementation of the BASIC language on CP/M. BASIC/Z generates executable machine code compatible with 8080, 8085, Z-80 under CP/M 80 and 8086/8088 processors under CP/M 86 and MS-DOS.

Syntax testing as you type. BASIC/Z has a powerful program editor with built in syntax testing as you type. Time saving features include global search and replace, fifteen local edit commands and extensive debugging facilities. Line trace, error line retention, and the unique ability to 'single step' a program with a continuous display of selected variables are just a few of the features which will save you time.

Multitiered error handling allows your program to trap logical errors, including previously fatal BDOS errors. Only BASIC/Z can trap that 'BDOS ERROR ON A: READ ONLY' before it happens.

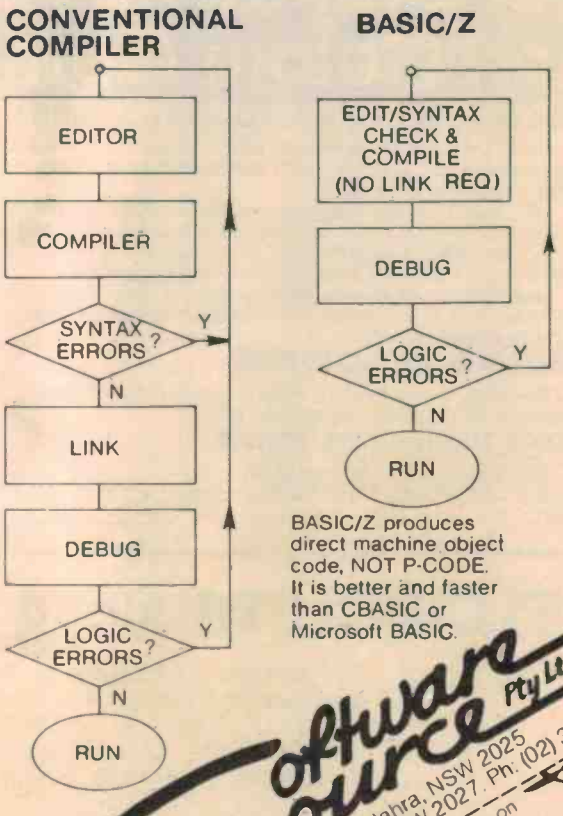
Printer/terminal customizing is built in. The runtime library of BASIC/Z (included in the package) includes installation routines for the majority of CP/M machines on the market. Your software will have near universal application without further modification. Just one set of programs will run on practically any hardware.

Unsurpassed accuracy. Floating point numerics with a range of 1E-61 to 1E+61, with a choice of precision from six to eighteen digits. All floating point maths are performed in decimal (BCD), avoiding rounding off errors.

Powerful executive functions aid programming. Using SORT, it can sort 2,000 elements in two seconds. User defined functions are fully recursive, support multiple arguments and may contain an unlimited number of statements.

No Royalties. BASIC/Z has no royalties nor runtime charges. The license agreement confers the right to distribute support software such as the BASIC/Z runtime module and the installation hardware configuration utility, subject only to specified copyright acknowledgements.

What does it all cost? BASIC/Z documentation & Software: $495* inc. tax. Available from your computer supplier or from Software Source direct. Available on 21 days approval (if software seal not broken). Or clip out the coupon and send in for further details.



BASIC/Z produces direct machine object code, NOT P-CODE. It is better and faster than CBASIC or Microsoft BASIC.

Software Source Pty Ltd

344-348 Oxford Street Woollahra, NSW 2025
PO Box 364, Edgecliff, NSW 2027. Ph: (02) 389 6388

Please send me further information on BASIC/Z

Name

Address

Master the Microprocessor

Learn how Microprocessors really work ...the practical way.

The Purpose of this Course

There is a considerable, expanding and world-wide demand for people with a real knowledge of microprocessors and general computer technology. Such people are needed to design and evaluate systems and to assess and develop the enormous range of possible applications, both present and future, of microprocessors and to understand the installation and servicing of the main types of equipment of which they may form the most vital component.
(A microcomputer has already been produced to replace the mechanical programmer on a domestic washing machine, for example.)
This Course provides the necessary basic information to enable a student to really understand the functioning of microprocessors and their supporting circuitry, usually refefred to as the "hardware". This is backed up by showing how to program a microcomputer (or produce its "software") in the most fundamental form of computer language called "machine code".
No previous knowledge of computers is necessary, though a little basic knowledge of electronics plus digital and logic circuits will be found helpful.
A special introductory short course is available to provide this back-ground information, if required by an individual student on the course without extra fee.

Student—Tutor Contact

A qualified Tutor is available to every Student throughout this Course in order to deal with any queries which may arise and to assess certain questionnaires which are issued to Students throughout the period of training.

Certificate

Issued to all Students completing the Course successfully. Course covers main requirements of the City and Guilds Certificates in Computers.

Practical Self Study Course

FREE COLOUR BROCHURE

Post coupon now: The Australian School of Electronics Pty. Ltd., P.O. Box 108, Glen Iris, Victoria, 3146.
Offices at: 219 Balaclava Rd., Caulfield North.

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ETI 8/83

How the Course is organised

The basis for the practical work in the Course is the Microcomputer.
This is supplied completely assembled and ready to use.
The Course text is carefully arranged in sequence so that each new section follows logically from previous work. Hardware description and programming technique progress together, so that the Student is discouraged from treating them as distinctly separate subjects. Following each section of descriptive text, detailed instructions are given in order to use the Microcomputer to provide a practical demonstration of each new function or technique. This provides a very powerful way of learning precisely how the system operates, and enables any possible ambiguities in the Student's mind to be quickly resolved.

For System 80™, TRS-80™ Model I/III and Colour Computer owners:

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If you own one of these computers, you should be reading MICRO-80 magazine, the magazine not only written by enthusiasts, but actual owners and operators of the same computers you use.

MICRO-80 understands your needs, is vital reading from cover to cover and features six new programs in each issue with full operating instructions.

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Instructional articles on programming techniques, hardware improvements and answers to readers' problems are also published each month.

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Commence my MICRO-80 subscription for 12 months. ☐

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My computer is a: System 80 ☐ Model I ☐ Model III ☐ Colour ☐

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ETI CIRCUITS No. 4

contains a wide range of circuits, ideas and data for the electronics enthusiast, arranged in 15 categories, including: Alarms, Audio, Computers, Games, Triggering & Switching, Techniques, RF and Test & Measurement.

Available from newsagents, selected electronic suppliers or direct from ETI Magazine, P.O. Box 227, Waterloo NSW 2017. Please add $1.00 for post and handling if buying by mail.

$2.95

Power House Museum's computer lab

Sydney's Power House Museum has established a 'computer lab' to allow groups of visitors the opportunity to use microcomputers and explore their potential for learning and leisure.

The 16 Tandy TRS-80 Extended Colour computers, donated by Tandy Australia, may be operated independently or connected, via a controller, to a master microcomputer for access to disk drives and a printer.

The laboratory is staffed by members of the museum's education service. A wide range of ready-made programs includes educational programs on art, mathematics and typing.

Sessions for the general visitor are held at 11.45 am and 2.45 pm on week days during the school term, and at regular intervals during weekends and public holidays. Entrance is free, but is restricted by the number of computers available.

Sessions for groups of 32 or less may be booked through the muesum's education service.

For further details contact **Power House Museum, Mary Ann Street, Ultimo NSW 2007. (02) 217-0111.**

Alpha—80 dot matrix impact printer

Intermec Australia Pty Ltd has released a new small business printer, the Alpha-80.

The printer is a small, compact and low cost unit which operates in applications designed for the Epson FX-80 or MX-80 with Graftrax option. Control sequences and codes to select any of the operating modes are the same.

The Alpha-80 has both standard printing and an italics character set. The user can select emphasised or double strike printing, compressed or expanded characters, superscripts or subscripts.

There are true descenders on lower-case characters and underline. A full pin-addressable graphics mode is standard as well.

The printer is supplied with both tractor and friction feed, a paper catch tray and a long-life cartridge ribbon. The cartridge is a re-loadable type for greater economy.

For more information contact **Intermec Australia, 1761 Ferntree Gully Rd, Ferntree Gully Vic. 3156. (03)758-7983.**

Apple makes Fortune

Apple Computer has been listed in the Fortune 500 index of leading United States industrial corporations, and is the first company to achieve Fortune 500 standing after less than five years operation.

Apple entered the personal computer market in 1977. By the following year the company's annual sales figure was US$7.8 million. In 1982, Apple's sales topped US$583 million, moving Apple comfortably into the Fortune 500, ranking 411th on sales, 201st in profit and 26th in return on equity. In its highest category ranking, Apple occupied the number two spot in sales increases.

Hewlett Packard chose Spellbinder over all other CP/M wordprocessors.

Why?

Hewlett Packard conducted exhaustive research before selecting a CP/M wordprocessor program to run on their HP125 business computer. The result? Spellbinder was judged superior in all key areas. Here are some of the reasons:

Spellbinder is fully customizable. Function keys and cursor keys really work on Spellbinder! This means faster training and more efficient use.

The most useful and workable malling list capabillties. Sort by post code then merge any individual information from a mailing list into text.

Powerful sorting facilities. Sort clients by income and then print out a list in order of income with telephone numbers. Sort alpabetically or numerically. Eg. Print up mailing labels for only NSW customers from an all states list and have them sorted by post code.

Note: These facilities are built in.
They are not expensive add-ons.

Boilerplating. The user can create entire documents by specifying the numbers of pertinent paragraphs on a master 'boiler plate' file and printing them in any order.

Advanced printing features. Includes the ability to print in two columns and to print multiple documents.

Forms generation facilities. Create a template that 'looks like' your invoice. Spellbinder will show you where to fill in the blanks – then print just the information on your pre-printed stationery.

Ease of use. The three interactive levels of help are fully customizable so they are right for YOUR system. You can even view other documents on your disk without disturbing your current text.

Arithmetical facilities are built in. Total your invoices, prices or statements automatically. Full 16 digit precision with up to 15 decimal places.

Full support. Software Source is dedicated to the support of this powerful package. A growing library of applications programs is available, from mail list entry to invoice generators.

Contact Software Source for further details and the name of your nearest dealer. Come and find out what real wordprocessing is all about.

Exclusive Australasian distributor:

Spellbinder Software Source Pty Ltd

344-348 Oxford Street Bondi Junction.
PO Box 364 Edgecliff NSW 2027 Phone (02) 389 6388.
Please send me further information on Spellbinder

Name .....

Address .....

HPYC/1

Glover & Assoc. SS/2

ALTRONICS KITS COST MORE

[Around $1 more]

REASONS ★ PREMIUM COMPONENTS USED eg. MOTOROLA, FAIRCHILD etc. ★ QUALITY INSTRUMENT CASES SUPPLIED WHERE INDICATED ★ EVERY LAST NUT AND BOLT SUPPLIED, EVEN SOLDER ★ IC SOCKETS SUPPLIED WHERE INDICATED.

Your finished product will look so good your friends won't believe you built it.

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PROTECT YOUR VALUABLE CAR AND CONTENTS

CURRENT TRIP CAR ALARM

Exit / entry delay
No false alarms
State of the Art
Design by ETI

Protect Your Valuable Car and Contents

Circuit detects minutest voltage drop across vehicle's battery earth strap, tripping the alarm ★ uses Milspec LM394 ★ Quality diecast box ★ genuine Fujitsu relay ★ automatic reset after pre set time period ★ installs in minutes ★ includes dash mounting LED-flashes to deter thieves.

K4330..... **$29.50**

CAR ALARM ETI 084

A staggering number of cars are stolen each year. Install an Altronics Alarm Kit and yours won't be one of them.

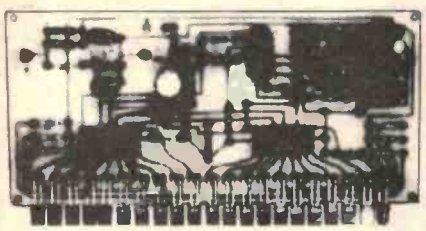
Circuit operates by detection of voltage drops in the electrical system and features a flashing LED for dash mounting as a deterrent to would be vandals and thieves.

K4084..... **$12.00**

MONITOR AND IMPROVE VEHICLE PERFORMANCE

TWIN RANGE LED TACHO

(SEE ETI AUGUST 1980)



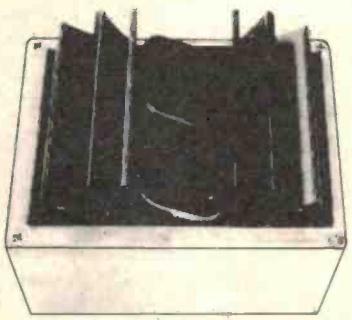
Unit suitable for 1, 2, 3, 4, 6 and 8 cylinder vehicles, 2 stroke or 4 stroke ★ fully compatible with conventional, CDI and transistorized ignition systems ★ includes protection circuitry to prevent noise and high voltage spikes from the points and coil circuit damaging the electronics. ★

Display flashes when over-reving occurs ★ only 3 connections required to electrical system.

Check The Performance of Your Vehicle At A Glance!

K4324..... **$24.50**

TRANSISTOR ASSISTED IGNITION WITH DWELL EXTENSION



The Altronics Kit includes all components for the modifications, detailed by Electronics Australia Feb. 1983.

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. Easy to build!

K4010..... **$35.00**

THE EVER POPULAR MUSICOLOUR IV EA PROJECT

Combination Colour Organ and Light Chaser. Four channel colour organ. Internal microphone or connect to speakers for colour organ operation. (The lights connected to each channel pulse in beat to the music proportional to portion of frequency spectrum concerned.) Four chaser modes forward and reverse. Output lamp load capacity a massive 2400 watts — that's 100 party globes. Full instructions and every last nut and bolt included. Great for parties, shop signs, display windows etc.

K5800..... **$89.50**

See EA November, 1982

POWER UP

A MUST FOR YOUR COMPUTER SYSTEM

This great new Project from EA is the answer to a Maidens Prayer.

What Does it Do?

A single 240v mains plug and lead feeds one unswitched master 240v outlet plus 4 switched 240v outlets. With say a hi-fi system, plug your main equipment item (e.g. Amp) into the master outlet and whenever you "switch on" your amp — presto — mains power is applied to the other 4 outlets i.e. simply "turning on" your amp turns on your tape cassette, tuner, turntable, graphic equaliser without mains spikes, plops etc.

Just the shot for your Computer System. The Altronics Kit includes case and all outlets.

K6000..... **$39.50**

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.
Genuine Hewlett Packard Hot Carrier Diode supplied.

K1724..... (still only) **$14.50**

SATURDAY ARVO KITS

(SEE ETI AUGUST 1983)

VALUE PLUS FUN

RADIO MIC K1106	$6.50
ALIEN INVADERS K1123	$13.95
SOUND BENDER K1492	$29.50
COURTESY LIGHT EXTENDER K4232	$3.95
SOUND EFFECTS PACK K1607	$17.50

(CONTAINS PARTS FOR ALL 5 PROJECTS)

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POWER DOWN
MAINS APPLIANCE TIMER
(ETI JULY '82)

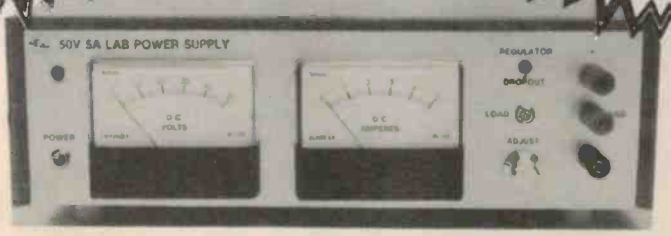
Clever new design from ETI, mains appliance is turned on at the press of a button and automatically turned off some preset time later.
Use for electric blankets, bathroom heaters, patio light. If your inclined to fall asleep while watching TV late at night — this is the kit for you.
☆ SEC Approved Transformer ☆ Screened Front-Panel ☆ Complete kit as per ETI article, includes every last part.

K6265..... only **$32.50**

2-50V DC at a massive 175W

EA's BRILLIANT LABORATORY POWER SUPPLY

FREE DELIVERY FOR THIS KIT THIS MONTH ONLY.



See Ea May and June 1983

Over the last 2 or 3 years we have had literally dozens of requests for a universal 5 amp Bench Power Supply Kit. Naturally we passed this on to the design team at Electronics Australia and at last it is now a reality. Just look at the design concept! A fully mains transformer isolated supply with a very clever "Switch Mode" low voltage circuit.
Most importantly it's dead easy to build (ours worked first time!).

Specifications
Input 240 V 50 Hz
Output Variable 2 – 50 V at up to 5 amps

K3300..... **$139.50**

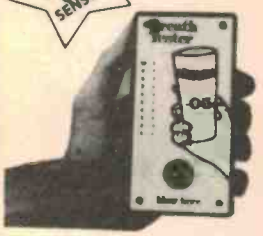
10 TURN VOLTAGE CONTROL OPTION
K3301..... (ONLY)... **$10.00**

HANDY + / – 12 V OPTION (SEE EA JULY 1982)
K3302..... **$12.50**

WHY PAY OVER $250 FOR AN INFERIOR COMMERCIAL UNIT?

GENUINE FIGARO GAS SENSOR

ALCOHOL BREATH TESTER



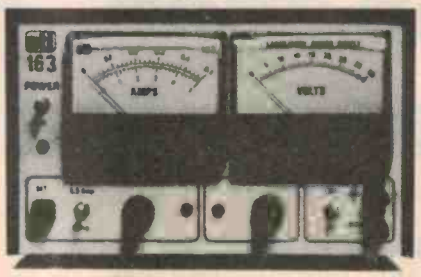
K1583 ONLY **$29.95**

(SEE EA MAY 1983)

This Great new Kit from EA will be a smash hit with all the smashed people at your next party. Fun to build, Fun to calibrate and Fun to use. More seriously, this unit could save lives.

0-40 VOLT / 5 AMP LAB SUPPLY

(SEE ETI MAY & JUNE 1983)



FEATURING: VARIABLE CURRENT LIMIT / DUAL METERING

A Laboratory Supply requires specifications second to none. **This Supply has them!**

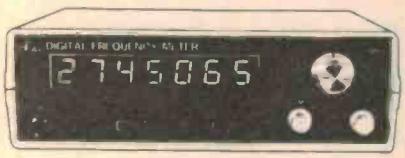
Output voltage	0-40 V, variable
Output current	0-0.5 A, variable limiting
	0-5 A, variable limiting
Output regulation	<50 mV at up to 2.5 A
	<100 mV up to 5 A
Maximum output power	200 watts
Metering Voltage	0-40 V in 1 V divisions
Current	0-0.5 A in 20 mA divisions
	0-5 A in 200 mA divisions

Series regulator design enables design and development of sensitive high gain audio and RF circuitry free from hum and noise sometimes associated with other techniques.

K3325..... **$175.00**

★ BUILD YOUR OWN PROFESSIONAL TEST GEAR ★

7 DIGIT FREQUENCY COUNTER



UNBELIEVABLE 0.005% ACCURACY

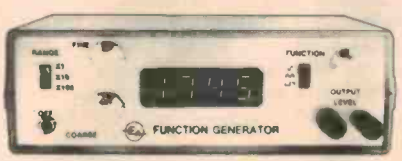
☆ **Frequency and Period measurement to 500 MHz (with optional prescaler)** ☆ **High input sensitivity. Professional unit at a fraction of the cost of built up units.**
☆ IC sockets provided throughout ☆ Low age rate 10.000 MHz XTAL ☆ Quality ABS plastic case with deluxe Front panel ☆ Specified LSI.

K2500..... **$119.50**

PRESCALER
K2501..... **$26.00**

DECIMAL POINT
K2502..... **$7.50**

FUNCTION GENERATOR



The most essential piece of test gear (second only to a good multimeter) on any hobbyist's bench is some kind of audio signal generator. This design utilizes the latest circuit techniques to produce stable, low distortion waveforms.

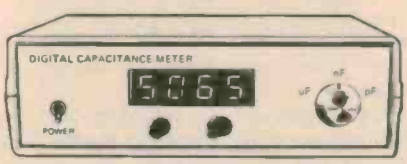
A truly versatile unit at a bargain price.

☆ 4 digit frequency readout (eliminates tiresome dial calibration) — typical accuracy ± 2% ☆ 3 overlapping ranges x1, x10, x100 ☆ 600 OHM Nominal Output — continuously variable 3MV — 2.5V P-P ☆ Distortion — sinewave : less than 0.7% @ 1KHz ☆ Linearity — triangle wave: better than 1% @ 1KHz ☆ Squarewave rise time — 6V/uz maximum output ☆ Amplitude stability — better than 0.1dB on all ranges.

With the exception of the display all components mount on a single PCB making this kit suitable for all constructors.

K2505..... **$85.00**

DIGITAL CAPACITANCE METER



with Deluxe Instrument Case

NEW DELUXE FINISH

We are pleased to announce the release of the Digital Capacitance Kit housed in our Deluxe H0480 ABS Instrument Case.
This superb Test Instrument kit now compliments our top selling Digital Frequency Counter and Function Generator Project Kit. Electronics Australia Project. Measures capacitance of both polarized and non-polarized capacitors from 1 picofarad to 99.99 microfarads in 3 ranges.
Check values of unmarked capacitors, especially those little trimmers that are never coded.
Select precise values for filters and timing networks within ease.

☆ **EXCLUSIVE TO ALTRONICS** ☆

Each kit includes precision measured capacitors for accurate calibration of each range.

K2521..... **$55.00**

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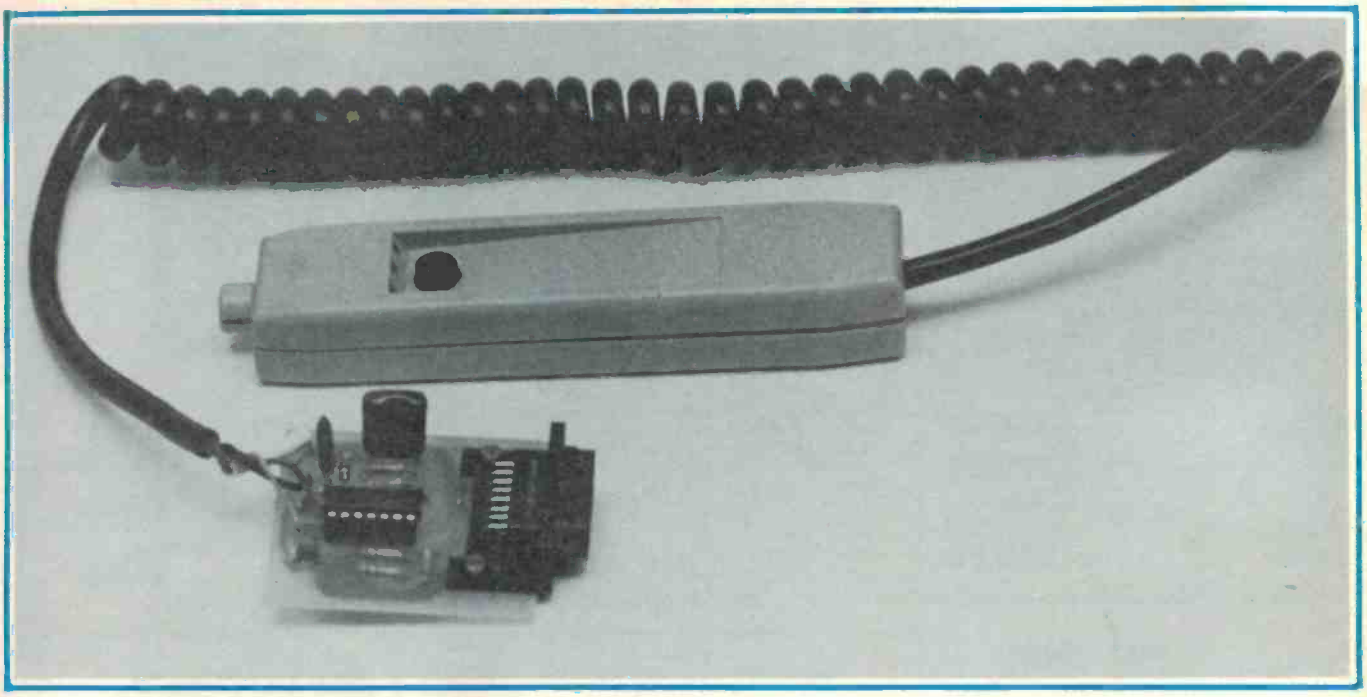


The 'screen spotter' — a light pen for the Microbee

This simple, low cost device plugs into the Microbee's 8-bit port and gives you an 'entry' into the world of light pens and interactive software. The project has been developed from an idea submitted by a reader, Andrew Allen, of Manly Vale NSW.

Geoff Nicholls

ADDING A LIGHT PEN to your computer can open up a whole new range of possibilities to explore in software and the interaction between people and computers. This project should give Microbee owners an 'entry point' to some of those possibilities.

The video display chip in the Microbee has a 'light pen' input but this is not readily accessible for external connection. Hence, other avenues for adding a light pen had to be explored and the eight-bit port seemed like a simple way to go about it and that's where this project plugs into the 'Bee.

To get a photosensitive device to 'see' a single pixel on a VDU screen requires some pretty fancy optics, way beyond the resources of the home constructor, but detecting a single low-res graphics 'block' is no problem. For that reason, this project has been dubbed the 'screen spotter'.

Mechanically and electronically, the project presents few difficulties. The software, we'll leave to you — apart from a demonstration program, reproduced later.

Design

There are two parts to the Screen Spotter — the 'head' and the 'interface'. The head is housed in a plastic logic probe case and contains a phototransistor to detect light from the VDU screen, plus pulse-forming circuitry and a momentary-action pushbutton so you can signal a 'response' to the computer.

The interface unit is a small board mounted on a DB15 plug which fits in the Microbee's 8-bit port. This board contains circuitry which provides the appropriate signals to the computer.

The head and interface units are connected via a coiled cord of three wires plus a shield.

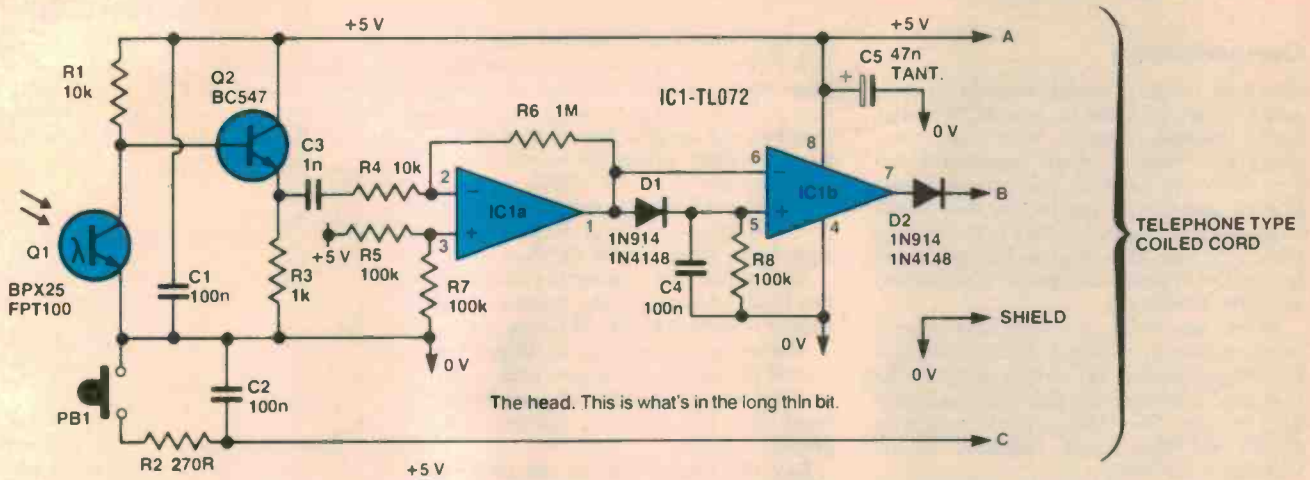
A coiled cord (rather like the one on your telephone) keeps itself out of the way when the unit is not in use. This cable does not have to be shielded, a four-wire cable will serve just as well.

Housing the head gave me a few headaches! Putting the bits in the barrel of a suitable pen is possible, but very difficult. Cigar tubes are great, but not everybody smokes cigars! If you're not fussy, a housing is unnecessary — but the ability of the phototransistor to discriminate between adjacent spots on the screen is not good without some method of restricting its 'view'.

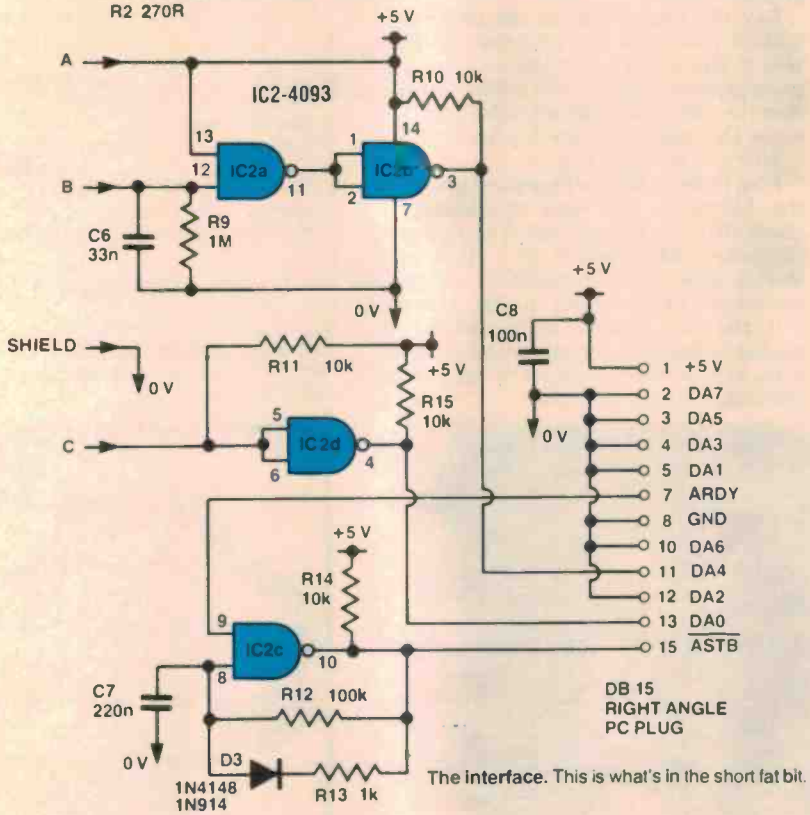
After some considerable searching and discussions with suppliers, I settled on a locally available logic probe case made by the General Specialties Corporation (USA), which was obtained from Jaycar. This comes complete with probe tip, etc, but only the case part is used. The phototransistor neatly fits in the moulding intended for the probe and this provides a tube which restricts the view of the phototransistor sufficient for the purpose here.

The pc board containing the head components was designed to fit snugly in the case. A hole has to be accurately drilled in the case top for the pushbutton key switch.

The head could be housed in some other sort of container, but that shall have to be left to your ingenuity and resourcefulness.



The head. This is what's in the long thin bit.



The interface. This is what's in the short fat bit.

HOW IT WORKS — ETI 649

Phototransistor Q1 is illuminated by white areas of the video monitor and produces a corresponding variation in current through R1. Transistor Q2 buffers the phototransistor and IC1a plus associated components forms a high gain ac amplifier. IC1b and associated components square up the output from IC1a. At this point, the signal is either 0 V if the pen is on a black area of the screen, or a train of pulses if the pen is on a white area. IC2a and C6-R9-D2 stretch the pulses so that a constant '1' is obtained at IC2b if the pen is on a white area, or vice versa.

The pushbutton output is debounced by R2-C2-R11 and IC2d. If the button is pressed, the output of IC2d is 1, and vice versa.

IC2c and associated components condition the ARDY prompt from the Microbee's PIO before feeding it to the ASTB input.

The decimal value at the port input, for the four input conditions, is given in Table 1.

TABLE 1

Light pen	pushbutton	input value
on black	off	0
on black	on	1
on white	off	16
on white	on	17

THE DIFFERENCE BETWEEN THE 'SCREEN SPOTTER' AND THOSE 'BIG BUCK' LIGHT PENS

A light pen is a device that allows a computer to locate the position of a sensor placed on the face of the computer's video monitor. Light pens simplify the entry of data to the machine, allowing easy input of graphic information, selections of options from a menu or entry of moves in games, such as chess.

The performance of light pens is limited by the hardware, which boils down to "you gets what you pays for". The ETI-649 uses a very simple hardware technique which trades off speed of response for economy. There are basically two types of light pen, the complex hardware type and the complex software type. The ETI-649 is the latter.

The complex hardware light pen works by incrementing a pair of counters in sympathy with the scanning electron beam in the video monitor. One counter counts the lines on the screen while the other counts the dots (pixels) in each line. The line counter is reset at the beginning of each frame (vertical sync.) while the dot counter is reset at the beginning of each line (horizontal sync.).

The counters are read by the computer when the light pen detects the scanning beam. The sensor in this type of pen has to be very well made, with extremely fine optics, in order to resolve individual dots on the screen.

The video generator chip in the Microbee has provision for this type of light pen, but the designers of the 'Bee have cleverly used this feature to simplify the keyboard scanning circuitry. It would be possible to duplicate the light pen hardware and tap into the horizontal and vertical sync. signals inside the Microbee, but the circuit would be tricky to install and the problem of making a good sensor would remain. Perhaps some enterprising hardware buff will address the problem and develop a future ETI-XXX high resolution light pen?

The ETI-649 uses a cheap and common phototransistor to sense the light from a block on the VDU and relies on the software to scan the screen and keep track of the location. The biggest drawback is that the screen cannot be updated faster than every 20 ms because of the frame refresh of 50 Hz. Any attempt to scan faster means the video information is written to the video generator and then erased before it actually has time to output it. Although this seems a major drawback, there are techniques in programming to reduce the scanning time. No doubt readers will devise programs to utilise the project in games, etc.

Construction

The unit is quite straightforward to construct. Start with the pc boards. Whether you've bought them or built your own, check the tracks for little 'bridges' where they run close together, particularly at the IC pins, and for tiny cracks. See that all the holes are drilled and that they're the correct size. Note that the mounting hole positions for the DB15 plug will depend on the brand and type purchased.

Before assembling the head board, use it as a template to mark out the hole position for the pushbutton key switch in the probe case top. Alternatively, you could measure its position. Do this carefully and you should get the whole assembly to fit together quite easily.

Assemble the components to the head board first (ETI-649a). Solder the resistors and capacitors in place as a first step, making sure you get the electrolytic capacitor, C5, the correct way round. Mount the transistor, the two diodes and IC next, making sure you get them correctly orientated, too. If you wish, an IC socket may be used for IC1. The phototransistor is mounted at full lead length so that it may be bent over and placed in the original probe moulding. Identify its leads carefully and cut the base lead short. Last of all, solder the pushbutton key switch in place. Check it thoroughly when you've finished.

Tackle the interface board next. Install the two links first. Note that one is under IC2. Solder the resistors and capacitors in place next, followed by diode D3, making sure you orientate it correctly. An IC socket may be used for IC2. Install this or the IC next, ensuring it faces the correct way (pin 1 faces *away* from the DB15 connector). Now mount the DB15 plug, bolting it to the pc board *before* soldering the pins. Check it thoroughly when you've finished.

Now solder the connecting cable to the two boards. Use a pc stake or piece of tinned copper wire for the shield connection.

The probe tip moulding in the probe case should be heavily blackened with a Pentel or other marking pen before assembling the head unit. See the accompanying photograph.

Lay the head board in the probe case bottom and bend the phototransistor so that it lays in the probe tip moulding (see photograph). Arrange the cable wires so that they won't foul the assembly and then screw the probe case top in place.

Now you're ready to go.

Plug in the interface board and power up the Microbee. Use your multimeter to check that +5 V is on lead A of the cable (measured with respect to 0 V — the shield). Enter the demonstration program reproduced here and give it a try.

If the unit doesn't work, switch off, unplug it and look for misplaced components, any unsoldered joints or incorrectly orientated semiconductors. ●

PARTSLIST—ETI 649

Resistors ..... all ¼W, 5%
- R1, R4, R10, R11, R14, R15 ..... 10k
- R2 ..... 270R
- R3, R13 ..... 1k
- R5, R7, R8, R12 ..... 100k
- R6, R9 ..... 1M

Capacitors
- C1, C2 ..... 100n ceramic 'bluechip'
- C3 ..... 1n ceramic or greencap
- C4 ..... 100n greencap or ceramic
- C5 ..... 47u/6V tantalum
- C6 ..... 33n greencap or ceramic
- C7 ..... 220n greencap or ceramic

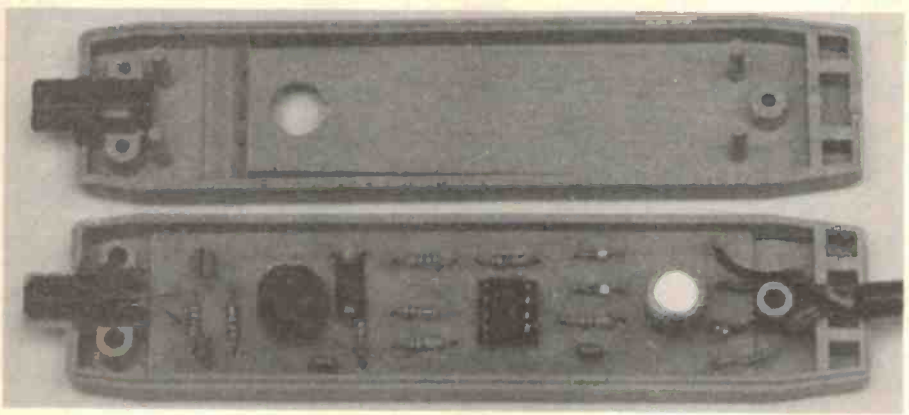
Semiconductors
- D1, D2, D3 ..... 1N914, 1N4148
- IC1 ..... TL072
- IC2 ..... 4093B
- Q1 ..... FPT100, BPX25
- Q2 ..... BC547

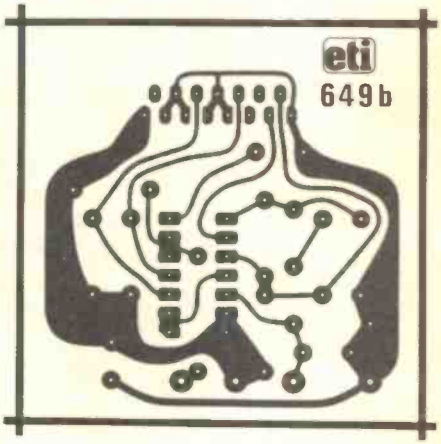
Miscellaneous
- SW1 ..... keyswitch (e.g. D.S.E. S-1200 or similar)

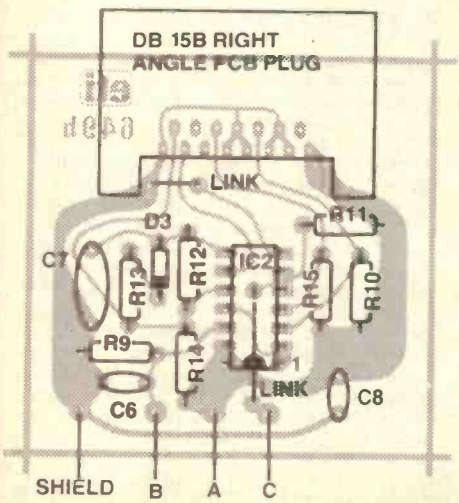
ETI-649 pc board; case—GSC type CTP1 or similar; DB15 plug; "curly cord" (if required)—about 1-1½ metres long, etc.

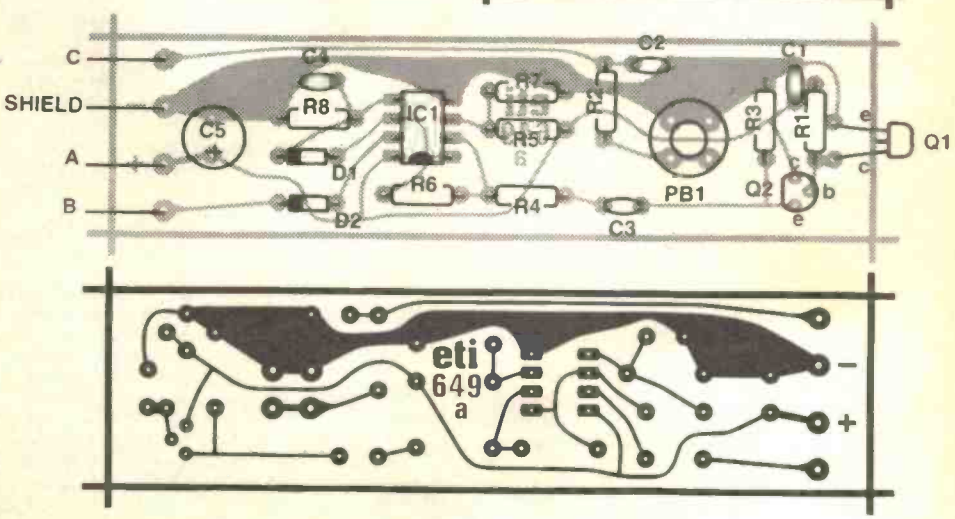
Estimated cost: $17-$35

Kits & Components. Suppliers of kits and components for this project can be found on the Shoparound page in this issue.









Microbee light pen

```
00100 REM ....SCREEN SPOTTER DEMONSRATION....
00110 REM
00120 REM  This program dispays a menu of 7 music notes,
      and scans
00130 REM  them with a white block to locate the
      spotting pen.
00140 REM  The scanning block stops at the pen,and will
      play
00150 REM  the relevent note if the pushbutton is
      pressed.
00160 REM
00170 REM Clear screen and label notes.
00180 REM
00190 CLS:LORES
00200 FOR N=0 TO 6
00210  CURS 57,N*2+1
00220  PRINT CHR(N+65);
00230 NEXT N
00240 REM
00250 REM    Scanning routine loops until pen is found
      (A=16 or
00260 REM    17 if switch on),then executes the selected
      play
00270 REM    subroutine.
00280 FOR X=1 TO 13 STEP 2
00290  CURS 60,X
00300  PRINT CHR(191);CHR(191);
00310   FOR N=1 TO 6:NEXT N
00320  A=IN(0)
00330  IF A=16 THEN 320
00340  IF A<17 THEN GOTO 390
00350  GOSUB (X+1000)
00360 REM  Software debouncer
00370  A=IN(0)
00380  IF A=17 THEN 370
00390  CURS 60,X
00400  PRINT CHR(32);CHR(32);
00410 NEXT X
00420 GOTO 280
00900 REM  The play subroutines. These could be
      replaced with
00910 REM  gosub calls to execute other programs etc.
      If the
00920 REM  programs are not written as subroutines,
      then you
00930 REM  must change line 00350 to GOTO (X+1000) and
      use
00940 REM  GOTO's to the other programmes.
01001 PLAY 1
01002 RETURN
01003 PLAY 3
01004 RETURN
01005 PLAY4
01006 RETURN
01007 PLAY 6
01008 RETURN
01009 PLAY 8
01010 RETURN
01011 PLAY 9
01012 RETURN
01013 PLAY 11
01014 RETURN
02000 END
```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Display	Interface	Connects to color TV or video display
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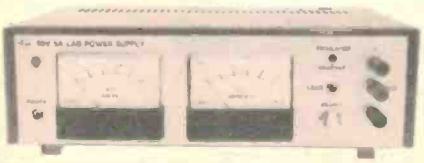
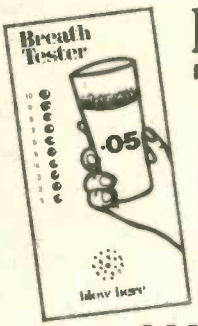
Cat. KE1520





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Grab the whole kit now for only $29.95. You never know, it may save your licence or your life!

Wide band AM Tuner

Ref: EA Dec-Jan 82-83

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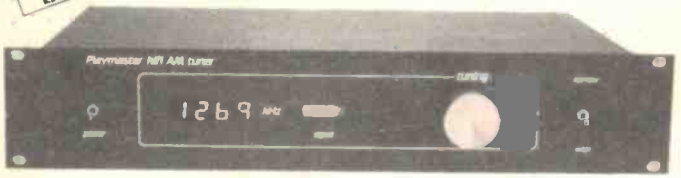

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Cat. KE4202

"BLUEPRINT"

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- AUX INPUTS (2 OFF)
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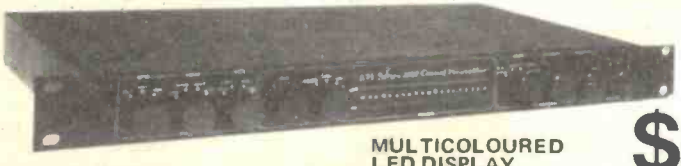

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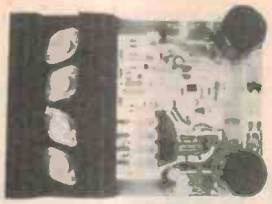

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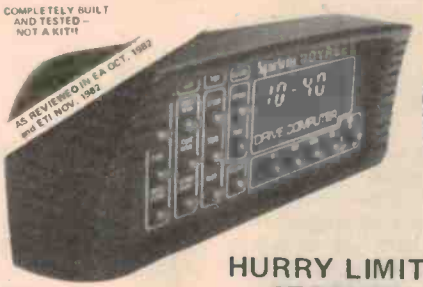

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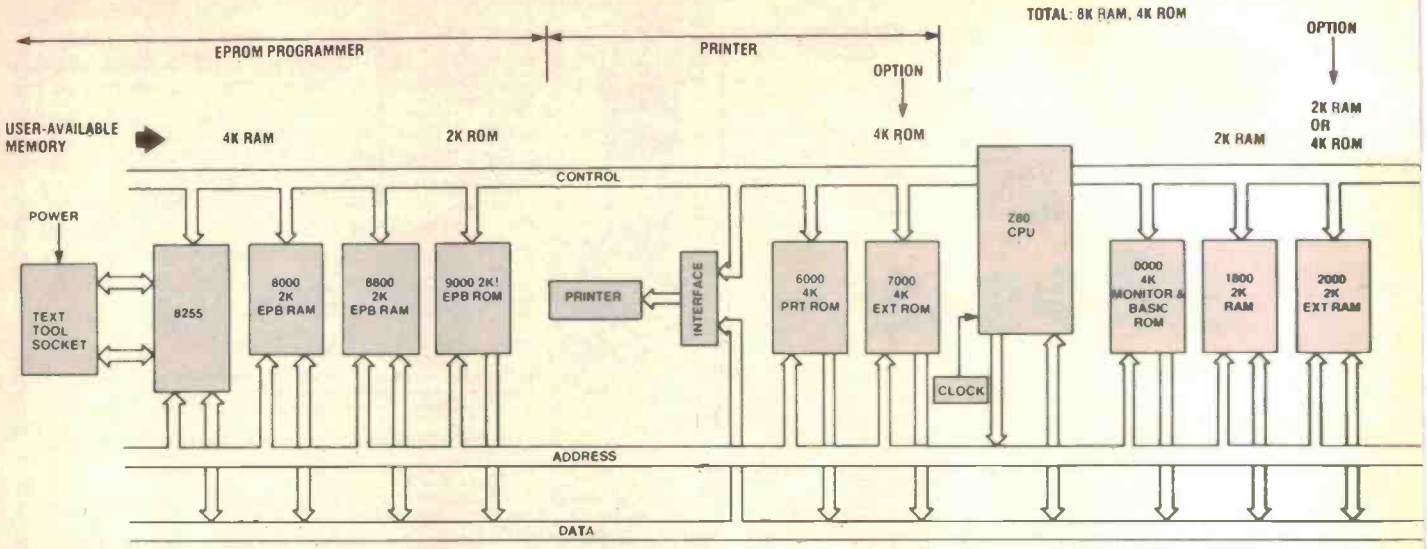

Figure 1. Block diagram of the MPF-1B and its add-on options.

Developing the MPF-1B Microprofessor

The MPF-1B Microprofessor, reviewed in the October 1982 issue of ETI, has enjoyed a certain 'cult' popularity among students and 'hackers'. Here's how to exploit its possibilities a little further.

Lance Wilson
Holme Bldg, Box 186,
University of Sydney NSW 2006

THE MPF1-B is a Z80-based educational development system which may be extended to control various devices or as a compact general purpose computer. It is supplied with 4K of EPROM in which resides the monitor and a tiny 2K BASIC interpreter. The standard RAM is 2K and there is a socket for an extra 2K-4K of RAM or EPROM.

A desirable accessory for the serious assembly language programmer is the thermal printer which contains 4K of character generation ROM and PRT monitor with space for another 4K of EPROM which may be used for general programs. (Similarly, the 4K of RAM on another accessory, the EPROM programmer, may be used for general purposes.)

The printer outputs 20 characters per line and includes memory dump, disassembler and BASIC listing facilities in its ROM. Particularly useful is the disassembler as it allows one to check an assembly language program for errors after entering it in machine code.

Documentation with the MPF1-B includes a User Manual, giving the fundamentals of the Microprofessor's operation, an annotated listing of the monitor program with its subroutines and an Experiment Manual which explores most of the programming avenues available on the MPF-1B.

The processor board has a six-piece 7-segment display controlled by the monitor subroutines which are user-accessible. As program is entered, the location (two bytes) and its contents (one byte) are displayed.

As an exercise in extending the capabilities of the MPF-1B towards those of a full microcomputer, a program was developed to utilise alphanumerics via the on-board key array, of which 32 are usable for such a purpose.

The two alternatives were therefore to utilise the keyboard in a QWERTY style array by means of a shift key or to delete some little-used or synomorphic characters from the 32 keys.

Initially, the second alternative was undertaken with the marked keys 0-9 and A-F taking their marked values and another 16 taking other alphabetic characters; the use of Z,K, V and O were replaced by 2,H,U and 0 respectively. Q was temporarily deleted. As each character is entered, it is displayed on the LED array and the ASCII equivalent is deposited in a buffer.

When a line is complete it is printed out from the buffer by the thermal printer.

```
GHIJCDEF
LMNP89AB
RSTU4567
WXY 0123
```

32-CHARACTER SET

Because the MPF-1B is programmable in machine language utilising the very powerful Z80 block instructions, with memory directly accessible, this program can be the beginnings of a primitive but very useful text editor. Note that a 7-segment display is limited in the variety of characters that it will create so artistic license is occasionally necessary.

The program may be adapted for use with 40 or 80 column printers. The files created may be written onto cassette tape using the MPF-1B's own inbuilt system, for later correction and manipulation, such as file-searching using the Z80 block instructions.

For example, one may set up a names and addresses file, entered from time to time in chronological order, and using Z80 sort programs from Rodney Zaks' "Programming the Z80" or one of the other sources, it is possible to put the list into alphabetical order, use it to print address labels or search out particular material.

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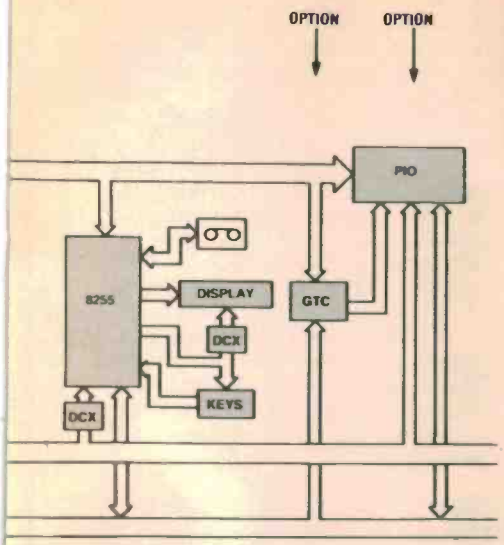


```
QWERTYIP   ( * " ) & < > =
ASDFGHJK   # $ : ; * / + -
ZXCVBNML   1 2 3 4 5 6 7 8
,U  □.     ! 9  0 ?
```

56-CHARACTER SET

Specifically, this could be used to list journal references and provide key-word searches for particular topics.

Overall therefore, there is a host of programming exercises with practical spinoff at a price that won't put you in hock for the next ten years.

The simplified version of the alphanumeric program provides the benefit of simplicity of use at the expense of a limited ASCII character set. This program and the one using SHIFT may be entered along with other utility programs onto EPROM where it would be accessible by means of a simple CALL.

Similarly one could, with a rather a larger amount of work extend the range of the printer to such things as Japanese symbols by modifying the PRT monitor onto another EPROM utilising a home-grown character set.

One of the great attractions of the Microprofessor is the relatively easy access to its monitors, for reasons both pedagogical and practical.

PROGRAM DETAILS

ASCON1:

Simple 32 character version.

After initialisation, which sets up buffers in the expansion RAM area, there is the setting up of a new line, setting up of a new word and it goes on to fetch the next character from the keyboard. The SCAN subroutine in the ROM monitor displays what is in the DISBUF and drops out of this subroutine when a key is pressed. A keycode is left in register A.

To use this on our 7-segment display and in ASCII for the printer, we have to convert it to the appropriate codes. This is done by means of look-up tables which, with register HL as a pointer, uses the keycode in A as an offset to find the location holding the appropriate code.

The 7-segment character is loaded into DISBUF and the ASCII into OUTBUF. The pointer IX is decremented ready for the next character and this also means that the display on each SCAN moves one place to the left so that the words, as they are entered, pass in from the right across the display.

Register HL is incremented for the next character also; the fact that IX and HL require opposite adjustments is due to the operation of the monitor.

A space denotes the end of a word and when this occurs the free spaces left in the 20-character line are displayed for about a second before we go back for the first character of the new word.

Carriage return is by end of line or SPACE + X. Carriage return and end-of-line insert 0D (stop print) until the line is printed and this is replaced by 0A (line feed) to separate lines. Any block of text for later printing needs to have 0D inserted for termination.

This simplified version is intended for experimentation. One may easily change the characters produced by accessing the 7-segment (7seg) and ASCII tables. With the rather more difficult job of getting into the print monitor, one may even produce new characters.

ASCON2: 56 characters with SHIFT, CR, BACKSPACE.

With this more complex program it was desired to be able to produce the (almost) full Microprofessor character set in order to create simple files, drive phoneme generators and all the other inconsequential things a computer buff desires to do without straining the pocket too much.

There is a shift key which, when pressed, exchanges the 2-character tables with two others in the pointer instructions to obtain the shifted characters.

There is a carriage return key and a backspace which allows one to make corrections. This program does not display free spaces left in the line; it is left as an exercise for the enthusiastic programmer to transfer this facility from the 32 into the 56. ▶

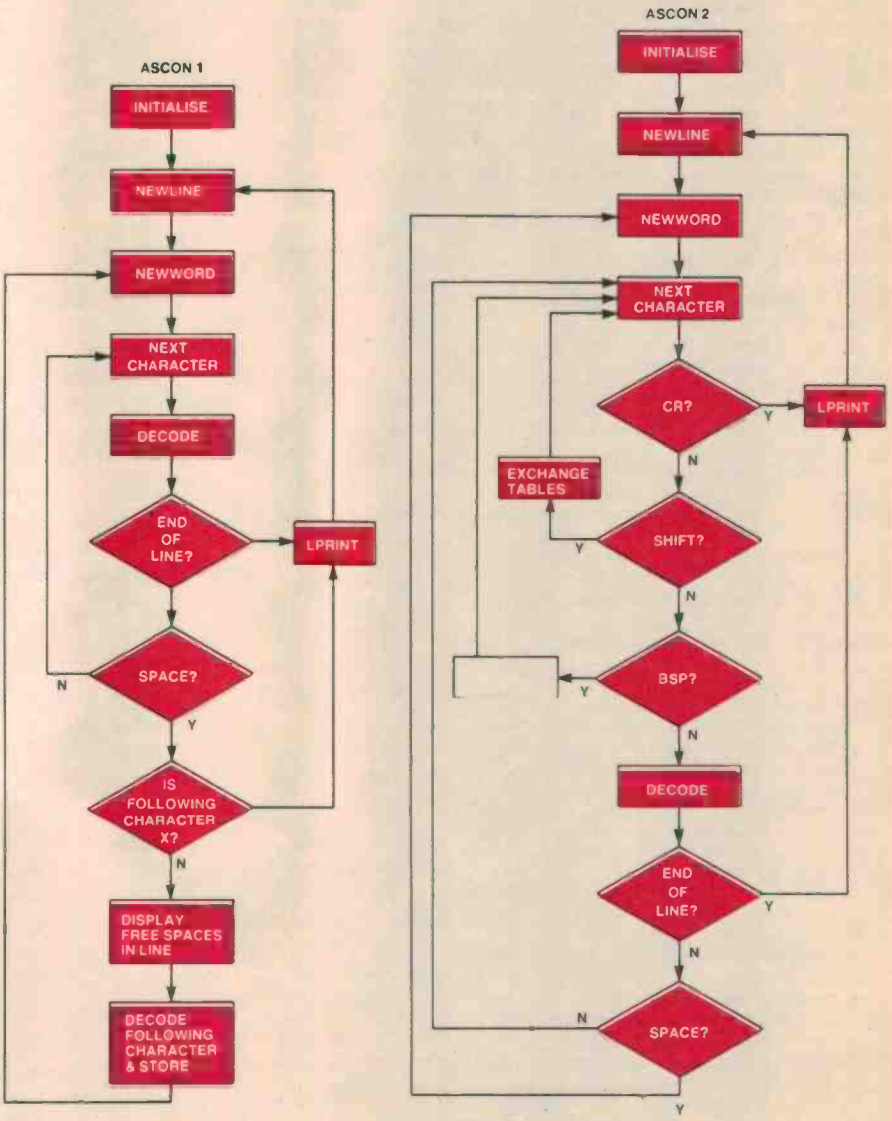

Figure 2. Flow charts for the two character set programs.

Neither program is perfect; the 32 will miscount free spaces and not to return automatically if one uses the SPACE key at the end of the line. However, if all the bugs were picked off its backside and all the possible extensions incorporated this article would never see the light from the topside of a round filing cabinet!

There are certain intrinsic strengths, such as easy access to the buffer itself to play with the characters or their formatting. The programs can be put on EPROM using the Microprofessor programmer and placed in the printer extension socket. In this case, any internal calls need to be to the appropriate 7000 location.

As previously mentioned, the program can be easily modified to accommodate 40 or 80 character lines and thus interface to larger printers.

To print out the full text one can use the routine from the PRT-MPF manual:

```
DD  21  01  20   LD IX, 2001
CD  AC  65       CALL MTPPRT
76               HALT.
```

For the printer to terminate, OUTBUF needs to hold 0D as its final code; this is most easily inserted by directly accessing the buffer to replace the 0A left by ASCON with 0D; the pointer to the last line is in IFFF/2000.

Useful references.

- A. R. Miller. *8080/Z80 Assembly Language, Techniques for improved programming.* Wiley (About $17.55).
- Rodney Zaks. *Programming the Z80.* Sybex. (Under $16 at Tandy and D.S.E.; others $26).
- William Barden Jr. *TRS80 Assembly Language Programming.* Tandy ($5).
- William Barden Jr. *The Z80 Microcomputer Handbook.* Sams ($11-$15).
- Joseph Carr. *The Z80 User's Manual.* Prentice-Hall (ETI Book Sales, $25).
- M. Sargent and R. L. Shoemaker. *Interfacing Microcomputers to the Real World.* Addison-Wesley. (About $15).
- Howard Boyet. 8080 Microcomputer Experiments. $14+
- William Barden Jr. More TRS-80 Assembly Language Programming. Tandy $7.

(The *8080 Bugbook* is also useful.)

The Microprofessor MPF-1B is available from Emona Computers, George St., Haymarket, Sydney and David Reid, York St., Sydney. Price of the basic machine is about $138 and the printer, about $105, (+ sales tax). ●

ASCON 1

Initialise by nominating DE as OUTBUF pointer and clearing OUTBUF. The lead address of the current line is held in 1FFF/2000 which impinges on the printer stack. Characters per line is loaded into C, and 1X is nominated to point to DISBUF for 7 segment display. Fifteen locations are cleared within DISBUF.

Go to SCAN monitor subroutine for key-in and to display anything in DISBUF. The keycode transferred via register A is decoded into 7-segment and ASCII via look-up tables and dropped into DISBUF and OUTBUF.

End-of-line is checked by decrementing the counter with each character. End-of-line or SP and X initiate a line print, effectively a carriage return. If SP is not followed by an X the indication is for a new word; the number of free spaces left in the line is then displayed.

The CLRBUF subroutine at 1880 loads 00 int (B) memory locations after the initial one indicated by (HL).

The DECODE subroutine at 1890 points HL firstly at the 7-segment lood-up table and uses the keycode in A to offset to the appropriate character and then the same for ASCII.

The LPRINT subroutine firstly loads a CR/STOP PRINT character into OUTBUF, calls the printer subroutine to print out the line and then replaces it by a line-feed character.

At the beginning of each new word the number of free spaces in the line is displayed by converting the contents of register C to 7-segment on the LEDs.

Remember: When placing these programs into a memory location, e.g: in a particular chip socket, any internal CALLS must be made to the correct location, i.e: to within that chip's area of addresses.

Using the empty EPROM socket in the printer the CALL CLRBUF (CD 8018) needs to be modified to CD 8070, location 7080, which is in the relocated program.

```
GHIJCDEF
LMNP89AB
RSTU4567
WXY 0123

1800 11 LD DE,2001
1803 62 LD H,D
1804 6B LD L,E
1805 06 LD B,FF
1807 CD CALL 1880
180A 00 NOP
180B 00 NOP
180C ED LD (1FFF),DE
1810 0E LD C,14
1812 DD LD IX,27F0
1816 00 NOP
1817 00 NOP
1818 21 LD HL,27E0
181B 06 LD B,1F
181D CD CALL 1880
1820 00 NOP
1821 00 NOP
1822 C5 PUSH BC
1823 CD CALL 05FE
1826 CD CALL 1890
1829 00 NOP
182A C1 POP BC
182B 0D DEC C
182C 28 JR Z,1860
182E 00 NOP
182F 00 NOP
1830 FE CP 20
1832 20 JR NZ,1820
1834 00 NOP
1835 CD CALL 05FE
1838 0D DEC C
1839 FE CP 12
183B 28 JR Z,1860
183D 00 NOP
183E 00 NOP
183F F5 PUSH AF
1840 DD LD IX,27F0
1844 DD PUSH IX
1846 E1 POP HL
1847 06 LD B,04
1849 CD CALL 1880
184C 00 NOP
184D 79 LD A,C
184E CD CALL 0678
1851 06 LD B,50
1853 CD CALL 0624
1856 10 DJNZ 1853
1858 00 NOP
1859 F1 POP AF
185A CD CALL 1890
185D 18 JR 1820
185F 00 NOP
1860 00 NOP
1861 00 NOP
1862 3E LD A,0D
1864 12 LD (DE),A
1865 DD LDIX,(1FFF)
1869 CD CALL 65AC
186C 3E LD A,0A
186E 12 LD (DE),A
186F 13 INC DE
1870 18 JR 180C
1872 76 HALT
1873 00 NOP
1874 00 NOP
1875 00 NOP
1876 00 NOP
1877 00 NOP
1878 00 NOP
1879 00 NOP
187A 00 NOP
187B 00 NOP
187C 00 NOP
187D 00 NOP
187E 00 NOP
187F 00 NOP
1880 AF XOR A
1881 77 LD (HL),A
1882 23 INC HL
1883 10 DJNZ 1881
1885 C9 RET
1886 76 HALT
1887 00 NOP
1888 00 NOP
1889 00 NOP
188A 00 NOP
188B 00 NOP
188C 00 NOP
188D 00 NOP
188E 00 NOP
188F 00 NOP
1890 DD DEC IX
1892 F5 PUSH AF
1893 CD CALL 1900
1896 DD LD(IX+00),A
1899 00 NOP
189A 00 NOP
189B F1 POP AF
189C CD CALL 1940
189F 12 LD (DE),A
18A0 13 INC DE
18A1 C9 RET
1900 21 LD HL,1910
1903 85 ADD A,L
1904 6F LD L,A
1905 7E LD A,(HL)
1906 00 NOP
1907 C9 RET
1908 FF RST 38H
1910 BD 30 9B BA
1914 36 AE AF 38
1918 BF BE 3F A7
191C 8D B3 8F 0F
1920 B6 B8 37 AE
1924 B5 30 37 3A
1928 B1 00 3D 1F
192C AD 85 1D 3A
1940 21 LD HL,1950
1943 85 ADD A,L
1944 6F LD L,A
1945 7E LD A,(HL)
1946 C9 RET
1947 FF RST 38H
1950 4F 31 32 33
1954 34 35 36 37
1958 38 39 41 42
195C 43 44 45 46
1960 59 54 58 53
1964 55 49 48 4D
1968 4A 20 4E 50
196C 47 4C 52 57
```

ASCON 2

Similar to ASCON 1, but instead of carriage return being SPACE + X, there is a CR key and no display of free spaces in the line.

After initialisation the program checks the keyboard, branches if the key-in is a CR to print the line. If it is any other key except SHIFT it branches to 184D where the check for a BACKSPACE and consequent operations is performed. If no BACKSPACE it goes on to decode the character and deposit it in OUTBUF. If this is space it goes back to NEWWORD instead of NEXC.

If the key was a SHIFT the pointer in the program to lookup tables is changed so as to look at the shifted characters.

```
1800 11 LD DE,2001
1803 62 LD H,D
1804 6B LD L,E
1805 06 LD B,FF
1807 CD CALL 1880
180A 00 NOP
180B 00 NOP
180C ED LD(1FFF),DE
1810 0E LD C,14
1812 DD LD IX,27F0
1816 00 NOP
1817 21 LD HL,27E0
181A 06 LD B,1F
181C CD CALL 1880
181F 00 NOP
1820 CD CALL 05FE
1823 FE CP 03
1825 28 JR Z,1870
1827 00 NOP
1828 FE CP 1F
182A 20 JR NZ,184D
182C 00 NOP
182D 2A LD HL,(18AC)
1830 D9 EXX
1831 2A LD HL,(1901)
1834 22 LD (18AC),HL
1837 D9 EXX
1838 22 LD (1901),HL
183B 00 NOP
183C 2A LD HL,(18AE)
183F D9 EXX
1840 2A LD HL,(18B1)
1843 22 LD (18AE),HL
1846 D9 EXX
1847 22 LD (18B1),HL
184A 18 JR 181D
184C 00 NOP
184D FE CP 19
184F 20 JR NZ,1858
1851 1B DEC DE
1852 DD INC IX
1854 18 JR 1820
1856 00 NOP
1857 00 NOP
1858 CD CALL 1890
185B 0D DEC C
185C 28 JR Z,1870
185E 00 NOP
185F FE CP 20
1861 20 JR NZ,1820
1863 18 JR 1817
1865 00 NOP
1866 00 NOP
1867 00 NOP
1868 00 NOP
1869 00 NOP
186A 00 NOP
186B 00 NOP
186C 00 NOP
186D 00 NOP
186E 00 NOP
186F 00 NOP
1870 3E LD A,0D
1872 12 LD (DE),A
1873 DD LD IX,(1FFF)
1877 CD CALL 65AC
187A 3E LD A,0A
187C 12 LD (DE),A
187D 13 INC DE
187E 18 JR 180C
1880 AF XOR A
1881 77 LD (HL),A
1882 23 INC HL
1883 10 DJNZ 1881
1885 C9 RET
1886 76 HALT
1887 00 NOP
1888 00 NOP
1889 00 NOP
188A 00 NOP
188B 00 NOP
188C 00 NOP
188D 00 NOP
188E 00 NOP
188F 00 NOP
1890 DD DEC IX
1892 F5 PUSH AF
1893 CD CALL 18B0
1896 DD LD(IX+00),A
1899 F1 POP AF
189A CD CALL 1900
189D 12 LD (DE),A
189E 13 INC DE
189F C9 RET
18A0 00 00 00 00
18A4 00 00 00 00
18A8 00 00 00 00
18AC 30 19 E0 18
18B0 21 LD HL,18C0
18B3 85 ADD A,L
18B4 6F LD L,A
18B5 7E LD A,(HL)
18B6 00 NOP
18B7 C9 RET
18E0 00 BD 5B 00
18E4 AE AF 38 BF
18E8 07 13 32 02
18EC EF 83 A2 82
18F0 BE BA 70 9B
18F4 36 14 10 EE
18F8 BB 00 90 28
18FC 8D A3 30 FF
1900 21 LD HL,1910
1903 85 ADD A,L
1904 6F LD L,A
1905 7E LD A,(HL)
1906 C9 RET
1930 20 30 3F 00
1934 35 36 37 38
1938 2A 2F 2B 2D
193C 26 3C 3E 3D
1940 39 33 21 32
1944 34 22 27 24
1948 29 00 3A 3B
194C 28 23 31 FF
```

MEMORY LOAD 56 CHARACTER

```
1800 11 01 20 62
1804 6B 06 FF CD
1808 80 18 00 00
180C ED 53 FF 1F
1810 0E 14 DD 21
1814 F0 27 00 21
1818 E0 27 06 1F
181C CD 80 18 00
1820 CD FE 05 FE
1824 03 28 49 00
1828 FE 1F 20 21
182C 00 2A AC 18
1830 D9 2A 01 19
1834 22 AC 18 D9
1838 22 01 19 00
183C 2A AE 18 D9
1840 2A B1 18 22
1844 AE 18 D9 22
1848 B1 18 18 D1
184C 00 FE 19 20
1850 07 1B DD 23
1854 18 CA 00 00
1858 CD 90 18 0D
185C 28 12 00 FE
1860 20 20 BD 18
1864 B2 00 00 00
1868 00 00 00 00
186C 00 00 00 00
1870 3E 0D 12 DD
1874 2A FF 1F CD
1878 AC 65 3E 0A
187C 12 13 18 8C
1880 AF 77 23 10
1884 FC C9 76 00
1888 00 00 00 00
188C 00 00 00 00
1890 DD 2B F5 CD
1894 B0 18 DD 77
1898 00 F1 CD 00
189C 19 12 13 C9
18A0 00 00 00 00
18A4 00 00 00 00
18A8 00 00 00 00
18AC 10 19 C0 18
18B0 21 E0 18 85
18B4 6F 7E 00 C9
18B8 FF FF EE FF
18BC DF FF F5 FF
18C0 00 BD 40 00
18C4 A7 3D BA 85
18C8 AD 27 B1 97
18CC B8 B6 30 1F
18D0 B5 8D 01 37
18D4 F5 8F 9A AE
18D8 1D 00 B3 0F
18DC FD 3F 9B 00
18E0 00 BD 5B 00
18E4 AE AF 38 BF
18E8 07 13 32 02
18EC EF 83 A2 82
18F0 BE BA 70 9B
18F4 36 14 10 EE
18F8 BB 00 90 28
18FC 8D A3 30 FF
1900 21 30 19 85
1904 6F 7E C9 FF
1908 FB FF BB FF
190C FE FF BF FF
1910 20 4F 2E 00
1914 42 4E 4D 4C
1918 47 48 4A 4B
191C 54 59 49 50
1920 55 43 2C 58
1924 56 45 57 53
1928 52 00 44 46
192C 51 41 5A FF
1930 20 30 3F 00
1934 35 36 37 38
1938 2A 2F 2B 2D
193C 26 3C 3E 3D
1940 39 33 21 32
1944 34 22 27 24
1948 29 00 3A 3B
194C 28 23 31 FF
```

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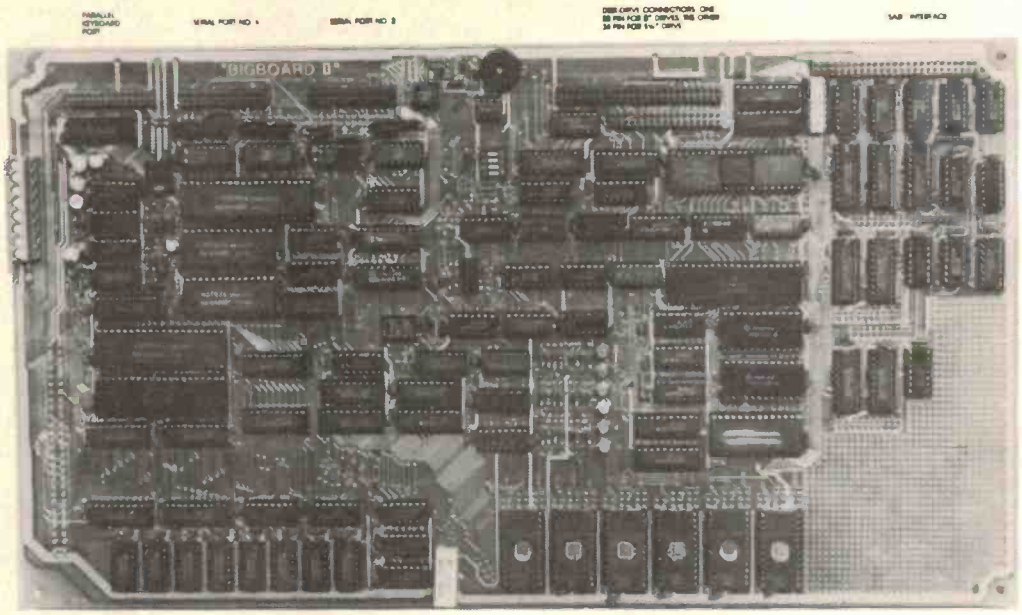
"BIG BOARD II"



EPROMs shown only for clarity.

STD Bus Connector

Prototyping Area

Jim Ferguson, the designer of the "Big Board" distributed by Digital Research: Computers, has produced a stunning new computer that we will begin shipping in November called "Big Board II", it has the following features:

4 MHz Z80 — CPU AND PERIPHERAL CHIPS

The Ferguson computer runs at 4 MHz. Its monitor code is lean, uses Mode 2 interrupts, and makes good use of the Z80-A DMA chip.

64K DYNAMIC RAM + 4K STATIC CRT RAM + 24K E(E)PROM OR STATIC RAM

"Big Board II" has the three memory banks. The first memory bank has eight 4164 RAMs that provide 60K of user space and 4K of monitor space. The second memory bank has two 2Kx8 SRAMs for the memory-mapped CRT display and space for six 2732 As, 2Kx8 staticRAMS, or pin-compatible E(E)PROMs. 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 350 nS2732 EPROM containing the monitor.

MULIPLE-DENSITY CONTROLLER FOR SS/DS FLOPPY DISKS

The new Ferguson single-board computer has a multiple-density disk controller. It can use 1793, 1797, or 8877 controller chips since it generated the signal with TTL parts. The board has two connectors for disk signal with 34 pins for 5.25" drivers, the other with 50 pins 8" drives.

VASTLY IMPROVED CRT DISPLAY

The new Ferguson SBC uses a 6845 CRT controller and 8002 Video Attributed controller to produce a display that will rival the display of quality terminals. Characters are formed by a 5x7 dot matrix on 15.75 KHz monitors and 7x9 dot matrix on 18.60 KHz monitors. The display is user programmable with the default display 24 lines of 80 characters. 8002a chip supplied for 18 to 60 kHz monitors.

STD BUS CONNECTOR

The Ferguson computer brings its bus signals to a convenient place on the PC board where users can solder an DSTD, bus cards can be plugged directly into it, and it can as well be connected by bus cable to industry-standard card cages.

DMA

The new Ferguson computer has a Z80-A DMA chip that will allow byte-wise data transfers at 500K bytes per second and bit serial transfers via the Z80-A S10 at 880K bytes per second with serial processor overhead, though the monitor for the new computer uses the DMA chip mainly for transferring data to and from disk, the chip can readily be used for other things since its "wait/ready" pin can be connected under software control to some half a dozen signal lines. When a hard-disk subsystem is connected to the "Big Board II" via its "SASI" interface, the DMA chip makes breathtaking disk performance possible.

"SASI" INTERFACE FOR WINCHESTER DISKS

The "Big Board II" implements the Host portion of the "Shugart Associates Systems Interface". Adding a Winchester disk drive is no harder than attaching a floppy-disk drive. A user simply 1: Runs a 50-conductor ribbon cable from a header on the board to any of several inexpensive controller cards for Winchester drives that implement the controller portion of the SASI interface. 2: Cables the controller to an appropriate drive, and 3: Provides power for the controller-card and drive. Since our CBIOS contains code for communication with hard-disk, that's all a user has to do to add a Winchester to a system!

A Z80-A S10/0 = TWO ASYNCHRONOUS/SYNCHRONOUS SERIAL PORTS
A PARALLEL KEYBOARD PORT = FOUR OTHER PARALLEL PORTS USER 1/0

The new Ferguson single-board computer has one parallel port for an ASCII keyboard and four others for user-defined 1/0. When the computer is powered-up or reset, the monitor looks for a carriage-return at the keyuboard and serial ports. If the first carriage-return the monitor gets comes from the parallel keyboard, the monitor uses the board's video display circuitry to communicate with the user via a CRT. If the first carriage-return is typed at an ASCII terminal attached to a serial port, the monitor autabauds and makes the terminal the system console.

TWO Z80-A CTCs = EIGHT PROGRAMMABLE COUNTERS/TIMERS

The new Ferguson computer has two Z80-A CTCs. One is used to clock data into and out of the Z80-A S10/0, while the other is for systems and application use.

PROM PROGRAMMING CIRCUITRY AND SOFTWARE

The new Ferguson SBC has circuitry and drivers for programming 2716s, 2732(A)s, or pin-compatible (E)EPROMs. Software $25 extra.

CP/M

CP/M with Russell Smith's CBIOS for the new Ferguson computer is available for $220. The CBIOS is available separately for $65.
Actual board size: 39.6cm x 22.2cm. 5 inch BIOS being developed. Approx price $95.

Pricing and Availability:

Availability: 2 weeks delivery.
In single quantities, full kits cost $775.00 + tax, and A&T'd computers cost $895. There are attractive discounts that range to 35% for OEM's and dealers. For details about them please call Rod Irving on (03) 489 7099. Ie: 3 Ferguson II "Big Board" are less 20% off the one-off price, hard disks disk controllers, boxes and power supply to suit both 8" & 5¼" systems will be available.
Bare board with main chips now available (includes PCB, Manual, PALS, Monitor ROM, SMC chips). You have to add rest of components at $495 + tax

Errors and omissions excepted.

WE are a No.1 Kit Supplier

SERIES 5000

PRICES SLASHED

As designed by ETI

PREAMPLIFIER

PRICES SLASHED this month only

~~$259~~ $239

SPECIFICATIONS

Frequency response:	High-level input: 15Hz-130 kHz, +0, −1 db Low-level input — conforms to RIAA equalisation, ±0.2 dB
Distortion:	1kHz <0.003% on all inputs (limit of resolution on measuring equipment due to noise limitation).
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 ohm source resistance connected: >86 dB flat >92 dB A-weighted. MC input, master full, with respect to full output (1.2V) and 200 μV input signal: >71 dB flat >75 dB A-weighted.

POWER AMPLIFIER

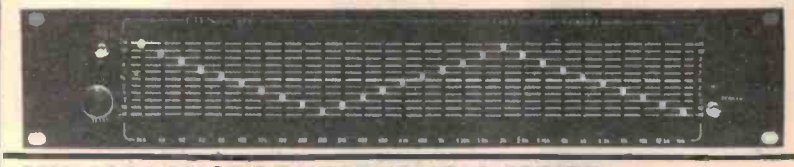
Please note that the "Superb Quality" Heatsink for the power amp was designed and developed by Rod Irving Electronics and is being supplied to other kit suppliers. This product cost $1,200 to develop so that your amplifier kit would have a professional finish as well as sound. We also have a new range of rack mounting boxes which will be released soon.

SPECIFICATIONS

Power output:	100W RMS into 8 ohms (±55 V supply).
Frequency response:	8 Hz to 20 kHz, +0−0.4 dB 2.8-Hz to 65 kHz, +0−3 dB. NOTE: These figures are determined solely by passive filters.
Input sensitivity:	1V RMS for 100W output.
Hum:	−100dB 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 4 A continuous. <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

Price Slashed ~~$299~~ $279

THIRD OCTAVE GRAPHIC EQUALIZER



SPECIFICATIONS E.T.I. Dec. 1982

Bands:	28 Bands from 31.5 Hz to 16 kHz
Noise: 20 kHz bandwidth	<0.008 mV, sliders at 0, gain at 0 (−102 dB),
Distortion:	0.007% at 300 mV signal, sliders at 0, gain at 0; max. 0.01%, sliders at minimum.
Frequency Response:	12 Hz-105 kHz, +0, −1 dB, all controls flat.
Boost & Cut:	14 dB

1 unit $189
2 units $359

MX-1200 MICROPHONE/AUDIO MIXER

MX 1200 $499 this month only

This unit features: 12 microphone line inputs with pan, bass, treble, effect and fold back controls for each channel • LED peak indicators for each channel • 2 turntable inputs with cross-fade and individual output controls • master equaliser for bass, midrange and treble • variable headphone output etc. etc. • complete with carrying case.

~~$599~~

SPECIFICATIONS:

INPUTS
Level/Impedance Mic .46 db/1K
Line .22 db/16K x 12
Phono .52 db/50K STEREO x 2 (.2mv) at 1KHz
Effect Return (Aux) .20 db/50K x 1
OUTPUTS
Level/Impedance L & R 0 db/2K
Effect Send 0 db/2K F/B Out 0 db/2K
Head phone Stereo +10 db/600 (100 .1K)
EQUALISATION
Channel
Bass ±15db
Treble ±15db
Master
Bass ±12db
Treble ±10db
Middle ±12db

FADER & CONTROLLERS
12 channel fader; Slide; 60m/m; LOG 25%
2 Master fader; Slide; 60m/m; LOG 15%
12 F/B Volume; 300; LIN
1 F/B Master level; 300; LIN
12 Effect Send; 300; LIN
1 Effect Return; 300; LOG 15%
2 Phono; 300; LOG 15%
1 Head Phone; 300; LOG 15%
S/N; 58DB
FREQUENCY RESPONSE: 20-20 KHz
TOTAL HARMONIC DISTORTION: Less than 0.1%
METER; 2 illuminated VU Meters 0db = 0.775V
PEAK INDICATOR: 12 LED Peak Indicators
VOLTAGE: 240 VAL 50Hz
POWER CONSUMPTION: 7.2 watts
DIMENSIONS: 620 (W) x 386 (D) x 108 (H) mm (supplied complete with carrying case)

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No. ..... — ORDER FORM — Please Debit my Bankcard

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POWER AMPLIFIER

KIT PRICE $299 P&P $8.00

- 1% Metal Film Resistors are used where possible
- Prewound Coils are supplied
- Aluminium case as per the original article
- All components are top quality
- Over 200 Kits now sold
- We have built this unit and so know what needs to go into every kit
- SUPER FINISH Front panel supplied with every kit at no extra cost to you
- We are so confident of this kit that we can now offer it assembled and tested so that people who do not have the time can appreciate the sound that this applifier puts out. This is done on a per order basis delivery approx. two weeks after placement.

only $425

**All parts available separately for both kits.*

PREAMPLIFER

KIT PRICE $259 P&P $8.00

- 1% Metal Film Resistors are supplied
- 14 metres of Low Capacitance Shielded are supplied (a bit extra in case of mistakes)
- English "Lorlin" Switches are supplied no substitutes as others supply
- We have built and tested this unit and so know what needs to go into every kit
- Specially imported black anodised aluminium knobs
- Again as with the power amp we are offering this kit A & T at a price which we do not believe there is a commercial unit available that sounds as good. Same delivery as the P.A.

only $425

Errors and omissions excepted.

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2 BRANCHES:

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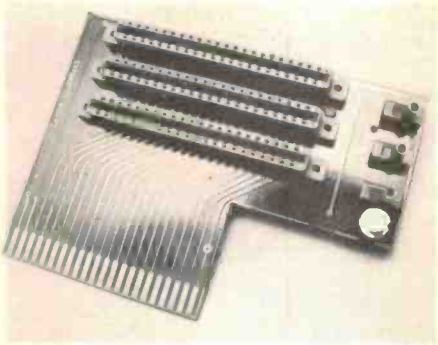
Mail orders: P.O. Box 235 Northcote, Vic. 3070

THE VIC-20 COLUMN

She was only an amateur's daughter, but she dit what her dah dah dit.

If you use Morse code and want to be able to listen to it before sending it off, you'll find the 'Morse Code Tutor' program very useful.

Neil Duncan, who wrote the program, has won the VIC-20 expansion board for the best software item this month.



☆ ENCOURAGEMENT ☆

Ozi-Soft, in conjunction with Computer Technics, is offering to donate a VIC-20 expansion board for the best software item submitted to this column every month.

The board is Australian designed and manufactured and simply plugs into the VIC-20's expansion slot. It features three sockets that can be independently switch-selected, plus an on-board reset switch. With it you can plug in up to three separate expansion units to your VIC-20 and avoid the hassle of plugging things in and out and turning the computer on and off each time. It is distributed by **Computer Technics, P.O. Box 25 Kogarah NSW 2217** and costs $59.95.

All submissions must be accompanied by a signed letter from you stating that it's your original work. The winning submission will be judged by the Editor and no correspondence will be entered into. All published submissions will be paid for.

Send entires to: **The Editor, VIC-20 Column, ETI Magazine, P.O. Box 21, Waterloo NSW 2017.**

MORSE CODE TUTOR

Neil Duncan, Heathmont Vic.

There are several ways of bringing your Morse up to scratch, but you want to be able to listen to code before sending it at any given speed.

This program allows the VIC-20 to send code to you without the noise problems of 'off air' Morse or having to use the skills of another person.

To use the program, type in the text (only numerics and alphabet letters are programmed) and play it back at the required speed. You may type in up to 1000 characters, which should be sufficient for a good work-out! The text may be replayed as often as required, and at whatever speed you wish.

To enter text, do not use the RETURN button. The F1 key will terminate the text. The F2 key will loop the playback to the start of the text. This loop will happen only once. If several loops are required, press the F2 key the required number of times.

The sophistication of editing, deletions, etc, has not been included. Neither has the facility to 'trim' the weighting of the Morse. The length of the listing of such a modified program starts to become a problem.

The underlined code in lines 120, 500 and 9010 refer to special keys on the VIC-20.

MORSE CODE TUTOR

```
10 DIM A$(36):L1=100
20 GOSUB 9000
30 PRINT "TYPE IN TEXT (1)"
40 PRINT "SELECT SPEED (2)"
50 PRINT "RUN CW       (3)"
60 PRINT "EXIT         (4)";
70 INPUT A
80 IF A>3 THEN END
90 IF A<1 THEN 30
100 ON A GOSUB 120,500,700
110 GOTO 20
120 PRINT "clear,home TYPE TEXT, NO RETURN."
130 PRINT "F1 FOR EXIT"
140 PRINT "F2 FOR LOOP"
150 PRINT "OR JUST TYPE..."
160 P=0
170 GET A$:IF LEN(A$)<>1 THEN 170
180 A=ASC(A$)
190 IF A=32 THEN A$=CHR$(96):A=96:GOTO 275
200 IF A<48 THEN GOSUB 300:GOTO 170
210 IF A<58 THEN A=A-47 :GOTO 275
220 IF A<65 THEN GOSUB 300:GOTO 170
230 IF A< 91 THEN A=A-54:GOTO 275
240 IF A=133 THEN RETURN
250 IF A=134 THEN GOTO 275
260 GOSUB 300:GOTO 170
270 IF P>1000 THEN RETURN
275 P=P+1:POKE M1+P,A:SYS(830)
280 B=ASC(A$):IF B>57 THEN B=B-64
290 POKE S1+21,B:GOTO 170
300 POKE P9,8:POKE T1,135:POKE V1,15
310 FOR I=1 TO 100:NEXT I
320 POKE V1,0:POKE P9,27
330 RETURN
500 PRINT "clear,home SELECT SPEED 1-5";
510 INPUT S:IF S<1 OR S>5 THEN GOSUB 300:GOTO 500
520 L1=30*(6-S)
530 RETURN
700 P1=0
710 P1=P1+1
720 IF P1>P THEN RETURN
730 X=PEEK(M1+P1)
740 IF X<1 THEN 710
750 SYS(830)
760 IF X>40 THEN 810
770 M$=A$(X):M2=LEN(M$)
780 Y=X-10:IF X<11 THEN Y=Y+57
790 POKE S1+21,Y
800 GOSUB 1300:GOTO 710
810 IF X=134 THEN POKE(M1+P1),0:P1=0
820 POKE S1+21,96:GOSUB 1200: GOTO 710
1000 REM DASH
1010 POKE T1,225:POKE V1,15
1020 FOR L=1 TO 3*L1:NEXT L
1030 POKE V1,0
1040 RETURN
1100 REM DOT
1110 POKE T1,225:POKE V1,15
1120 FOR L=1 TO L1:NEXT L
1130 POKE V1,0
1140 RETURN
1200 REM SPACE
1210 L2=L1:IF L1>80 THEN L2=L2*1.5
1220 FOR L=1 TO 4*L2:NEXT L
1230 RETURN
1300 FOR J=1 TO M2
1310 FOR L = 1 TO L1/3:NEXT L
1320 IF MID$(M$,J,1)="-" THEN GOSUB 1000:
     GOTO 1340
1330 GOSUB 1100
1340 NEXT J
1350 L2=L1:IF L1 >80 THEN L2=L2*2
1360 FOR L=1 TO L2*3:NEXT L
1370 RETURN
9000 REM INITIALIZE
9010 PRINT "clear,home ":S1=7900:C1=38620:
     V1=36878:T1=36875:P9=36879
9020 FOR I = 830 TO 858:READ X:POKE I,X:NEXT I
9030 M1=6500
9040 FOR I=1 TO 36:READ A$(I):NEXT I
9050 RESTORE:RETURN
9060 DATA 72,8,162,0,160,1,185,220,30,157
9070 DATA 220,30,169,0,157,220,150,157,241,150
9080 DATA 232,200,224,21,208,236,40,104,96
9090 DATA -----,.----,..---,.....,....-,.....
9100 DATA -....,--...,---..,-----.
9110 DATA .-,-...,-.-.,-..,...-.,--.,....,..
9120 DATA .---,-.-,.-..,--,-.,---,.--.,--.-
9130 DATA .-.,...,-,..-,....-,.--,-.--,-.--,-...
```

FLUORO BALLASTS

NEW, 20 WATT OR 6/8 WATT STANDARD FLUORO LIGHTING BALLASTS EX MANUFACTURER. (Normally $4.90) SORRY, NO MAIL ORDERS ACCEPTABLE!

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110v AC..$1.25 240v AC..$4.50

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- NEVER AGAIN AT THESE PRICES!

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WE'RE OVERSTOCKED ON THESE ALL BRAND NEW, CURRENT TYPES, NORMALLY 0.35¢ ea. TAKE YOUR PICK, VALUES MAY BE MIXED FOR QUANTITY DISCOUNTS!

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10-99 **15¢** each 100 **10¢**

(V) Vertical (H) Horizontal

SMALL 5MM TRIMPOTS
100 (V), 220 (V), 1K (V), 1K (H) 2K (V), 2K2 (H), 5K (V), 5K (H), 10K (V), 10K (H), 20K (V), 25K (H), 47K (V).

LARGE 10MM TRIMPOTS
100 (H), 200 (V), 470 (V), 1K (V) 1K (H), 2K2 (V), 2K2 (H), 4K7 (H) 10K (H), 10K (V), 25K (V), 470K (V), 2M2 (H), 4M7 (V).

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Two for the price of ONE!

HIGHEST QUALITY

$1.10 32 x 6.3MM FUSE 3 AG

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2 POLE CHANGEOVER
2 AMP CONTACTS
110v AC..$2.00. 220v AC..$2.75

4 POLE CHANGEOVER, COMPLETE WITH SOCKETS. 2 AMP CONTACTS
115v AC COIL.....ONLY $3 EA

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4 WAY DE-LUXE..$2.10
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15	PIN METAL COVER	$1.00	$0.90
25	PIN FEMALE SOCKET	$3.50	$3.00
25	PIN MALE PLUG	$3.70	$3.30
25	PIN PLASTIC COVER	$2.95	$2.55
37	PIN FEMALE SOCKET	$4.55	$4.00
50	PIN FEMALE SOCKET	$6.00	$5.25
50	PIN MALE PLUG	$6.00	$5.25

Amphenol, Plessey, AMP, Cannon, AB etc.

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15-30v DC OPEN TYPE..$3.00 $2.55
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3.3 uF	35v	0.60	15 uF	16v	0.70
15 uF	35v	0.95	22 uF	6v	0.60
33 uF	10v	0.70	47 uF	6v	0.70

★★★★★★★★★★

ROCKER SWITCHES NOW 5¢ EACH

250V 3A MAINS OR 3 POLE CHANGEOVER

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CENTRONICS PRINTER PLUGS

$8.75

Extremely small, ribbon-contact connectors suit computers and std. CENTRONICS printer input. Comprises 24 pin plug with gold-plated contacts and metal cover, polarised.

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A joystick-operated 'sprite' editor for the Commodore 64

Here is a sprite editor for the Commodore 64 that simplifies the otherwise laborious job of designing animated characters or graphics for games.

Mark Lingane

THE UNIQUE FEATURE about this sprite editor is that it uses the joystick to do everything: save, load, change colour etc. When you run the program you will see a large grid on the left and several small grids on the right of the screen with the cursor in the large grid. You move the cursor by moving the joystick.

When you have located the point where you want to begin the graphic, be it a space ship or cartoon character, then press the fire button. If there is no dot, pressing the button puts one there. If there is one, then pressing the button removes it.

The boxes on the right hand side of the screen comprise the control section. Placing the cursor in any of these boxes followed by a press of the button does various jobs.

They are:

- The top box is for identifying page number (you can save several sprites on different pages and recall them at will). You can change the page number by placing the cursor in the top box. To get there you have to move the cursor out of the sprite editor grid through the gap in its right hand wall.
- To select a page number push the joystick left or right and the page is displayed in the box. When the desired page has been reached press the button again.
- The second box is for selecting high resolution and multicolour: When the button is pressed while the cursor is in this box it will toggle (switch) the sprite between high-res and multicolour.
- The third to sixth boxes are for colour selection: Pressing the fire button while the cursor is in these boxes will change the colours. If the sprite is in multicolour mode then the colour one will change. The same happens for the next two boxes. The sixth box is the screen colour, it operates as all the others do.
- The seventh box: X expand, Y expand, Save sprites, Load sprites: Pressing the button while on the X to expand or contract. The Y has the same function but expands and contracts on the Y axis.

Saving and loading are also achieved by joystick control. Move the cursor to either S or L (Save or Load) and then simply press the button.

Pressing the button on either of these letters (S or L) will cause the cursor to jump to the line of characters on the bottom line. The computer will ask a few questions which you answer by moving the cursor along the line and pressing the button on the chosen characters.

If you make a mistake, cursor along to the second last character (the back arrow) and press the button. When the input is complete cursor along to the last character on the end (the reverse M) and press the button. You will know it is right because it will say "loading sprites" or "saving sprites".

- The bottom box: Clear, Reverse, Quit: pressing the button on C will cause the sprite grid you are working on to be erased. Reverse will cause the sprite grid to be reversed. Q will quit the programme.

That's all there is to it! It is a lot harder to explain than actually do.

This program saves hours of work once you can get the hang of using the joystick — and it's cheaper than a light pen!

```
10 PK=1065:S4=53281:VC=53248:DIMCOL$(15):PG=200:S1=VC+39:C1=PEEK(S1)AND15
20 S2=VC+38:C2=PEEK(S2)AND15:C4=PEEK(S4)AND15:S3=S2-1:C3=PEEK(S3)AND15
30 PRINT"                                ":FORI=1TO11
32 PRINT"                               ":NEXT
33 PRINT"                                ":FORI=1TO9
34 PRINT"                               ":NEXT
35 PRINT"                               "
40 DN$="
42 LI=13:COL=5:ST$="ONE MOMENT PLEASE":GOSUB2000
45 FORI=0TO999:POKE55296+I,1:NEXT
50 LI=1:CO=28:ST$="                    PAGE:                    ":GOSUB20
00
51 LI=4:CO=28:ST$="                                             ":GOSUB20
00
52 LI=7:CO=28:ST$="                                             ":GOSUB20
00
53 LI=10:CO=28:ST$="                                            ":GOSUB2
000
54 LI=13:CO=26:ST$="                  X/Y/S/L                   ":GOSUB2
000
55 LI=16:CO=28:ST$="                  C/R/Q                     ":GOSUB2
000
56 FORI=1TO26:POKE1983+I,I:NEXT:FORI=0TO9:POKE2010+I,I+48:NEXT:POKE2020,31
57 MC=12*4096:POKE2021,141
58 READA:IFA=-1THEN60
59 POKEMC,A:MC=MC+1:GOTO58
60 FORI=0TO15:READCOL$(I):NEXT
61 LI=5:CO=29:ST$="HIGH-RES":IFPEEK(VC+28)AND2↑CSTHENST$="MULTICOL"
62 GOSUB2000
70 GOSUB500:GOSUB75:GOSUB80:GOTO100
75 POKE2040,PG:POKEVC+16,2↑CS:POKEVC+CS*2,20:POKEVC+1+CS*2,200:POKEVC+21,2↑CS
76 GOSUB2010:RETURN
80 LI=8:CO=29:ST$=COL$(C1):GOSUB2000
82 LI=8:CO=34:ST$=COL$(C2):GOSUB2000
84 LI=11:CO=29:ST$=COL$(C3):GOSUB2000
86 LI=11:CO=34:ST$=COL$(C4):GOSUB2000
89 RETURN
100 V=PEEK(PK+PX+PY*40):POKEPK+PX+PY*40,128ORV
101 IFPEEK(56320)<>127THEN120
110 GETA$:IFA$=""THEN101
120 J=PEEK(56320):POKEPK+PX+PY*40,V
122 IFA$="J"OR((JAND2)=0)THENPY=PY+1
125 IFA$="K"OR((JAND1)=0)THENPY=PY-1
130 IFA$="H"OR((JAND8)=0)THENPX=PX+1
135 IFA$="U"OR((JAND4)=0)THENPX=PX-1
140 IFPEEK(PK+PX+PY*40)<>160THEN150
142 IFPX=-1THENPX=23
144 IFPX=24THENPX=0
146 IFPY=21THENPY=0
148 IFPY=-1THENPY=20
150 IF(JAND16)=0ORA$=" "THENGOSUB400
```

```
 152 IFPX)37THENPX=37
 153 IFPY)21THENPY=21
 154 IFPY(0THENPY=0
 200 GOTO100
 400 IFPX)24THEN450
 402 PP=PG*64+INT(PX/8)+PY*3
 405 IFPEEK(PK+PX+PY*40)=32THENPOKEPK+PX+PY*40,81:GOTO410
 407 IFPEEK(PK+PX+PY*40)=81THENPOKEPK+PX+PY*40,32:GOTO415
 410 POKEPP,PEEK(PP)OR(2↑(7-(PX-INT(PX/8)*8))):GOTO420
 415 POKEPP,PEEK(PP)AND255-(2↑(7-(PX-INT(PX/8)*8)))
 420 RETURN
 450 IF(PX)27ANDPX(36)ANDPY=0THENGOSUB1000:RETURN
 455 IF(PX)27ANDPX(36)ANDPY=3THENQQ=28:GOSUB600:LI=5:CO=29:ST$="MULTICOL"
 456 IF(PX)27ANDPX(36)ANDPY=3ANDTG=1THENST$="HIGH-RES"
 457 IF(PX)27ANDPX(36)ANDPY=3THENGOSUB2000:RETURN
 460 IFPX=28ANDPY=12THENQQ=29:GOSUB600
 462 IFPX=30ANDPY=12THENQQ=23:GOSUB600
 464 IF(PX)27ANDPX(31)ANDPY=6THENC1=(C1+1)AND15:POKES1,C1:GOSUB80
 466 IF(PX)32ANDPX(36)ANDPY=6THENC2=(C2+1)AND15:POKES2,C2:GOSUB82
 468 IF(PX)27ANDPX(31)ANDPY=9THENC3=(C3+1)AND15:POKES3,C3:GOSUB84
 469 IF(PX)32ANDPX(36)ANDPY=9THENC4=(C4+1)AND15:POKES4,C4:GOSUB86
 470 IFPX=29ANDPY=15THENFORI=PG*64TOPG*64+64:POKEI,0:NEXT:GOSUB500:RETURN
 472 IFPX=33ANDPY=15THENPOKEVC+21,0:PRINT"■";:END
 475 IFPX=31ANDPY=15THENFORI=PG*64TOPG*64+64:POKEI,255-PEEK(I):NEXT:GOSUB500:RETU
RN
 480 IFPX=32ANDPY=12THEN1200
 485 IFPX=34ANDPY=12GOTO1500
 490 RETURN
 500 PRINT"■■";:FORI=0TO20:PRINT"■";:FORJ=0TO2:POKE828,PEEK(PG*64+I*3+J):SYS12*40
96
 510 NEXT:PRINT:NEXT:RETURN
 600 TG=0:IF(PEEK(VC+QQ)AND2↑CS)THEN620
 610 POKEVC+QQ,PEEK(VC+QQ)OR2↑CS:RETURN
 620 POKEVC+QQ,PEEK(VC+QQ)AND255-2↑CS:TG=1:RETURN
1000 J=PEEK(56320):IFJ=127THEN1000
1010 IF(JAND4)=0THENPG=PG-1:GOSUB75
1020 IF(JAND8)=0THENPG=PG+1:GOSUB75
1030 IF(JAND16)=0THENGOSUB500:RETURN
1040 GOTO1000
1200 LI=24:CO=0:ST$="FROM PAGE:":GOSUB2000:GOSUB3000:PA=VAL(IN$):IFPA=0THEN100
1210 LI=24:CO=0:ST$="                    ":GOSUB2000
1220 LI=24:CO=0:ST$="TO PAGE:":GOSUB2000:GOSUB3000:PH=VAL(IN$):IFPH=0THEN1200
1230 LI=24:CO=0:ST$="                  ":GOSUB2000
1240 BE=PA*64:EN=PH*64+64:HB=INT(BE/256):LB=BE-HB*256:HE=INT(EN/256)
1350 LE=EN-HE*256:LI=24:CO=0:ST$="FILENAME:":GOSUB2000:GOSUB3000:FL$=IN$
1360 LI=24:CO=0:ST$="                                ":GOSUB2000
1370 LI=24:CO=0:ST$="■TAPE OR ■DISK:":GOSUB2000:GOSUB3000:D=ASC(IN$)
1375 DEV=1
1380 IFD=68THEN FL$="0:"+FL$+",PRG,WRITE":DEV=8
1400 GOTO1600
1500 LI=24:CO=0:ST$="FILENAME:":GOSUB2000:GOSUB3000:FL$=IN$
1510 LI=24:CO=0:ST$="                                ":GOSUB2000
1520 LI=24:CO=0:ST$="■TAPE OR ■DISK:":GOSUB2000:GOSUB3000:D=ASC(IN$)
1530 PRINT"■";:DEV=1
1540 IFD=68THENFFL$="0:"+FL$:DEV=8
1550 PRINT "■■■■■■■■■■■■■■■■■■■■LOADING "FL$
1560 PRINT"■LOAD"CHR$(34)FL$CHR$(34)",DEV",1:RUN":POKE631,19:POKE632,13:POKE198
,2:END
1600 PRINT" ■■■■■■■■■■■■■■■■■■■■SAVING "FL$:POKE646,PEEK(53281)AND15
1605 PRINT"■P┌43,"LB"■:P┌44,"HB"■:P┌45,"LE"■:P┌46,"HE"■:S■"CHR$(34)FL$CHR$(34);
1610 PRINT","DEV"■,1"
1620 PRINT"■■■■■■■■■■■■■■■■P┌43,1:P┌44,8:P┌45,136:P┌46,26:RUN■"
1630 POKE631,19:FORI=632TO640:POKEI,13:NEXT:POKE198,10
1999 END
2000 PRINTLEFT$(ON$,LI)TAB(CO)ST$;:RETURN
2010 LI=2:COL=34:ST$=MID$(STR$(PG),2):IFPG(100THENST$=ST$+" "
2011 GOSUB2000:RETURN
3000 PS=1984:TB=1:IN$=" "
3005 X=PEEK(PS):POKEPS,128ORX
3010 J=PEEK(56320):IFJ=127THEN3010
3020 POKEPS,X
3030 IF(JAND4)=0THENPS=PS-1:IFPS(1984THENPS=2021
3040 IF(JAND8)=0THENPS=PS+1:IFPS)2021THENPS=1984
3050 IF(JAND16)=0THEN3070
3060 GOTO3005
3070 IFX=31ANDTB)1THENIN$=LEFT$(IN$,TB-1):TB=TB-1:PRINT"■ ■";:GOTO3005
3072 IFX=31THEN3005
3075 IFX=141THEN3100
3080 IFX)0ANDX(27THENX=X+64
3090 IN$=IN$+CHR$(X):PRINTCHR$(X);:TB=TB+1:GOTO3005
3100 IN$=MID$(IN$,2):RETURN
63990 DATA173,60,3,41,128,32,65,192,173,60,3,41,64,32,65,192,173,60,3,41
63992 DATA32,32,65,192,173,60,3,41,16,32,65,192,173,60,3,41,8,32,65,192
63994 DATA173,60,3,41,4,32,65,192,173,60,3,41,2,32,65,192,173,60,3,41
63996 DATA1,32,65,192,96,208,5,169,32,76,74,192,169,209,32,210,255,96,-1
63998 DATABLK,WHT,RED,CYN,PUR,GRN,BLU,YEL,ORG,BRN,LTR,GR1,GR2,LTG,LTB,GR3

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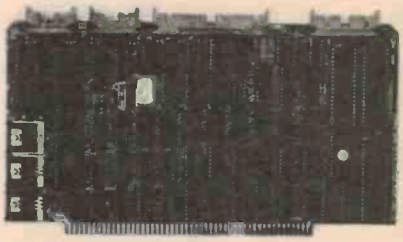

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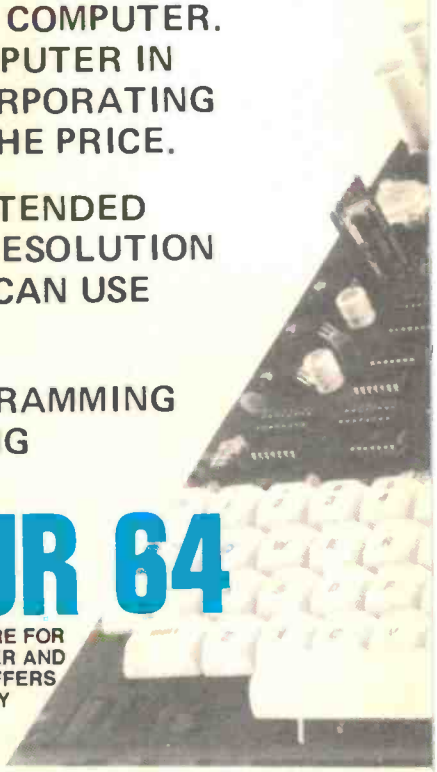

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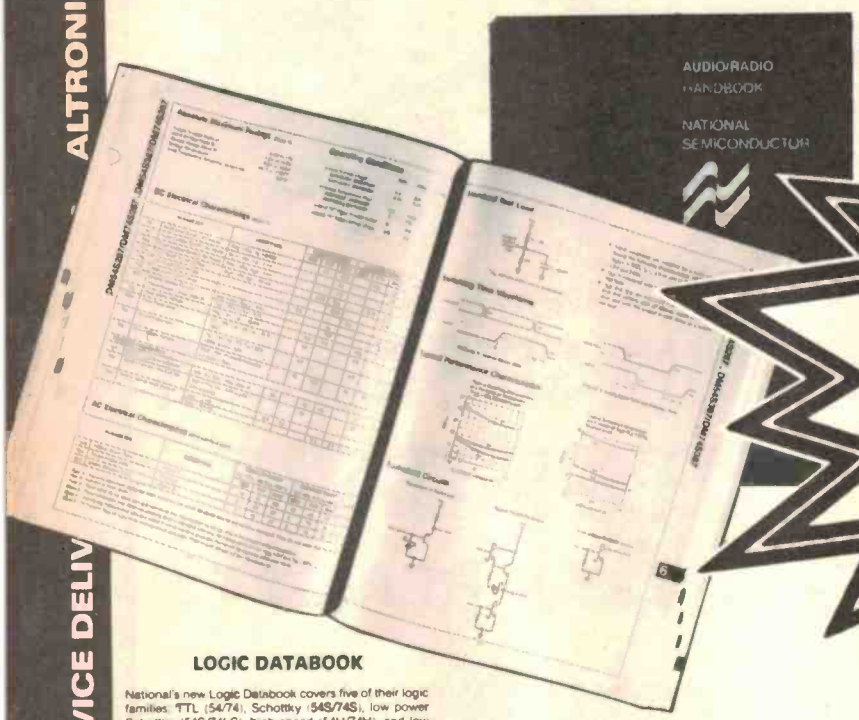

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To keep current on all new National transistors, please contact your National sales representative or franchised distributor and ask to be placed on the customer mailing list.

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MICROBEE COLUMN

Now there's no excuse for sending in badly typed articles. J. Murfet has solved a few problems for you, and hopefully, for us as well.

His 'Typing Tutor' program should soon have you all producing accurate and neat letters and programs. Sometimes it's not easy to figure out, midst the blotches and corrections, what you're really trying to say.

And if practising your typing doesn't keep you busy, you can try out the 'Screen Saver' which is another useful program.

SCREEN SAVER

D.J. Whyatt, South Plympton SA

This utility machine code program allows the contents of the screen RAM to be dumped elsewhere in memory, to be recalled later. This means that a particular text or graphic display may be written or drawn once, and then instantly returned to the screen.

This is especially useful for slow, hi-res graphs, plots, or diagrams. Any number of screens may be saved, depending only upon the available memory space.

Each dump requires 3072 bytes; some experimentation is sometimes required to find a safe area. The code may be stored anywhere, provided allowance is made for this when the routine is called.

The following example uses 15000 for saving and 15020 for retrieval.

To load the code, use a GOSUB 1000 early in the host program.

To save a screen to 8000, enter

S = USR(15000, 8000)

To retrieve screen from 8000, enter

S = USR(15020, 8000)

SCREEN SAVER

```
01010 REM
01020 RESTORE 1060
01030 FOR L=15000 TO 15038
01040     READ D:POKE L,D
01050 NEXT L:RETURN
01060 DATA 89,80,33,0,240,1,0,4,237,176,33,0,248
01070 DATA 1,0,8,237,176,201,0,105,96,17,0,240
01080 DATA 1,0,4,237,176,17,0,248,1,0,8,237,176,201
```

TYPING TUTOR

J. Murfet, Hadspen Tas.

Here's a Typing Tutor program that takes 5K of memory and has room for modification. A keyboard is put together with the PCG RAM and the keys used for the eight fingers to 'rest' on are indicated.

A random sentence is then generated and the student is directed to copy that sentence. If the wrong key is pressed, a note is sounded and the letter is not printed. The program is aimed at accuracy *rather* than speed.

TYPING TUTOR

```
00110  CLS: PRINT "TYPING TUTOR is a program to test your typing accuracy."
00120  PRINT:"Sentences are selected at random and you are to copy them.
":PRINT
00130  PRINT " The correct resting positions for your eight fingers are"
00140  PRINT " indicated by circles around the appropriate letters.": PRINT
00150  REM *** SET UP STORAGE FOR SENTFNCE COMPONENTS ***
00160  STRS (500)
00170  DIM R1 (8),  Z1 (8), S1 (8), O1 (8)
00180  FOR I = 1 TO 8:R1$ (I) ="":Z1$(I)="":S1$(I)="":O1$(I)=""
00190  NEXT I
00200  FOR I = 1 TO 8
00210  READ  R1$(I)
00220  READ Z1$(I)
00230  READ S1$(I)
00240  READ O1$(I)
00250  NEXT 1
00260  REM *** BUILD THE KEY TOPS AND LETTERING ***
00270  K=63488+44*16
00280  FOR I=K TO K=16*2-1
00290  READ L: POKE I,L
00300  NEXT I
00310  K=63488+48*16
00320  FOR I = K TO K +16*12-1
00330  READ L;POKE I,L
00340  NEXT I
00350  K = 63488+65*16
00360  FOR I = K TO K+16*27-1
00370  READ L: POKE I,L
00380  NEXT I
00390  INPUT "HOW MANY SENTENCES TO BE TESTED?";B;
00400  K=63488+97*16
00410  FOR I = K TO J+16*5-1
00420  READ L: POKE I,L
00430  NEXT I
00440  REM *** DRAW KEYBOARD ***
00450  CLS: CURS 1,10
00460  PCG: PRINT "ab1bcab3bcab3bcab4bcab5bcab6bcab7bcab8bcab9bcab0bcab:bcab-
bc": NORMAL
00470  CURS 3,11
00480  PCG:PRINT" abQbcabWbcabEbcabRbcabTbcabYbcabUbcabIbcabObcabPbcab[bc":
NORMAL
00490  CURS 6,12
00500  PCG: PRINT "adAecadSecadDecadFecabGbcabHbcadJecadKecadLecad;ec":
NORMAL
00510  CURS 8,13
00520  PCG: PRINT "abZbcabXbcabCbcabVbcabBbcabNbcabMbcab.bcab.bc":
NORMAL
00530  CURS 15,14
00540  PCG: PRINT "abbbbbbbbbbbbSbPbAbCbEbbbbbbbbbbbbbc": NORMAL
00550  REM *** COMPOSE SENTENCE FROM DATA ***
00560  FOR J = 1 TO B
00570  R=INT (RND*8)+1
00580  Z=INT (RND*8)+1
00590  S=INT (RND*8)+1
00600  O=INT (RND*8)+1
00610  M1$=R1$(R)+" "+Z1$ (Z) + " THE " +S1$ (S) + " " +  O1$ (O)
00620  CURS 25,1: PRINT " SENTENCE  " J
00630  REM *** PRINT SENTENCE ***
00640  CURS 1,3: PRINT "
                        ":CURS 1,3: PRINT M1$
00650  CURS 1,4: PRINT "
                        ":CURS 1,4
00660  REM *** RECEIVE TYPED INPUT ***
00670  FOR I = 1 TO LEN (M1$)
00680  A1$= KEY $: IF A1$="" THEN 680
00690  IF A1$ = M1$ (;I,I): PRINT A1$;: GOTO  710
00700  PLAY 6: M=M+1: N=N+1: GOTO 680
00710  NEXT I
00710  IF M>1: CURS 1,3: PRINT " YOU MADE "M" MISTAKES ON THIS LINE
   GIVE IT ANOTHER TRY"
00730  IF M>1: CURS 1,4: PRINT "
                                ":PLAY 0,30:M=0: GOTO 640
00740  M=0
00750  NEXT J
```

MICROBEE COLUMN

```
00760  PLAY 0,30: CURS 1,8: PRINT "OVERALL YOU MADE "N" MISTAKES.";
00770  IF N>B*3 THEN PRINT "YOU NEED MORE PRACTICE."
00780  IF FLT (N)< FLT (B) *3: IF FLT (N) =>FLT (B) *.3 THEN PRINT
"A FAIR RESULT, KEEP TRYING"
00790  IF FLT (N)<FLT (B) * .3 THEN PRINT " A VERY GOOD RESULT, CONGRAT-
ULATIONS"
00800  END
00810  DATA "JOE BJELKE", "THREW", "FAT", "PIG"
00820  DATA "THE QUICK BROWN FOX","MASHED","WHIMPERING","GUPPY"
00830  DATA "LADY DI","KISSED "," SHOULDERING","HAT BRIM"
00840  DATA "FRED","LICKED","SLIPPERY","FROG"
00850  DATA "HEATHER","SUCKED","COLD","RAT"
00860  DATA "BERT","SAT ON","SICK","DOG"
00870  DATA "DOREEN","PUSHED","SMUG","COW"
00880  DATA "BIGGLES","SHOT","SMOOTH","PRESSED HAM"
00890  DATA 0,255,0,0,0,0,0,28,28,28,4,24,0,255,0
00900  DATA 0,255,0,0,0,0,0,255,0,0,0,0,0,255,0
00910  DATA 0,255,0,0,0,0,0,0,0,60,60,0,0,0,255,0
00920  DATA 0,255,0,60,66,131,133,137,145,161,193,66,60,0,255,0
00930  DATA 0,255,0,8,24,8,8,8,8,8,8,8,28,0,255,0
00940  DATA 0,255,0,124,130,1,2,28,96,128,128,128,255,0,255,0
00950  DATA 0,255,0,124,130,1,2,62,2,1,1,130,124,0,255,0
00960  DATA 0,255,0,2,6,10,18,34,66,130,255,2,2,0,255,0
00970  DATA 0,255,0,255,128,128,252,2,1,1,1,130,124,0,255,0
00980  DATA 0,255,0,63,64,128,128,254,129,129,129,66,60,0,255,0
00990  DATA 0,255,0,255,130,4,8,16,32,32,32,32,32,0,255,0
01000  DATA 0,255,0,126,129,129,129,126,129,129,129,129,126,0,255,0
01010  DATA 0,255,0,126,129,129,129,127,1,1,1,130,124,0,255,0
01020  DATA 0,255,0,0,60,60,0,0,60,60,0,0,0,0,255,0
01030  DATA 0,255,0,0,60,60,0,0,60,60,4,8,16,0,255,0
01040  DATA 0,255,0,60,66,129,129,255,129,129,129,129,129,0,255,0
01050  DATA 0,255,0,252,130,129,130,252,130,129,129,130,252,0,255,0
01060  DATA 0,255,0, 60, 66,128,128,128, 128,128,128,66,60,0,255,0
01070  DATA 0,255,0,252,66,65,65,65,65,65,65,66,252,0,255,0
01080  DATA 0,255,0,255,128,128,128,254,128,128,128,128,255,0,255,0
01090  DATA 0,255,0,255,128,128,128,252,128,128,128,128,128,0,255,0
01100  DATA 0,255,0,62,65,128,128,128,159,129,129,65,63,0,255,0
01110  DATA 0,255,0,129,129,129,129,255,129,129,129,129,129,0,255,0
01120  DATA 0,255 0,124,16,16,16,16,16,16,16,16 124,0,255,0
01130  DATA 0,255,0,7,2,2,2,2,2,2,2,66,60,0,255,0
01140  DATA 0,255,0,129,130,132,136,144,176,200,132,130,129,0,255,0
01150  DATA 0,255,0,128,128,128,128,128,128,128,128,255,0,255,0
01160  DATA 0,255,0,129,195,165,153,153,129,129,129,129,129,0,255,0
01170  DATA 0,255,0,129,193,161,161,145,137,133,133,131,129,0,255,0
01180  DATA  0,255,0,60,66,129,129,129,129,129,129,66,60,0,255,0
01190  DATA 0,255,0,252,130,129,129,130,252,128,128,128,128,0,255,0
01200  DATA 0,255,0,60,66,129,129,129,129,137,133,66,61,0,255,0
01210  DATA 0,255,0,254,129,129,129,254,144,136,132,130,129,0,255,0
01220  DATA 0,255,0,126,129,128,128,126,1,1,1,129,126,0,255,0
01230  DATA 0,255,0,254,16,16,16,16,16,16,16,16,16,0,255,0
01240  DATA 0,255,0,129,129,129,129,129,129,129,129,129,126,0,255,0
01250  DATA 0, 255,0,129,129,129,66,66,36,36,24,24,24,0,255,0
01260  DATA 0,255,0,129,129,129,129,129,153,153,165,195,129,0,255,0
01270  DATA 0,255,0,129,129,66,36,24,24,36,66,129,129,0,255,0
01280  DATA 0,255,0,130,130,68,68,40,40,16,16,16,16,0,255,0
01290  DATA 0,255,0,255,1,2,4,8,16,32,64,128,255,0,255,0
01300  DATA 0,255,0,126,64,64,64,64,64,64,64,64,126,0,255,0
01310  DATA 0,127,64,64,64,64,64,64,64,64,64,64,64,64,127,0
01320  DATA 0,255,0,0,0,0,0,0,0,0,0,0,0,0,255,0
01330  DATA 0,254,2,2,2,2,2,2,2,2,2,2,2,2,254,0
01340  DATA 0,255,3,12,48,96,192,128,128,192,96,48,12,3,255,0
01350  DATA 0,255,192,48,12,6,3,1,1,3,6,12,48,192,255,0
```


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AUTOMOTIVE TUNE-UP AND EMISSION-CONTROL SERVICE
F0120P **$22.75**
Car owners who wish to save money and maintain their cars at peak performance will learn how to adjust, repair and maintain the systems that ensure best operation.

electronic music and audio/video

CHEAP VIDEO COOKBOOK
G0123P **$11.75**
Complete discussion of a new, low-cost way to get words, pictures and opcode out of your computer and onto any ordinary television screen, using a seven-IC easy-to-build circuit which you can build for $20.

AN INTRODUCTION TO VIDEO
G0124B **$6.95**
This book is written in layman's language and is for anyone who is thinking about buying or renting or who has just bought or rented a video recorder and wants to get the best out of the machine.

AUDIO CYCLOPEDIA
G0125P **$71.95**
A complete in-depth look at the art of audio — from the basic principles of sound to solid-state and integrated circuits. More than 3000 entries and hundreds of illustrations and circuit diagrams cover acoustics, amplifiers, recording, reproduction, test equipment, audio measurements, and much more.

ELECTRONIC MUSIC CIRCUITS
G0126P **$26.95**
How to build a custom electronic music synthesiser, outlines numerous other circuit designs and then shows you how to modify them to achieve particular responses. Many of the circuits can be used as special-effects boxes for guitars and other musical instruments.

INTRODUCTION TO ELECTRO-ACOUSTIC MUSIC
G0127P **$15.95**
This book assumes no previous technical knowledge. It discusses the relationship between the technology and the composition of electro-acoustic music.

MODERN RECORDING TECHNIQUES
G0128P **$21.95**
Explains the equipment controls and techniques found in a modern recording studio and how to use them creatively and correctly to produce a desired result. Numerous photographs, diagrams and charts.

SOUND-SYSTEM ENGINEERING
G0129P **$35.50**
Dealing with audio systems as a whole, it includes installing and equalising the sound system and interfacing the electrical and acoustic systems. Instrumentation, the acoustic environment and designing for acoustic gain.

TUBE SUBSTITUTION HANDBOOK
G0130P **$8.75**
Complete, accurate, up-to-date guide to direct substitutes for receiving and picture tubes. Contains more than 6000 receiving tube substitutes, 4000 monochrome and colour picture tube substitutes, and 600 communications substitutes. Also includes pinouts for quick operational checks.

HOW TO BUILD SPEAKER ENCLOSURES
G0131P **$8.75**
A guide to the 'whys' and 'hows' of constructing top-performance loudspeaker enclosures.

VIDEO TAPE RECORDERS
G0132P **$19.50**
In this completely revised second edition, the author tells in simple language how helical VTRs work and how to operate and service them. Includes numerous examples of circuits and mechanical systems.

ELECTRONIC SYNTHESISER PROJECTS
G0133B **$5.95**
For the electronic music enthusiast, an invaluable reference. This book is full of circuits and information on how to build analogue delay lines, sequencers, VCOs, envelope shapers, etc, etc. The author takes a clear and logical approach to the subject that should enable the average enthusiast to understand and build up what appears to be a quite complex instrument.

AUDIO PROJECTS
G0134B **$6.95**
Covers a wide range of audio projects, including preamplifiers and mixers, power amplifiers, tone controls and matching, etc. Board layouts and wiring diagrams included.

ELECTRONIC MUSIC PROJECTS
G0135B **$5.95**
Provides constructors with practical circuits for the less complex music equipment including fuzz box, waa-waa pedal, sustain unit, reverb and phaser, tremolo generator, etc. Text covers guitar effects, general effects, sound generators, accessories.

AUDIO PROJECTS FROM ETI
G0260E **$5.00**
Projects include Series 4000 moving-coil cartridge preamplifier, general-purpose 150 W MOSFET power amp module, versatile public-address amplifier, etc, etc.

ELECTRONIC MUSIC AND CREATIVE TAPE-RECORDING
G0136B **$5.95**
Shows how electronic music can be made at home with the simplest and most inexpensive of equipment. Describes how the sounds are generated and how these may be recorded to build up the final composition.

computer hardware and techniques

THE 6809 COMPANION
J0154B **$6.95**
This is not a beginner's introduction to microprocessors in general but a discussion of the features of the 6809 and a reference.

COMPUTERS AND COMPUTING YEARBOOK '82
J0155E **$4.95**
Includes disks, CP/M and your computer, learners microcomputer, programming in CHIP-8, alphasort, fast plotter, PET talk, System 80.

COMPUTERS AND COMPUTING YEARBOOK '83
J0014E **$4.95**
Includes ZX81, Epson MX80 printer, System 80 joystick project, 660 software, ZX80 programs, etc, etc.

Z80 MICROCOMPUTER DESIGN PROJECTS
J0156P **$20.75**
A complete look at the internal architecture of the Z80, the heart of many microcomputers, and even shows how to build a microcomputer, the EX80, using this powerful chip.

MICROPROCESSOR CIRCUITS
J0157P **$14.75**
Presents basic microprocessor concepts in simple language for beginners and teaches you to construct a useful microcontroller system. Offers 30 demo circuits which take you through assembly, operation and programming of a microcontroller.

INTERFACE PROJECTS FOR THE APPLE II
J0158P **$15.95**
A series of interface projects that are easily built and enable the user to realise the computer's potential through project construction. Projects are primarily hardware-orientated, with some software supporting the hardware.

DON LANCASTER'S MICRO COOKBOOK
J0159P **$20.75**
This 'cookbook' starts with the very fundamentals of microprocessors and microcomputers and takes you through number systems, codes, etc, till you can work intelligently with micros.

THE S100 AND OTHER MICRO BUSES
J0160P **$13.25**
The key to successful computer expansion is a complete understanding of the bus system, through which the computer communicates with peripherals. This book will give you that understanding.

MICROCOMPUTER DESIGN AND TROUBLESHOOTING
J0161P **$26.75**
Tells you how to design microcomputer systems and make them work without an expensive commercial development system or the need for costly test instrumentation. Includes a complete description of two microprocessors — the 8085 and the 6502.

USING THE 6800 MICROPROCESSOR
J0163P **$13.25**
Guides the reader through the conception, configuration, writing and running of a variety of programs that demonstrate practical use of a 6800 system.

8080 MICROCOMPUTER EXPERIMENTS
J0164A **$29.50**
This 'hands on' book includes 105 experiments, presenting programs and diagrams.

A STEP-BY-STEP INTRODUCTION TO 8080 MICROPROCESSOR SYSTEMS
J0165A **$16.95**
Doesn't require any electronics or computer background. This book describes the 8080 architecture and instruction set through simple examples. Some basic software is introduced.

DIGITAL CIRCUITS WITH MICROPROCESSOR APPLICATIONS
J0166A **$43.25**
An introductory text, this book provides readers with the basic ideas and tools needed to analyse and design digital circuits and computer systems. Discusses microprocessor computer organisation, machine-language number systems and gate circuits.

computers for beginners

COBOL FOR BEGINNERS
H0140P *$27.95*
It is a solid text for introductory programming courses in Cobol, using a format that is easy to understand, yet comprehensive enough to make supplementary readings unnecessary.

THE PET PERSONAL COMPUTER FOR BEGINNERS
H0141P *$20.95*
This handy guide is written for use with all varieties of PET computer, from the original 2001 to the 8032 Super PET. It is suited to novices with no practical experience and provides advice and practical examples.

BEGINNER'S GUIDE TO MICROPROCESSORS AND COMPUTING
H0143B *$5.95*
Introduction to basic theory and concepts of binary arithmetic, microprocessor operation and machine language programming. Only prior knowledge assumed is very basic arithmetic and an understanding of indices.

AN INTRODUCTION TO BASIC PROGRAMMING TECHNIQUES
H0145B *$6.75*
Ideal for beginners seeking to understand and program in BASIC. Includes program library for biorhythms, graphing Y against X, standard deviations, regressions, generating musical note sequences, and a card game.

BEGINNING FORTRAN
H0147A *$25.50*
Starts with simple elementary examples and proceeds to intermediate level programs. Also includes references, tutorials, flow charts, deck set-ups and matrix algebra.

NAILING JELLY TO A TREE
H0149A *$25.50*
This guide to software teaches you about machine language, assembly language programming and BASIC. The emphasis is not on learning to write programs but on learning to use the thousands of available programs that have already been written.

PEANUT BUTTER AND JELLY GUIDE TO COMPUTERS
H0150A *$16.75*
A simple, easy-to-digest source of information on personal computing for the potential buyer who is less than an expert in the field.

FROM CHIPS TO SYSTEMS: AN INTRODUCTION TO MICROPROCESSORS
H0152A *$25.75*
Explains exactly what a microcomputer system is and how it works. Introduces fundamental concepts and covers all aspects of microprocessors and related components: internal operation, memories, interfacing and system development, etc.

computing software

THE CP/M HANDBOOK (WITH MP/M)
K0173A *$24.95*
Contains a step-by-step description of all the CP/M command features. Designed for the beginner, the book progresses to detailed explanations of the file transfer, debugging and CP/M text-editing programs.

STARTING FORTH
K0177P *$23.75*
A clear and complete guide to Forth, this book covers fundamental principles and then a full set of high-level Forth commands. It concludes with advanced techniques and style.

COMPUTER GRAPHICS PRIMER
K0180P *$21.95*
Almost every page has a colour drawing, photograph, picture or a schematic to help you learn computer graphics quickly and easily. Programming concepts apply to all microcomputers, and examples are given in BASIC for the Apple II.

STARSHIP SIMULATION
K0178A *$12.95*
Offers both a specific simulation, which can be implemented, modified and played, and a look at how to put together a simulation on almost any subject.

BASIC PROGRAMS FOR SCIENTISTS AND ENGINEERS
K0179A *$19.95*
Contains scientific and engineering application programs written in BASIC.

HOW TO GET STARTED WITH CP/M
K0174A *$19.95*
This practical book eases the reader into the essentials of the system, giving an overview of the operating system, an idea of what it will be like to use and what it can do for the reader.

THE 68000: PRINCIPLES AND PROGRAMMING
K0176P *$19.95*
An easy-to-read, systematic approach to the 68000 advanced 16-bit microprocessor. The book guides you through the complex architecture, instruction set, pinouts and interfacing techniques. Written for design engineers, programmers and students.

PASCAL PROGRAMS FOR SCIENTISTS AND ENGINEERS
K0181A *$23.50*
More than 60 of the most frequently used scientific algorithms, with program implementation in Pascal.

USING THE UNIX SYSTEM
K0185P *$24.95*
This book by Richard Gauthier, of RGL, has been written for people with some knowledge of computers, but with no specific knowledge of Unix. It is also of value to current Unix users.

PROGRAMMING IN BASIC FOR PERSONAL COMPUTERS
K0186P *$15.75*
Simple instructions show how to give BASIC commands and statements a wide range of applications, from programming video games to developing business or scientific programs.

FIFTY BASIC EXERCISES
K0188A *$17.95*
Designed to teach BASIC through actual practice, this book contains graduated exercises in math, business, operations research, games and statistics. The programs were designed to run directly on a TRS-80 but will run on any system with MicroSoft BASIC.

APPLE FILES
K0190P *$23.25*
This book is for people who know some BASIC and would like to expand and apply this knowledge by using the capabilities of the Apple. Includes programs for the stock market, inventories, grades and medical records.

CP/M PRIMER
K0191P *$21.95*
A complete one-stop course on CP/M, the very popular operating system for 8080, 8085 and Z80-based microcomputers. Complete terminology, hardware and software concepts, startup of a CP/M/system, and a complete list of CP/M-compatible software.

MOSTLY BASIC: APPLICATIONS FOR YOUR TRS-80 — BOOK 1
K0204P *$19.25*
28 ready-to-use BASIC programs which have been completely tested and debugged. Programs include a telephone dialler, digital stopwatch, spelling test, house buying guide, gas mileage, and others. Complete with explanations of each program, sample runs, and complete program listing.

MOSTLY BASIC: APPLICATIONS FOR YOUR TRS-80 — BOOK 2
K0205P *$19.25*
32 ready-to-run BASIC programs, including two to test your ability in history and maths, a Dungeon of Danger that's strictly for fun, 11 household programs, seven on money and investment, two to test your ESP level, and more. Complete with explanations, sample run and listing for each program.

A FORTRAN PRIMER
K0193P *$6.95*
Assumes no previous knowledge of program writing. It covers the fundamentals of the Fortran language, enables extensive program writing and concentrates on programming style.

INTRODUCTION TO STRUCTURED FORTRAN
K0194A *$19.95*
Written for the beginner, the text incorporates the Fortran 77 with a discussion of structural programming. Includes a discussion of time-sharing, pseudo-language programming and WATFIV statements.

TRS-80 ASSEMBLY-LANGUAGE MADE SIMPLE
K0208P *$19.25*
If you have an understanding of BASIC programming, this will help you to plan, write and hand-assemble your own assembly-language programs in memory, using the T-bug and Level II BASIC ROM subroutines.

TRS-80 ASSEMBLY-LANGUAGE SUBROUTINES
K0210P *$19.25*
A wide spectrum of applications is discussed in this book, which provides easy-to-use routines that can be used as they stand or modified.

APPLE BASIC
K0212P *$19.25*
This book gives the beginner a thorough introduction to BASIC programming on an Apple computer, and covers all areas of programming, including graphics, mathematical programs, games and a great deal more.

APPLESOFT LANGUAGE
K0214P *$13.95*
Written for the Apple II micros that use the MicroSoft language, this introduction covers each aspect of programming in non-technical language, from elementary concepts to advanced techniques.

8080 MACHINE-LANGUAGE PROGRAMMING FOR BEGINNERS
K0230A *$12.95*
The book will take the reader step-by-step through the most common 8080 op codes and it will do so at a level anyone can understand.

PROGRAMMING THE Z80
K0231A *$19.95*
This book will enable every reader to write complete application programs for Z80-based computer systems. Includes exercises to measure progress and comprehension at each level of programming.

PROGRAMMING THE Z8000
K0232A *$25.95*
A complete introduction to programming concepts and techniques for use with the 16-bit, Z8000 microprocessor. Presents detailed descriptions of the architecture and functions of this 'super chip'.

INTRODUCTION TO PASCAL
K0198P *$19.95*
The design and construction of Pascal programs, involving a wide range of basic computer algorithms in a practical context. Second edition.

APPLE MACHINE LANGUAGE
K0215P *$21.95*
This straightforward book teaches machine language programming through BASIC, the transition being made step-by-step. Many sketches of video displays are provided, as well as exercises with answers.

EXPLORE COMPUTING WITH THE TRS-80 (AND COMMONSENSE)
K0225P *$17.95*
This introduction to microcomputers and the BASIC language is suitable for novices and users of the TRS-80. Among the topics covered are creating tables, arts and graphics, games and simulation.

All prices of publications in this catalogue listing are subject to change without notice.

BS0143

Here's one for all you turkeys who enjoy playing games. In 'Gobble' not only must you avoid the enemy, but you also have to eat as many pills as possible. All to music.

Once you get tired of playing 'Gobble' you can always have a bash of 'Table Tennis' with a friend, or if you are musically inclined there's a program which will play a sequence of notes over and over again.

H. Greber has come up with a simple cure for solving problems with colour operation.

SEQUENCER

Tim Parish, Myrtle Bank SA

This program remembers a sequence of notes and rests, and then plays back the sequence repeatedly until you reset.

Once the program is running, the sequence is recorded by simply playing it on the keypad, and then pressing F will start the play back.

The only limitations are:

1. Maximum number of notes is 796 for a 3K machine or 113 for a 1K machine.
2. Maximum length of any note or rest is approximately five seconds (longer notes or rests will be truncated to five seconds).
3. Notes need to be separated by an audible gap, otherwise errors may result in the recorded sequence.

SEQUENCER

```
Addr.  Mnemonic          Code   Comments
0600 I = 06aa            a6aa   sequence will start
                                at 06aa
0602 VE = 05             6e05   constant
0604 V8 = ff             68ff   constant
0606 GSB 064e            264e
0608 SKFN V0 = ff 40ff   key pressed?
060a GOTO 0606           1606   no
060c M(I) = V0           f055   store pitch
060e SKFN V0 = 0f 400f   end of input?
0610 GOTO 0630           1630   yes, play tune
0612 TIME = V8           f815   start timing
0614 GSB 064e            264e
0616 SKF V0 = ff 30ff    key released?
0618 GOTO 0614           1614   no
061a V0 = TIME           f007
061c M(I) = V0           f055   store note duration
061e TIME = V8           f815   start timing
0620 GSB 064e            264e
0622 SKFN V0 = ff 40ff   key pressed?
0624 GOTO 0620           1620   no
0626 V2 = V0             8200   save V0
0628 V0 = TIME           f007
062a M(I) = V0           f055   store rest duration
062c V0 = V2             8020   restore V0
062e GOTO 060c           160c   next note...
0630 I = 06aa            a6aa   set data pointer to
                                start of sequence
0632 V0:V2 = M(I)        f265   V0 = pitch
                                V1 = note duration
                                V2 = rest duration
0634 SKFN V0 = 0f 400f   end of tune?
0636 GOTO 0630           1630   yes, play again
0638 PITCH = V0          f000
063a TIME = V8           f815   start timing
063c TONE = Ve           fe18   play note
063e V0 = TIME           f007
0640 SKF V0 = V1         5010   time up?
0642 GOTO 063c           163c   no, keep playing
0644 TIME = V8           f815   start timing
0646 V0 = TIME           f007
0648 SKF V0 = V2         5020   time up?
064a GOTO 0646           1646   no, wait
064c GOTO 0632           1632   next note...
064e V0 = ff             60ff
0650 V0 = V0 + 01        7001
0652 SKFN V0 = 0f 400f   any more keys?
0654 GOTO 06a4           16a4   no
0656 SKF KEY = V0        e09e   key pressed?
0658 GOTO 0650           1650   no, try next key
065a V0 = V0 + V0        8004 }
065c V0 = V0 + V0        8004 } select pitch
065e GOTO # + V0         b660 } ( done this way to
0660 V0 = 80             6080   avoid altering I )
0662 GOTO 069e           169e
0664 V0 = 71             6071
0666 GOTO 069e           169e
0668 V0 = 65             6065
066a GOTO 069e           169e
066c V0 = 5f             605f
066e GOTO 069e           169e
0670 V0 = 54             6054
0672 GOTO 069e           169e
0674 V0 = 4b             604b
0676 GOTO 069e           169e
0678 V0 = 43             6043
067a GOTO 069e           169e
067c V0 = 3f             603f
067e GOTO 069e           169e
0680 V0 = 38             6038
0682 GOTO 069e           169e
0684 V0 = 32             6032
0686 GOTO 069e           169e
0688 V0 = 2f             602f
068a GOTO 069e           169e
068c V0 = 2a             602a
068e GOTO 069e           169e
0690 V0 = 25             6025
0692 GOTO 069e           169e
0694 V0 = 21             6021
0696 GOTO 069e           169e
0698 V0 = 1f             601f
069a GOTO 069e           169e
069c V0 = 00             6000
069e PITCH = V0          f000
06a0 TONE = Ve           fe18 play note
06a2 return              00ee
06a4 SKF KEY = V0        e09e key = 0f?
06a6 V0 = ff             60ff 'no playable key
06a8 return              00ee          pressed'
06aa  Sequence
      storage
        :
        :
        :
```

TABLE TENNIS

Tim Parish, Myrtle Bank SA

This is a monochrome game for two people, which may be a little difficult to play if you are using a hex keypad. Each player controls his/her bat with four keys, as follows:

Player 1 (left)

up slow — key 0	up fast — key 1
down slow — key 8	down fast — key 9

Player 2 (right)

up slow — key 6	up fast — key 7
down slow — key E	down fast — key F

Player 1 serves first, by pressing either 'slow' key. Service alternates as in the real game and (wait for it!) you can 'spin' the ball viciously, gently or not at all by appropriate use of the bat!

Scoring is like the real game in that misses or shots off the edge of the 'table' give a point to the opposing player.

Messages appear to announce change of service and the winner of the game.

TABLE TENNIS

```
0600  6000 a64b 6100 d011 612e d011 7008 3040
0610  1604 601a 6100 a93e d012 7102 312e 1618
0620  6200 6300 6400 6500 6601 a928 f655 a92e
0630  fd65 a93c d784 6704 d784 a93c d451 673a
0640  6200 4704 1656 6000 e0a1 62ff 6008 e0a1
0650  6201 4200 1646 6006 e0a1 62ff 600e e0a1
0660  6201 4200 1656 a93c 6e00 3704 169e d784
0670  4801 1684 4802 1684 6000 e0a1 78ff 6001
0680  e0a1 78fe 4829 1698 482a 1698 6008 e0a1
0690  7801 6009 e0a1 7802 d784 8180 16cc d794
06A0  4901 16b4 4902 16b4 6006 e0a1 79ff 6007
06B0  e0a1 79fe 4929 16c8 492a 16c8 600e e0a1
06C0  7901 600f e0a1 7902 d794 8190 a93c d451
06D0  8434 6002 8042 3b00 4000 8524 d451 4407
06E0  8610 4437 8610 4405 16ee 3439 173e 8010
06F0  9500 170c 7001 9500 170c 7001 9500 170c
0700  3c00 1742 7001 9500 170c 173e 6030 f000
0710  6001 f018 373e 171e 6704 63fe 1726 3704
0720  1726 673a 6302 6b00 8060 8015 8204 4201
0730  6b01 42ff 6b01 42fe 62ff 4202 6201 4500
0740  1754 452e 1754 4401 1754 443d 1754 6000
0750  2820 1666 a93c d451 452e 1760 3500 1772
0760  a928 f565 373a 176c 7301 177e 4704 7201
0770  177e a928 f665 4704 7301 473a 7201 282a
0780  6030 2820 282a 320b 1792 2874 a90c 7401
0790  179c 330b 17a2 2874 a911 7501 6030 d015
07A0  17a0 8b20 8b34 a928 f555 6005 8b05 3b00
07B0  17d6 2858 6060 2820 2858 a92e f065 a91e
07C0  6b01 3001 17ca a918 6b02 f565 80b0 a92e
0700  f055 2892 1640 3f00 17ac a92e f065 a91e
07E0  3001 a918 f565 2892 1640 d714 4101 1804
07F0  4102 1804 6b00 8b04 eba1 71ff 6b01 8b04
0800  eba1 71fe 4129 181c 412a 181c 6b08 8b04
0810  eba1 7101 6b09 8b04 eba1 7102 d714 00ee
0820  f015 f007 3000 1822 00ee a924 8b20 f233
0830  f265 f129 600a 6115 d015 7004 f229 d015
0840  a924 f333 f265 f129 6030 6115 d015 7004
0850  f229 d015 82b0 00ee a8b4 6014 610f d01b
0860  7008 a8bf d01b 7008 a8ca d01b 7008 a8d5
0870  d01b 00ee a8e0 6013 610f d01b 7008 a8eb
0880  d01b 7008 a8f6 d01b 7008 a901 d01b 6115
0890  00ee a93c 6704 d784 6815 d784 673a d794
08A0  6915 d794 a93c d451 a92e f065 3001 6704
08B0  00ee 00ff 3a22 2322 3a00 ee88 ec28 eebe
08C0  abbe aaae 00f0 94f0 a295 5e50 d652 5e00
0800  5754 5494 17e0 80c0 80e0 0070 4060 4070
08E0  0f08 0b09 0f00 e8a8 e888 8e74 5577 5456
08F0  00ee a5e0 a2a0 dc50 5950 5c00 bb22 3322
0900  3a00 00c0 0000 00c0 40c0 8040 40c0 4040
0910  e0e0 2040 80e0 00ff 0000 00fe 3916 0000
0920  0002 0516 ---- ---- ---- ---- ---- --01
0930  0002 0516 153e 1515 0001 0001 8080 8080 ▶
```

GOBBLE

Peter Easdown, Kew NSW

Gobble 660 is a game similar to Pacman. The basic aim of the game is to avoid the enemy and to eat as many of the pills as possible. The maze is quite different but is complex enough to make a good game.

Here are a few of its features:

1. The enemy moves at the same speed as you but can catch you easily if you have trouble getting around corners, or if it takes short cuts.
2. There is only one enemy as more would only slow the game down; also 3K isn't enough memory for more than one enemy.
3. The enemy can get stuck if you outsmart them; this will allow you to get more points without the threat of being caught.
4. The game has two tunes in it to make it more professional. These tunes are appropriate to the different stages of play.
5. The program incorporates the 'five digit scoring' routine at locations 06B0 — 0726. This routine has previously been published in the January 1983 issue of ETI.
6. It also incorporates part of the Character Generator which was published in the March 1983 issue of ETI.
7. The speed of the game is quite good considering the amount of work done for the enemy between moves.

If you wish to change the values for the keys used for directing your gobbler around the screen then change the values at:

0912 — up
0918 — down
091E — left
0924 — right

This program will not work on any other computer as it uses all of the 660's screen.

With the program in as listed use the following keys:

Key	Direction
0	up
1	down
2	left
3	right

The score is shown at the top of the screen and the amount of gobblers left is shown below the maze. There are 2350 points for every full board.

Happy gobbling.

GOBBLE

```
600 6A0A 6B02 A768 272A DAB5 7A04 A76A 272A
610 DAB5 7A04 A76c 272A DAB5 7A04 A76E 272A
620 DAB5 7A04 A770 272A DAB5 7A04 A772 272A
630 DAB5 A748 6000 610A D011 6126 D011 7001
640 303F 1636 6004 610E D011 6122 D011 7001
650 301E 1646 6021 610E D011 6122 D011 7001
660 303B 1656 6008 6112 D011 611E D011 7001
670 3012 1666 6015 6112 D011 611E D011 7001
680 302A 1676 602D 6112 D011 611E D011 7001
690 3037 1686 600C 6116 D011 611A D011 7001
6A0 301E 1696 26B0 1774 0000 0000 0002 320A
6B0 6000 6100 6200 6300 6400 6502 670A 16FE
6C0 A6A8 F765 8084 8075 4F00 16D0 7101 16c6
6D0 700A 8175 4F00 16DC 7201 16D2 710A 8275
6E0 4F00 16E8 7301 16DE 720A 8375 4F00 16F4
6F0 7401 16EA 730A 8475 3F00 16F6 740A A6A8
700 F755 1708 A6A8 F765 6622 F429 D655 7604
710 F529 D655 7604 F229 D655 7604 F129 D655
720 7604 F029 D655 00EE 1774 F165 A7F4 8200
730 8310 64E0 6580 2762 8020 275C 8020 8004
740 8152 3100 7001 2758 8030 2760 8030 275A
750 A7FA F565 A7F4 00EE 8004 8004 8004 8004
760 8004 8042 F055 00EE 711D F24F F6DF F7EB
770 F3CF 1C70 6021 6116 A748 D011 611A D011
780 7001 3033 1776 610B 6000 D011 603E D011
790 7101 311A 1798 611A 6000 D011 603E D011
7A0 7101 3126 1798 610F 6004 D011 603A D011
7B0 7101 3117 17A8 611A 6004 D011 603A D011
7C0 7101 3122 17B8 6113 6008 D011 6036 D011
7D0 7101 3117 17C8 611A 6008 D011 6036 D011
7E0 7101 311E 17D8 6117 600C D011 601D D011
7F0 6021 17FE 00E0 00E0 0006 7808 090A 6403
800 D011 6032 D011 7101 311A 17E8 6002 610C
810 D011 6124 D011 7004 3012 180E 6013 610C
820 D011 6124 D011 7004 302F 181E 6030 610C
830 D011 6124 1D00 6002 6110 D011 6120 D011
840 7004 3012 1838 6013 6110 D011 6120 D011
850 7004 302F 1848 6030 6110 D011 6120 D011
860 7004 3040 1858 6002 6114 D011 611C D011
870 7004 3012 1868 6013 6114 D011 611C D011
880 6018 6114 D011 611C D011 7004 6114 D011
890 611C D011 7006 D011 6114 D011 7004 D011
8A0 611C D011 7005 D011 6114 D011 7005 D011
8B0 611C D011 7004 D011 6114 D011 7004 D011
8C0 611C D011 7004 D011 6114 D011 7104 D011
8D0 70FC D011 70FC D011 6002 D011 7004 D011
8E0 7004 D011 6D5E 2D5C 601E 6117 6301 2B46
8F0 6601 6717 6904 2D40 4F01 2B30 F600 0318
900 6C25 19A2 294E 4F01 2986 294E 00FF 00FF
910 00FF 6A00 EAA1 6304 6A01 EAA1 6303 6A02
920 EAA1 6302 6A03 EAA1 6301 4301 7001 4302
930 70FF 4303 7101 2B04 4901 77FF 4902 76FF
940 4903 7701 4904 7601 F000 0318 1B72 3300
950 1960 4201 A974 4202 A977 4203 A97A 1B62
960 4301 A974 4302 A977 4303 A97A 4304 A97D
970 D013 00EE 60C0 60C0 60C0 40E0 A0A0 E040
980 A0A0 A0E0 00E0 410B 1A28 410F 1A28 4113
990 1A28 4117 1A28 411B 1A28 411F 1A28 4123
9A0 1A28 8800 8E60 7802 58E0 19B0 9170 1D70
9B0 78FE 7E02 58E0 19BC 9170 1D70 8810 8E70
9C0 7802 58E0 19CA 9060 1D70 78FE 7E02 58E0
9D0 19D6 9060 1D70 3C25 19F8 6000 1904 A748
9E0 180C 0000 78FE 7E02 58E0 19F0 91B0 0000
9F0 8810 8B30 7802 1B48 294E 4301 70FF 4302
A00 7001 4303 71FF 4304 7101 1A8E AA26 D012
A10 6A19 AEF0 FF55 2704 26C0 AEF0 FF65 7DFF
A20 3D00 00EE 1A94 0040 4001 1A0C 4005 1A0C
A30 4009 1A0C 400D 1A0C 4011 1A0C 4012 1A0C
A40 4015 1A0C 4016 1A0C 4017 1A0C 401A 1A0C
A50 4019 1A0C 401B 1A0C 401E 1A0C 4021 1A0C
A60 4022 1A0C 4023 1A0C 4025 1A0C 4026 1A0C
A70 4027 1A0C 402A 1A0C 402B 1A0C 402F 1A0C
A80 4033 1A0C 4037 1A0C 403B 1A0C 19A2 294E
A90 8230 1B68 2960 2B02 19DE 4601 1D0a 4605
AA0 1D0A 4609 1D0A 4612 1D0A 461E 1D0A 4633
AB0 1D0A 4637 1D0A 463B 1D0A 470B 1AEA 470F
AC0 1AEA 4713 1AEA 4717 1AEA 471B 1AEA 471F
AD0 1AEA 4723 1AEA 4901 A980 4902 A983 4903
AE0 A980 4904 A983 D673 00EE 8800 8E60 8E85
AF0 3F01 1AF8 6902 1AD6 6904 1AD6 1D0A 00FF
B00 6904 1AD6 49FF 1B10 2AD6 1B24 69FF 00EE
B10 4501 A980 4502 A983 4503 A980 4504 A983
B20 D673 00FF 4304 71FF 00EE 0000 6C25 FF0A
B30 2AD6 4901 7701 4902 7601 4903 77FF 4904
B40 76FF 2AD6 8590 1B0C 58E0 1B50 9020 0000
B50 1700 2580 0B00 2BC0 2F00 2600 2900 2C80
B60 3F00 4204 A970 1970 6300 00EE 3900 1938
B70 1948 470A 10C8 4724 1CCC 4600 10C8 463C
B80 1CCC 370C 1B94 4601 18F6 461E 18F6 463B
B90 18F6 1CCC 370E 1BA6 4601 18F6 461E 18F6
BA0 463B 18F6 10C8 3710 1BC4 4601 18F6 4605
BB0 18F6 4612 18F6 462A 18F6 4637 18F6 463B
BC0 18F6 1CCC 3712 1BE2 4601 18F6 4605 18F6
BD0 4612 18F6 462A 18F6 4637 18F6 463B 18F6
BE0 10C8 3714 1C04 4604 18F6 4605 18F6 4609
BF0 18F6 461E 18F6 4633 18F6 4637 18F6 463B
C00 18F6 1CCC 3716 1C26 4601 18F6 4605 18F6
C10 4609 18F6 461E 18F6 4633 18F6 4637 18F6
C20 463B 18F6 1CC8 3718 1C48 4601 18F6 4605
C30 18F6 4609 18F6 461E 18F6 4633 18F6 3637
C40 18F6 463B 18F6 1CCC 371A 1C6A 4601 18F6
C50 4605 18F6 4609 18F6 461E 18F6 4633 18F6
C60 4637 18F6 463B 18F6 1CC8 371C 1C88 4601
C70 18F6 4605 18F6 4612 18F6 462A 18F6 4637
C80 18F6 463B 18F6 1CCC 371E 1CA6 4601 18F6
C90 4605 18F6 4612 18F6 462A 18F6 4637 18F6
CA0 463B 18F6 1CC8 3720 1CB8 4601 18F6 461E
CB0 18F6 463B 18F6 1CCC 3722 18F6 4601 18F6
CC0 461E 18F6 463B 18F6 7701 1CCE 77FF 8590
CD0 69FF 18F6 462A 1CFA 4606 1CFA 4609 1CFA
CE0 4612 1CFA 461E 1CFA 4633 1CFA 4637 1CFA
CF0 4601 1CFA 463B 1CFA 1AD6 9170 1ABA 1E74
D00 D011 7004 3040 182E 1836 8810 8E70 8E85
D10 3F01 1D18 6901 1AD6 6903 1AD6 1600 1D24
D20 6903 1Ad6 69FF 4C01 A980 4C02 A983 4C03
D30 A980 4C04 A983 00FF 00EE 9D32 9326 95C1
D40 39FF 1CD4 4501 1ABA 4503 1ABA 4602 1A9A
D50 4504 1A9A 0000 6A0A 6400 00EE 2B54 6E2A
D60 A974 6A00 D8E3 7A01 9A40 00EE 7807 1D64
D70 00FF 74FF 4400 1D80 2D5C 2D8A 2AD6 18E8
D80 2AD6 2D8A FF0A 00E0 1600 6871 6E20 2DC4
D90 6E10 2DC4 6E10 2DC4 6E10 2DC4 685F 6E20
DA0 2DC4 6865 6E10 2DC4 6E10 2DC4 6871 6E10
DB0 2DC4 6E10 2DC4 6876 6E10 2DC4 6871 6E20
DC0 2DC4 00EE F800 6F04 FE15 0318 FE07 3E00
DD0 1DCC FF15 FF07 3F00 1DD4 00EE 6854 6E0B
DE0 2DC4 6832 6E0B 2DC4 6854 6E0B 2DC4 6832
DF0 6E25 2DC4 00EE 6854 6E25 2DC4 682A 6E0B
E00 2DC4 6E0B 2DC4 6E0B 2DC4 6832 6E0B 2DC4
E10 6E0B 2DC4 6E0B 2DC4 00EE 683F 6E0B 2DC4
E20 6E0B 2DC4 6E0B 2DC4 6854 6E25 2DC4 00EE
E30 6854 6E0B 2DC4 6E0B 2DC4 6E0B 2DC4 683F
E40 6E25 2DC4 00EE 2DDC 2DDC 2DF6 2E1A 2DF6
E50 2E30 00EE AF00 FF55 6000 6100 6201 A5C0
E60 F24E 00FF F055 7101 313A 1E60 AF00 FF65
E70 6801 00EE 462A 1D0A 1A9A ---- ---- ----
```

ONE-BYTE SHIFTER

M. Samerski, Loftus NSW

This routine will save those CHIP 8 hackers who have keyed in a program and found that they left out a few bytes, then had to enter the new bytes and re-type the remaining code.

It steps through memory between two given addresses and shifts each byte back one space. If a whole CHIP 8 instruction needs to be inserted, simply run the program twice or however many bytes you need free.

XXX + YY is the starting address.

XXX + ZZ is the ending address.

e.g: if XXX = 600 and YY = 8C and ZZ = 30, the program will move everything between 0630 and 068C back one byte.

Note that this program can only move 255 (FF) bytes at a time; if more than this is required, change XXX, YY and ZZ, then re-run the program to move anything you want.

The routine is located at 0800 and a 1800 instruction is placed at 0600 to run it. Later, change 0600 back to your original instruction.

```
0600    1800
0800    61YY
        AXXX
        71FF
        F11E
        F065
        F055
        31ZZ
        1802
        0000
```

CURE FOR COLOUR PROBLEMS

If you've had problems with colour operation, H. Greber of Qld has come up with a simple cure. He found that a slight dc level on the colour burst line can give trouble with colour operation.

The solution is to cut the track from pin 12 of the 4066, IC21, and insert a 10n capacitor across the cut (i.e.: in series with the BURST line from pin 25 of IC4, the 1864, and pin 12 of the 4066, IC21).

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POMONA

SRS

CooperTools
Technology and Service

OK Industries Inc.

Low-cost systems multimeter

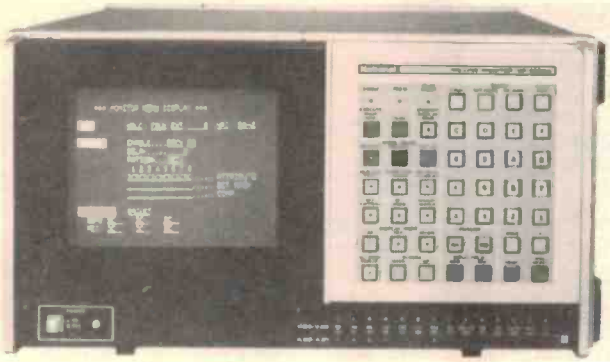
Tech Sales Pty Ltd has announced the release of the Solartron 7150, 6½-digit Systems voltmeter, capable of measuring dc and ac volts, dc and ac current and two- or four-terminal resistance.

The 7150 also features automatic null and selectable digital filter for ease of measurement. Accuracy for dcV is 0.002% and for acV is 0.004%.

An IEEE-488 interface is standard and the auto-calibration facility makes the 7150 ideal for both bench and system use.

With a price of less than $1600, the 7150 is the best price/performance Systems voltmeter available, according to Tech Sales.

For further information, contact Nigel Gamblin, **Applications Engineer, Tech Sales Pty Ltd, 83 Wellington Street, Windsor Vic. 3181. (03)51-1306.**



On-line monitor for packet switching networks

National has developed a portable on-line data monitor for the development or maintenance of devices used in packet networks.

The VP-3680A has a monitor for serial data on data communication lines and a function for the simulation of a network or terminal device.

In addition to the conventional monitor functions, the VP-3680A has a function for real-time protocol translation displaying CCITT X.25 commands, response names or packet names on the CRT in mnemonic. There's also a selective trace function and a program trigger.

Another National product which has just been released is the VP3620A logic analyser that meets a wide range of industrial needs for the development and troubleshooting of microprocessor controlled devices.

The 20 MHz, 32-channel logic analyser contains a logic state analysing function for the self-contained microprocessor operation analysis and a logic timing function for the evaluation of the peripheral operations.

A series of personality modules is also available to adapt the VP-3620A to the specific characteristics of an individual microprocessor.

These National products are available from **Scientific Devices Australia Pty Ltd, 2 Jacks Rd, South Oakleigh Vic. 3167. (03)579-3622.**

Universal counters with mathematics capability

Systron Donner, of California, has introduced a sophisticated multi-function universal frequency counter, the 6100 series, which combines a high-performance microwave counter with an advanced universal counter design.

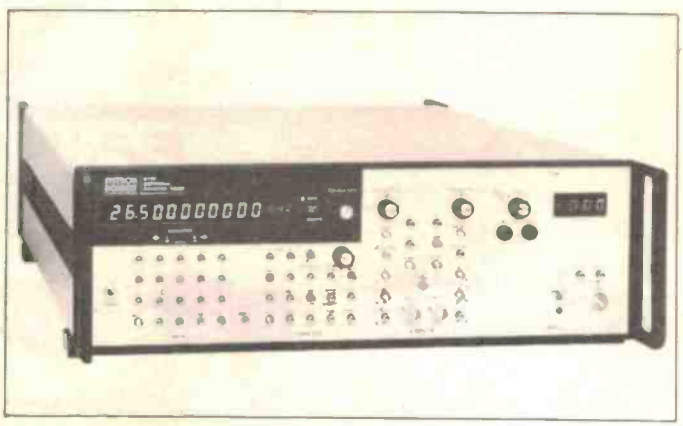
Each 6100 series instrument comes in a choice of four frequency ranges — 100 MHz, 1.3 GHz, 18 GHz and 26.5 GHz — and all models include a mathematics package that offers three-level operations.

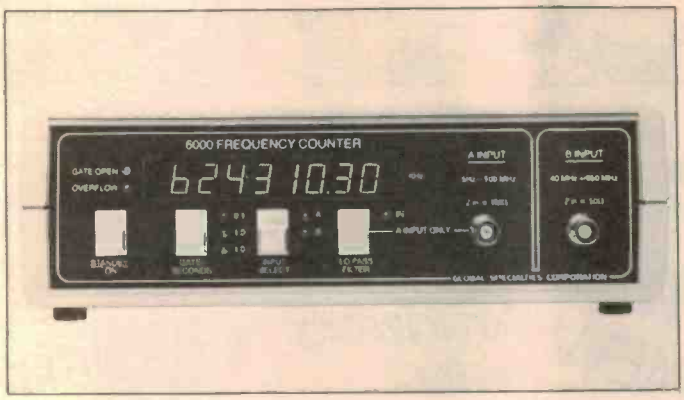
This feature makes it possible to carry out mathematical manipulation of measured signals, and offers separate memories for each measurement function.

Frequency offsets and other special mathematical functions are programmed into the counter via front-panel push-button controls.

A built-in 3¼-digit DVM allows 1 mV resolution and monitoring of the trigger level, in addition to conventional manual and automatic-trigger level controls.

For additional details, contact the distributor, **Scientific Devices Australia, 2 Jack's Road, South Oakleigh Vic. 3167. (03)579-3622.**





Low-cost frequency counter

A new low-cost frequency counter, offering high performance, ease of operation and measurement flexibility from 5 Hz to 650 MHz, has been introduced by Global Specialties.

The 6000 incorporates an easy-to-read eight-digit LED display and push-button controls with LED indicators for selecting the input, gate time and low-pass filter.

Two front-panel inputs are provided, one covering 5 Hz to 100 MHz with a 1M input impedance and the other for signals between 40 MHz and 650 MHz. Gate times of 0.1, 1.0 and 10 seconds are available.

The standard 6000 has a 3.58 MHz temperature-compensated crystal oscillator, while an alternative high-stability model, the 6500, features a crystal oven oscillator.

Compact (76 x 254 x 178 mm) and light (1.6 kg), the 6000 features a flip-up leg for benchtop use.

For more details, contact **Vicom International, 57 City Road, South Melbourne Vic. 3205. (03)62-6931.**

3½-digit true RMS multimeter

The latest addition to Fluke's standard-setting 8020B-series of handheld DMMs is the 8026B.

It's a 3½-digit, eight-function handheld model that features true RMS ac capabilities while retaining all of the performance and versatile functions of the 8020B.

The 8026B makes it possible to measure true RMS ac when measuring non-sinusoidal waveforms in modems, terminals, monitors and mechanical equipment.

In addition to making precision ac measurements, the 8026B measures dc voltage to 0.1% basic accuracy, resistance, conductance, dc current, performs a diode test and has a high-speed continuity beeper which lets you make fast, positive checks for open and short circuits.

It also has a one year calibration cycle.

Fluke products are available from **Elmeasco Instruments Pty Ltd, 15 Macdonald St, Mortlake NSW 2137. (02)736-2888.**

Industrial video cameras

The Fairchild CCD3000 and CCD4000 are rugged self-contained cameras which make it easy for industrial users to take advantage of the inherent geometric accuracy, wide dynamic range, and reliability of a buried-channel charge coupled device image sensor.

The CCD3000 Video Communications Camera provides standard television output signals for display of high-resolution images on low-cost monitors or for digital analysis using NTSC image processing equipment.

The CCD4000 Austomation Camera provides image data output in a non-interlaced 256 by 256 element square pixel pitch format which can be used as a relatively small single-component camera, or be separated into a camera control unit plus a cable-connected sense head which is robust enough to be mounted onto a robot arm.

Full details from **Fairchild Australia Pty Ltd, P.O. Box 19, Nunawading Vic. 3131. (03)877-5444.**

Autoranging capacitance meter

Global Specialties' new hand-held autoranging capacitance meter, the 3002, features a degree of precision, range and flexibility that is normally associated with benchtop instruments.

The new meter, which has a 3½-digit liquid-crystal display and measures 193 x 95 x 44 mm, provides direct readings of capacitance from 1 pF to 19 990 uF.

Eight automatically selected ranges eliminate the need for manual switching, and a dual-threshold measuring technique ensures an accuracy within 9.2% from 1 pF to 199 uF and 1% between 200 uF and 19.9 mF.

The 3002 operates from six AA nickel-cadmium or alkaline batteries. There is an optional ac adaptor/charger.

For further information, contact the Australian agent, **Vicom International, 57 City Road, South Melbourne Vic. 3205. (03)62-6931.**

Dobbie Instruments (Australia)

Following the recent merger of Brookeades and Dobbie Instruments, a new national company, Dobbie Instruments (Australia) Pty Ltd has been formed.

The full range of Dobbie thermometers and pressure gauges, industrial, electronic, meteorological and surveying instruments will be marketed.

An Environmental Monitoring System, specifically developed to provide a continual status report on the environmental conditions within computer rooms, acts as an early warning system for failure or malfunction of computer room air conditioning plants.

A large digital display of temperature and relative humidity is easily legible from distances up to 15 metres.

The head office is located at **18-20 George St, Sandringham Vic. 3191. (03)598-8244.** Branch offices are in Sydney, Brisbane, Adelaide, Perth, Darwin and Kalgoorlie with a representative in Bunbury WA.

JAYCAR

¼" TAPE

Tape Sensation!!

NEW Amazing only **$19.95**

2500' – 1.5 mil
Cat. AL-1560

3600' – 1.0 mil
Cat. AL-1561

Jaycar has done it again – for all of the Hi Fi buffs who have professional NAB centre reel-to-reel tape recorders – a superb METAL spool complete with either 2500' or 3600' of quality tape. Both tapes are priced the same, the only difference between tape lengths is the thickness of the tape itself. The 3600' tape is 1.0 mil thick and the 2500' tape is 1.5 mil thick. You make your choice from these two superb bargains.
The spool size is 10¾"

'Power UP'

POST STOCKTAKE SPECIAL

Ref: EA 11/82

~~$39.50~~
SAVE $5.00
$34.50

NO ROOM FOR DETAILS

NEW sprayon conductive plastic $6.95

This handy 200 gram spray enables you to do all manner of things. You can spray sheets of Styrene foam and make them suitable for storing your MOS IC's. Far cheaper than other methods!! You can make conducting screens inside plastic boxes to shield RF. You can re-coat the back of CRTs. You can make conductive parts of equipment cabinets to help reduce static.
The paint dries to a hard varnish like film. Non-inflammable and Non toxic.
Grab a can now. You never know when you will need it!
Cat. NA-1010 $6.95

low cost hi fi

2 SETS (6 SPKR) FOR STEREO ONLY $39.95

3–WAY SYSTEM $24.95 a set

That's right a 3 – WAY HI FI speaker kit from only $19.98!!
Each kit contains a massive 10" (250mm) woofer, cone midrange and DOME tweeter!! You also get, at no extra charge, the special cross-over capacitors!
The system is rated at approximately 20 watts RMS so it is ideal as an economical but reasonably powerful main HI Fi unit or as a second system for another room or outdoors.
Each 3-way kit comes with a recommended enclosure design which you can build yourself easily!
You would normally pay well over $60 for the equivalent from major kit speaker suppliers so this is an outstanding bargain. Sensitivity of system 93dB/1m/1 watt. Cat. AK3700
HURRY LIMITED STOCKS and they are made in JAPAN!!

Woofer not to same scale as other components

FROM **$19.98**

minitune

Specification

Function	F.S.D.	Resolution	Accuracy
Voltage (d.c.)	20V	10mV	0.5% ± 1 digit
	200V	100mV	0.5% ± 1 digit
Resistance	200Ω	100mΩ	0.5% ± 1 digit
	20kΩ	10Ω	0.5% ± 1 digit
R.P.M.	20,000r.p.m.	10r.p.m.	1% ± 3 digits
Dwell	90°	0.1	2% ± 3 digits

FAR CHEAPER THAN DPM SEPARATELY

NEW $42.95

Ref: EA June 1983

Following the spectacular success of the DP2010 Digital Multimeter kit, we now have an ENGINE ANALYSER KIT!
But the spectacular thing is the price! It is ACTUALLY CHEAPER than the DPM-05 Display and Case!!
The Minitune will measure voltage, resistance (down to a very low range), RPM and Dwell Angle.
Cat. KJ7012 MINITUNE KIT $42.95
TEST LEADS TO SUIT ONLY $2.95

Software for your MicroBee →→→

Jaycar is proud to announce the first of a range of Computer Software for the Australian - made "MicroBee" Computer. Like the MicroBee, the software is made in Australia and is of outstanding quality. Our initial range consists of six of the most professional items that we have seen.
All programs come in a plastic wallet with comprehensive instructions. The program is recorded on a high quality cassette.

BEEZ80
SECRET CODE DISASSEMBLER

BEEZ80 will disassemble ANY code sequence. Nothing is illegal! It will allow you to program with codes that no other disassembler can decipher!

$19.95

Cat. YS-4022

BASIC TUTORIAL
Let your MicroBee Teach You MicroWorld BASIC

Super teaching aid for the classroom. Excellent for both young and old, regardless of background

Cat. YS-4024 $19.95

TOUCH – TYPE – TUTOR
for the MicroBee Computer
Learn to touch type in hours Cat. YS-4021 $19.95

ASTEROIDS PLUS

Cat. YS-4020 $22.50

Amazing Value $22.50

MYTEK MONITOR
GENERAL PURPOSE MONITOR PROGRAM

Cat. YS-4025 $14.95

MACHINE CODE TUTORIAL
for the MicroBee Computer

Let Your MicroBee Teach You Machine Code Programming and All About Itself

$24.95 Cat. YS-4023

Unrivalled versatility

TRANSISTOR ASSISTED IGNITION

Ref: EA Jan '83. Latest version of this popular kit. The Jaycar kit has a genuine die cast box - as used in the EA prototype. Beware of others that use flimsy sheet metal.
Cat. KA1506 $35

magnificent!

BBD EFFECTS BOX

Fantastic low-cost instrument using the versatile MN3001 Bucket-Brigade Delay line to achieve brilliant sonic effects.
Now you can emulate the commercial rock groups with Phasing, Flanging, Reverb and Echo. The Jaycar kit includes all components INCLUDING IC sockets and the TU-04 box. (Not cut down but this is easily done).
Jaycar has a specially built cabinet for this kit with all holes pre-punched etc., at only $10 extra but only if you buy the original kit from us. Available as a separate item for $29.50.
WHEN THE KIT IS PURCHASED WITH THE DE-LUXE CASE THE TU-04 CASE WILL NOT BE SUPPLIED.

COMPLETE KIT
Cat. KE1522
$79.00
Special cabinet to suit $10.00
Cat. HB6445

MICRON 30 WATT
SOLDERING IRON

Cat. TS-1450 $9.95

LIGHT WEIGHT – SCREW IN INTERCHANGEABLE TIPS – EFFICIENT THERMAL TRANSFER FROM ELEMENT TO TIP – TIP TEMPERATURE MAINTAINS WITHIN THE LIMITS SUITABLE FOR ELECTRONIC WORK AND ALSO SMALL HOUSEHOLD JOBS – FULLY S.E.C. TESTED & APPROVED

LOW COST DIGITAL MULTIMETER KIT

Ref: EA March 1983 (This month)
Almost everyday we are asked for a multimeter kit. Up until now we thought that it was just not worth it considering the fine low cost built up units available. The DP2010 changed all that.
This kit, fully imported from the UK uses the famous ICM 05 custom LCD Voltmeter to achieve phenomenal accuracy at very modest cost!
All parts are included to complete the meter including an attractive and colourful front panel.
(a 9V battery is required)

Set of test probes to suit $2.95
Probe to suit Cat. WT5312 ONLY $2.50
Eveready 216 (red) 9V Battery Cat. SB2370 ONLY $1.40

DP2010 kit Cat. KJ7010 ONLY $45

SPECIFICATIONS

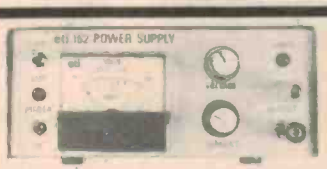
Function	f.s.d.	Resolution	Accuracy	Protection
Volts (d.c.)	2V	1mV	1% ± 1 digit	500V for one minute
	20V	10mV	1% ± 1 digit	
	200V	100mV	1% ± 1 digit	
	500V	1V	1% ± 1 digit	
Current (d.c.)	2mA	1uA	1% ± 1 digit	1A/250V
	20mA	10uA	1% ± 1 digit	
	200mA	100uA	3% ± 1 digit	
	2000mA	1mA	5% ± 1 digit	
Volts (a.c.)	2V	1mV	2% ± 5 digit	500V for one minute
	20V	10mV	2% ± 5 digit	
	200V	100mV	2% ± 5 digit	
	500V	1V	2% ± 5 digit	
Current (a.c.)	2mA	1uA	2% ± 5 digit	1A/250V
	20mA	10uA	2% ± 5 digit	
	200mA	100uA	4% ± 5 digit	
	2000mA	1mA	7% ± 5 digit	
Resistance	2K	1	1% ± 1 digit	260V
	20K	10	1% ± 1 digit	r.m.s.
	200K	100	1% ± 1 digit	
	2000K	1K	1% ± 1 digit	
Diode Test	2V	1mV	1% ± 1 digit	260V r.m.s.

AC VOLTAGE AND CURRENT RANGES
When S3a selects a.c. functions the output from either the voltage attenuator or current shunts is fed through C1 to remove any d.c. component.

CannonXL
connectors - great new range * * *

5 PIN AND RIGHT ANGLE TYPES ARE NOW IN STOCK

PP2120 – 3pin male line	$3.50
PS4020 – 3pin female line	$3.95
PP2112 – 3pin male chassis	$3.25
PS4012 – 3pin female chassis	$3.95
PP2117 – 5pin male line	$6.95
PS4026 – 5pin female line	$7.95
PP2116 – 5pin male chassis	$5.95
PS4016 – 5pin female chassis	$6.95
PS4010 – 240V mains line	$6.50
PP2110 – 240V mains chassis	$5.25
PP2113 – 3pin male r/angle	$4.95
PP4030 – 3pin female r/angle	$5.95



0-30V 1amp power supply
ETI 162 Ref: ETI December 1982

Cat. KE4570

$49.50

- Fully protected
- Output variable from 0-30V DC
- Selectable current limit
- Both voltage and current metering
- After a multimeter & soldering iron an absolute must for the enthusiast.

You will never own a more useful piece of gear.

POWERSONIC AUSTRALIA

INTRODUCTORY OFFER

ANNOUNCING
A COMPLETE RANGE OF RECHARGEABLE BATTERIES

RECHARGEABLE GEL-TYPE BATTERIES

FEATURES • GEL ELECTROLYTE • LEAK PROOF • EASY HANDLING • OVERCHARGE PROTECTION • CYCLE OR FLOAT APPLICATIONS • NO POLARITY CHANGE • HIGH DISCHARGE RATE • COMPACT AND RUGGED • EXTENDED SHELF LIFE

MODEL	NOMINAL VOLTAGE	AMP-HOURS
426	4	2.6
610	6	1.0
612	6	1.2
618	6	1.8
626	6	2.6
630	6	3.0
640	6	4.0
660	6	6.0
682 (670)	6	8.2
6100	6	10.0
6200	6	20.0
1210L	12	1.0
1210S	12	1.0
1212	12	1.2
1219 (1215)	12	1.9
1226	12	2.6
1245	12	4.5
1260	12	6.0
1265	12	6.5
1282S	12	8.2
12200	12	20.0
12240	12	24.0
12400	12	40.0

RECHARGEABLE NICKEL-CADMIUM BATTERIES

FEATURES • STABILITY OVER WIDE TEMPERATURE RANGE • GOOD OVERCHARGE CAPABILITY • LOW SELF DISCHARGE • FLAT DISCHARGE VOLTAGE CURVE • HIGH RATE DISCHARGE • HERMETICALLY SEALED

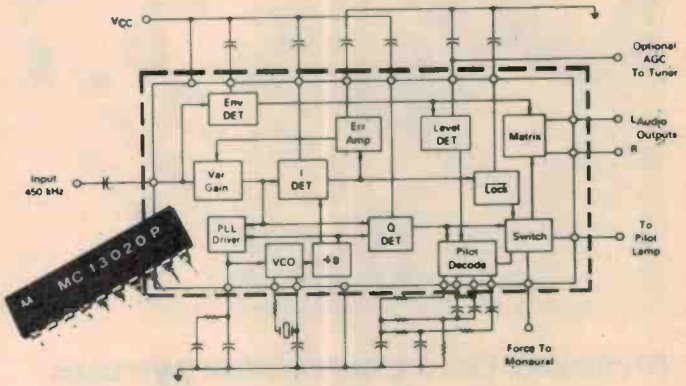
OTHER TYPES AVAILABLE ON REQUEST

	MODEL	NOMINAL VOLTAGE	CAPACITY 5 HR RATE (mAh)
Standard Cells	PS-1/3AA	1.2	110
	PS-N	1.2	150
	PS-AAA	1.2	180
	PS-2/3AA	1.2	250
	PS-AA	1.2	500
	PS-½SC	1.2	600
	PS-SC	1.2	1200
	PS-C	1.2	1800
	PS-½D	1.2	2200
	PS-D	1.2	4000
	PS-F	1.2	7000
Fast Charge Cells	PS-SCF	1.2	1200
	PS-CF	1.2	1800
High temperature Cells	PS-1/3AH	1.2	110
	PS-AAH	1.2	500
	PS-SCH	1.2	1200
	PS-CH	1.2	1800
	PS DH	1.2	4000

Available from: **POWERSONIC AUSTRALIA** 102 May Street, St Peters 2044
Phone (02) 519 8890, 519 6894

Motorola releases AM stereo decoder chip

Motorola's Semiconductor Products Sector has introduced an integrated decoder chip designed for compatibility with the Motorola-developed C-QUAM AM stereo broadcasting system, widely adopted by US AM stations already broadcasting in stereo, and being considered here.



The 'compatible quadrature amplitude modulation', or C-QUAM, system modulates the left and right channels information onto two phases of the AM transmitter carrier in such a way as to produce a 'true' L+R carrier envelope, according to Motorola (see ETI, June '82, page 12).

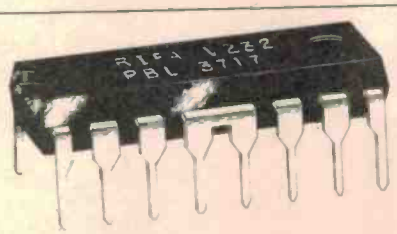
The chip is designated MC13020P and it provides full decoding for the C-QUAM system. The MC13020P is intended to take the place of the standard envelope detector in a conventional AM radio.

It accepts 200 mV RMS IF signal and puts out approximately 100-200 mV of audio, say Motorola. The MC13020P requires few peripheral components and needs no adjustments or tuning coils. The stereo detection mode is only permitted when a valid stereo signal is received and signal conditions are good.

In addition to a small number of resistors and capacitors, only a cheap ceramic resonator for the phase-locked reference oscillator is required.

Motorola quote the THD as 0.75% max in stereo, 0.5% in mono. Channel separation is given as 30 dB and L-R rejection as —50 dB. Stereo lockup time (on retuning) is quoted at 30 ms and the adaptive pilot tone detection circuit takes 17 seconds.

Our information came direct from Motorola's **Semiconductor Products Sector, Hong Kong (ph: 0-223111, tlx: HX 43501 MOTSEM).** Motorola Australia is looking into it.



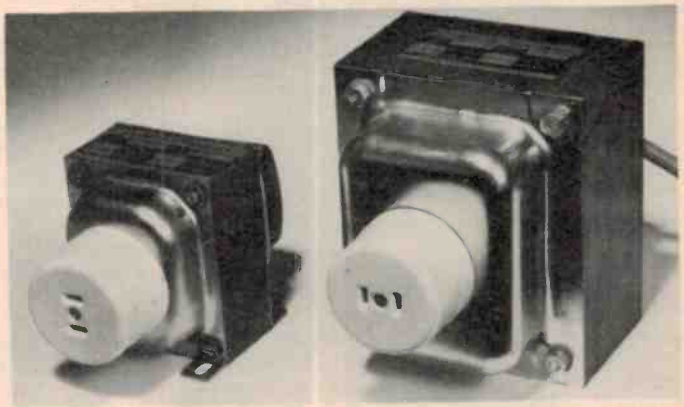
Stepper motor drive circuits

Rifa has released the PBL3717 stepper motor drive circuits, designed to control and drive the current in one winding of a bipolar stepper motor.

Two PBL3717s and a few external components can form a complete control and drive unit for TTL or microprocessor controlled stepper motor systems.

Features of the PBL3717 are: bi-directional driving stage with built-in protection diodes; current control range is 20-500 mA; voltage range is 10-40 V; ability to operate on unstabilised supply voltage; and current levels can be selected in steps or varied continuously.

For further information contact **Rifa Pty Ltd, 202 Bell St, Preston Vic. 3072. (03)480-1211.**



Stepdown transformers

Selectronics have a range of stepdown transformers suitable for operating imported instrumentation and equipment on 115 V/50 Hz.

A mains isolation transformer 240/240 at 1 A rating is also available to avoid risk of serious electric shock.

Types available at present are 240/115 V at 500 VA auto, 240/115 V at 250 VA isolated, 240/115 V at 50 VA isolated and 240/240 V at 250 VA isolated.

They are manufactured in Australia and comply with Australian standards.

For further information contact **Selectronic Components Pty Ltd, 25 Holloway Drive, Bayswater Vic. 3153. (03)762-4822.**

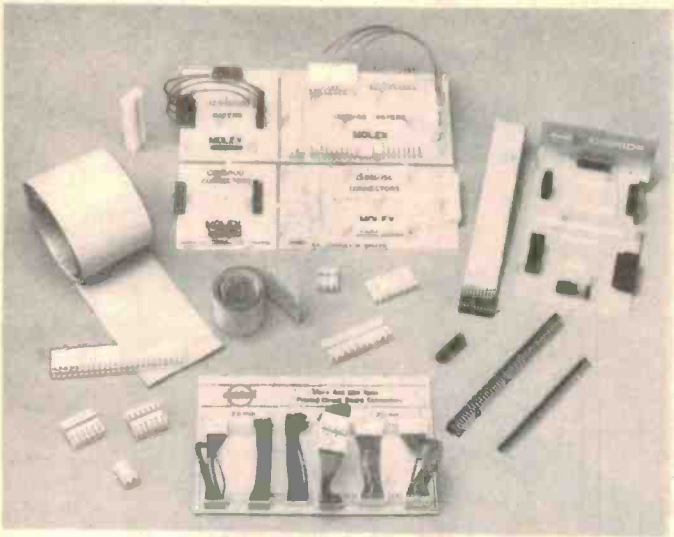
Daneva range at Avtek Electronics

DanevaAustralia has appointed Avtek Electronics to represent their range of data communication products and computer peripherals.

The product range at Avtek Electronics includes: Western Digital's data communications devices and board level products; Micro Peripherals' floppy disk drives; General Instrument's keyboards; Sharp's Z80 devices, LCD dot matrix displays and optocouplers.

More information about these products can be obtained by contacting Phil Gleeson at **Avtek Electronics, 119 York St, Sydney, NSW 2000. (02)267-8777.**

Component NEWS



Molex C-Grid connector system

The latest American-made Molex connector system to be introduced to Australia is the high-density, dual-row C-Grid insulation displacement technology (IDT) series, designed as a complete system of products to maximise use of 2.54 x 2.54 mm matrix PSBs.

This matrix has been chosen by Molex as the most satisfactory compromise between the need for density and the practical size limit for human handling capabilities.

Pins can be set either directly on to the board, in volume with wafer bodies or in volume using automatic insertion equipment.

The C-Grid wafers, which are made from 94 V-O flame-retardent glass filled thermoplastic, join the K.K. single-row crimp interconnection system and a complete single-row IDT system to form a three-strong range of Molex connectors available in Australia.

Each system is supported by a range of tools for hand or high-speed assembly.

For further information, contact the Australian distributor, **Utilux, 14 Commercial Road, Kingsgrove NSW 2208. (02)50-0155.**

Coax/waveguide accessories catalogue from Hewlett-Packard

The latest edition of Hewlett-Packard's Coaxial and Waveguide Measurement Accessories catalogue is now available with product information on more than 350 microwave measurement accessories used in coaxial and waveguide measurements to 40 GHz and above.

Product sections include attenuators, detectors, couplers, filters, power sensors, slotted lines, network analysis and noise-figure equipment, and a good selection of 75 ohm items.

More than 25 pages of this 96-page catalogue are devoted to a microwave measurement handbook section summarising common scalar measurement techniques of attenuation, SWR power, frequency and noise figure.

Measurement tables compare accuracy, cost and techniques.

Waveguide data and flanges, coaxial connector information, and descriptions of other important product characteristics provide useful information to design engineers, production test personnel, quality-assurance and metrology engineers, field-test and system-maintenance engineers.

Hewlett-Packard's Coaxial and Waveguide catalogue, Publication No. 5952-8262, is available without charge. Contact **Hewlett-Packard, 31-41 Joseph St, Blackburn Vic. 3130. (02)89-6357.**

High-performance hybrid DAC

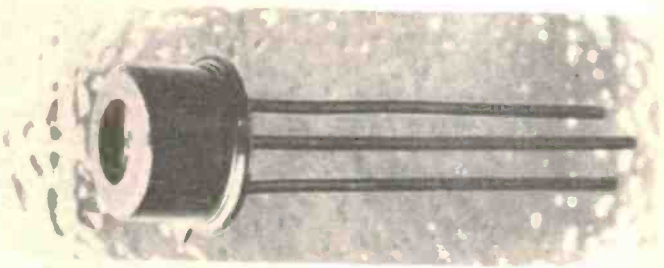
Philips' new OM91, a high-performance 14-bit DAC, contains the naked chip of the established TDA1540 monolithic DAC, together with the peripheral components needed to make up a complete 14-bit DAC.

This hybrid IC is for equipment which needs the high performance of the standard TDA1540, but where space is limited.

Inside the OM91, which is intended for professional audio and instrumentation applications, a naked chip of the TDA1540 uses the dynamic element-matching method of current division to achieve high-accuracy, binary-weighted currents with long-term stability.

The OM91 can convert a 14-bit digital system into an analague audio signal; 16-bit signals can be handled when the OM91 is used with the SAA7030 digital filter.

For further information, contact **Philips Electronic Components and Materials, 67 Mars Road, Lane Cove NSW 2066. (02)427-0888.**



100 MHz fibre-optic emitters

Motorola's new infrared emitters for fibre-optic systems, MFOE1201 and MFOE1202, are the industries first planar LEDs capable of data transmission at greater than 100 MHz.

The emitters allow fibre-optic system operation in areas previously reserved for edge-emitting LEDs and laser diodes.

They are encased in a TO-52 metal package which is of hermetic, industry standard size and configuration and fits into commercially available fibre-optic connectors. The internal lensing enhances coupling efficiency and provides a 250 µm diameter optical spot at 0.3 Na on the emitters.

Designed for fibre-optic applications requiring high power and fast response time, the emitters' spectral response peaks at 820 nm, which is spectrally matched to the minimum attenuation region of most medium-distance fibre-optic cable. With a power output of 1.0 to 3.5 mW, the devises make short- to medium-distance, high-speed systems economically feasible.

Applications are broad, and include industrial controls, computer systems, CATV and military.

For further details, contact **Motorola Semiconductor Products, 250 Pacific Highway, Crow's Nest NSW 2065. (02)438-1955.**

High voltage triggers

A series of semiconductor devices for high voltage bilateral trigger applications has been introduced by Motorola.

Known as SIDACs, the devices combine the high voltage bilateral trigger capabilities of triacs with the simplicity and low cost of two-terminal diac triggers.

Applications include line-voltage transient protection, high voltage power supplies and high pressure sodium vapour lighting.

The breakdown voltages range from 104 V to 115 V for the MKIV-115; 110 V to 125 V for the MKIV-125; 120 V to 135 V for the MKIV-135.

More information can be obtained from **Motorola Semiconductor Products, 250 Pacific Hwy, Crows Nest NSW 2065. (02)438-1955.**

More power. Smaller size. Philips chunky capacitors.

Philips' smaller 'chunky' 050 capacitors give designers improved volume efficiency.

Providing 470 μF (100v) to 68,000 μF (10v) coverage in can sizes substantially smaller than the earlier 071, the 050 meets all the requirements of IEC 384-4 specifications.

Excellent performance is achieved by special construction giving high resistance to shock and vibration, and capacitors are completely cold welded and proof against high charge and discharge currents.

Typical life expectancy 200,000 hours at 40°C.

And a Philips first is the choice of two versions, either with solder tag terminations or pinned terminations designed to drop into printed wiring boards.

For further information phone your local Philips Components office.

PHILIPS Electronic Components and Materials

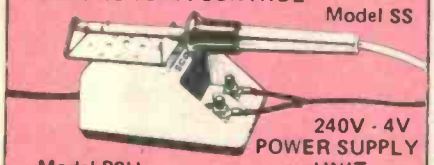
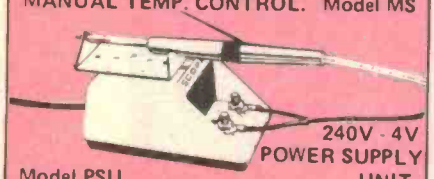
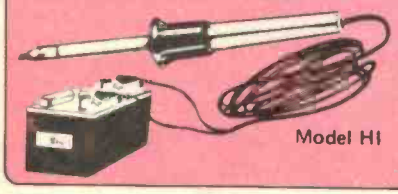
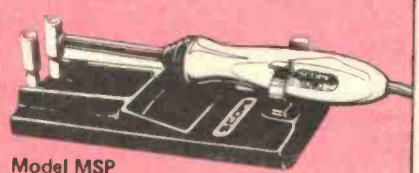
PHILIPS

Philips Electronic Components and Materials. Sydney: PO Box 50, Lane Cove, 2066. Phone: 427 0888. **Melbourne** Phone: 542 3333. **Adelaide** Phone: 243 0155. **Brisbane** Phone: 44 0191. **Perth** Phone: 277 4199.

AHEARN EL78

SCOPE PRODUCT

for WORKSHOP and LABORATORY TECHNICIANS, MOBI

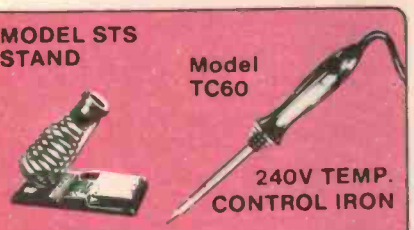
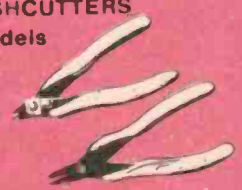
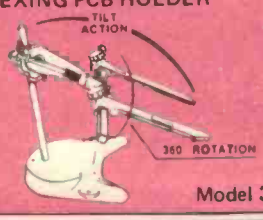
TAKE THIS TOOL	FOR THIS SITUATION	GET THIS USER ADVANTAGE
SUPERSCOPE 20W - 140W MANUAL TEMP. CONTROL Model SS  240V - 4V POWER SUPPLY UNIT Model PSU	• Unpredictable maintenance and repair situations. • May be used for light or heavy Electrical, Electronic or Mechanical Soldering. • You can't come back to base for a bigger or smaller iron. • Ability to insert cold iron thru heat sensitive parts.	1. Adjustable Wattage 20w-140w whilst soldering 2. Adjustable heat 200° 500° C 3. Fast heating, 200° in 5 seconds 4. Easy owner maintenance 5. Low voltage safety, powered by Scope 4 Volt PSU 6. Automatic switch off
MINISCOPE 10W - 70W MANUAL TEMP. CONTROL. Model MS  240V - 4V POWER SUPPLY UNIT Model PSU	• Unpredictable maintenance and repair situations. • May be used for light or heavy Electrical, Electronic or Mechanical Soldering. • You can't come back to base for a bigger or smaller iron. • Ability to insert cold iron thru heat sensitive parts. • You need a small pencil grip.	1. Adjustable Wattage 10w-70w whilst soldering 2. Adjustable heat 200° – 500° C 3. Fast heating, 200° in 5 seconds 4. Easy owner maintenance 5. Low voltage safety, powered by Scope 4 Volt PSU 6. Automatic switch off
12 VOLT SUPERSCOPE 30W - 180W MANUAL TEMP. CONTROL  Model HI	• 12 volt Battery power available only. • Outdoor and bad weather expected. • Service vehicle can get within 6 metres. Other details as for Superscope above.	1. Adjustable Wattage 30w-180w whilst soldering 2. Adjustable heat 200° – 500° C 3. Fast heating, 200° in 5 seconds 4. Easy owner maintenance 5. 12V Safety outdoors 6. Automatic switch off
60W CORDLESS IRON MANUAL TEMP. CONTROL Model C60	• No power • No time to get power • Must work on live gear • Where you need to control temperature	1. 40-150 Terminations depending on conductor size 2. Recharges overnight (3 Charge options) (a) Auto Cig. Lighter (b) Transformer (c) Mains 240V 3. Heats in 6 seconds 4. 60watts – Adjustable Wattage 5. Automatic switch off
SPARE PARTS KIT Model SK1 and SK2	• Retail shops • Industrial stores • Schools • Maintenance workshops	• Storage cabinet FREE! • Correct mix of popular parts. • Quantity based on national sales. • Each kit is portable and easy to store.
MINI SOLDER POT  Model MSP	• You need to rapidly tin a quantity of wire • Where you already own a Scope TC60 • You only need a small reservoir (Allow 8mm penetration)	1. Fast heat up – 2 Minutes 2. Fast conversion time (60 seconds) to assemble your TC60 3. Built in flux reservoir 4. Stable cast iron base 5. Solder bar storage tray

VICTORIA: (03) 338 1566, QLD.: BRISBANE: (07) 52 5231, ROCKHAMPTON: (079) 27 3370, TOWNSVILLE: (077) 75 2765.

SELECTION GUIDE

SCOPE

SERVICEMEN, OEM PRODUCTION LINES, and HOBBYISTS

TAKE THIS TOOL	FOR THIS SITUATION	GET THIS USER ADVANTAGE
MODEL STS STAND **Model TC60**  **240V TEMP. CONTROL IRON**	• Modern sophisticated PCB equipment. • Accurate & Automatic temp. control wanted. • Components are heat critical.	1. Heats in 45 seconds. 2. Dial any temp. 20°-400°. 3. Plugs direct to mains. No transformer needed. 4. Accept iron plated tips from 0.8mm to 6.4mm. 5. Safety Stand available.
COMMODORE 20W 240V NON TEMP. CONTROLLED **LONG LIFE TIP AIRCOOLED HANDLE** **Model PH20**	• Continuous Production • Electronic Students • Serious Hobbyists • Maintenance Workshops	1. Aircooled Grip 2. Interchangeable Tips 3. Long Life iron plated tips (4 shapes available) 4. 370° C Tip (Idling) 5. Safety stand available See Illustration above Model STS
FLUSHCUTTERS **4 Models**  **LONG NOSE PLIERS**	• High Volume cutting 5000-10000 cuts per shift. • Female operatives predominate many use finger tip grip. • Offcuts must not FLY — for operator and product safety. • Wire shaping and location (Pliers).	1. 50% fatigue reduction due to scissor type slicing action (conventional cutters need more effort because they 'crush' cut). 2. Extended Cushion grip handles, spring loaded-high leverage maximise comfort. 3. Models feature safety catcher which holds offcut till released. 4. Model 378 Long Nose (25mm) plier thin profile — serrated jaws.
SOLDER REMOVER **Model SR** **Self Cleaning** **Replacement Nozzle Model SRN**	• High volume of desoldering. • The component in hard to access. • Tool kit and work bench abuse.	1. Avoids the cost of a 'Desolder Braid'. 2. The heat resisent extended nozzle penetrates 20mm 3. The solid metal body resists crushing better than the plastic equivalent 4. Self cleaning 5. Safety guard
SOLDER BLOTTER **Model SB3 (3mm)** **Model SB2 (2mm)** 	• Lower volume of desoldering. • Conventional 'braid' dispenser causes burnt finger tip. • Conventional braid too limp to be positioned accurately.	1. No need to invest in desolder tool 2. Metal tipped extended dispenser keeps finger away from iron tip 3. Heat resist nozzle dispenser locates tape positively 4. Plastic dispenser avoids short circuits 5. 2 metre length (30% longer than most brands).
INDEXING PCB HOLDER  **Model 333**	• For medium volume production of PC boards • Where you need quick release of PC board • Where you need to locate board in wide range of positions	1. Rotates and locks in 45° increments 2. Tilts and locks at 4 angles-vertical, 45° · 90° · 120° 3. Offers 200mm of vertical adjustment to the work height 4. Has a heavy cast iron base with bench mounting holes as option 5. Retains the quick loading facility of spring mounted arms to hold the PCB 6. Offers cross bars to 750mm for large or multiple board work using extra sets of arms

N.S.W.: (02) 546 6144. S.A.: (08) 352 1166. W.A.: (09) 387 4966. TAS.: LAUNCESTON: (003) 31 5545. HOBART: (002) 34 2811.

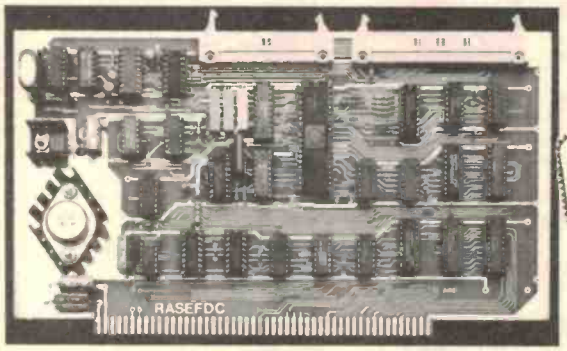
S100 PRODUCTS

Australian Designed and Manufactured

What's New!

HI-TECHNOLOGY PRODUCTS

S100 Floppy Disc Controller



HIGH TECHNOLOGY PRODUCTS AND EXPERIENCE

GENERAL DESCRIPTION:

The extensive capabilities of the rasefdc are to a large part due to the presence of the Western Digital WD1795 double density controller chip. This device will perform the majority of the timing and control functions as required by floppy disk drives when carrying out the following operations:

1. Head loading and unloading.
2. Track seeking.
3. Address reading and writing.
4. Data conversion during read and write.
5. IBM3740 soft sector compatibility.
6. CRC error code inspection/generation.
7. Double density write precompensation.

The board uses the phase locked loop technique when recovering data from disk, the vco of the phase locked loop is under the control of the WD1691 circuit to ensure very reliable data recovery during double density operations. To ensure syncronism between the CPU and the controller card during disk read and write operations the rasefdc will insert wait states until the WD1795 is ready to pass or receive the next byte of data.

When used with rase80 CPU card the rasefdc card is available with full software support in the form of an eprom that is designed to interface with the rase80 monitor for console message passing. As well as the double density raw bios on the eprom there is a full disk diagnostic routine that permits the following operations to be carried out:

1. Head seek testing.
2. Sequential sector write/read testing with random data.
3. Read testing for CRC and seek errors.
4. Random sector write/read testing with random data.
5. Multi drive random write/read testing.
6. Disk formatting (any type of disk).

During implementation of the above tests, any errors that may occur are fully reported back to the console for operator action.

When using either CP/M or MP/M the rasefdc and rase80 CPU card are fully supported with boot, bios and xbios routines that will ensure a very smooth transition into the use of the above systems. Under normal circumstances the board operates within a polled environment, however when using interrupt based disk operating systems there are provisions for jumpering the necessary interrupt onto the S100 bus.

Bare Board **$150 & tax**
Kit Price **$295 & tax**
Assembled & Tested **$350 & tax**
Manual Available Separately for $12 inc. Postage

The Mitsubishi range of disc drives

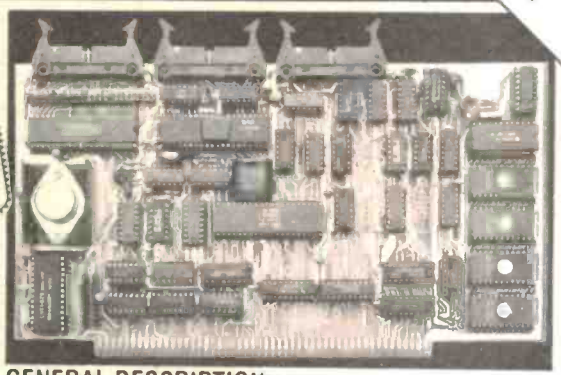
M2896-63
Slimline 8" Disk Drive, Double Sided, Double Density, No AC power required. 3ms track to track, 1.6 mbytes unformatted, 77 track/side, 10^9 bit soft error rate.
$495 + tax. Box & Power supply to suit $95 + tax

M2894
Standard size 8" drive, Double sides, double density, 3ms track to track access, 77 track/side, 10^9 bit soft error rate.
$495 + tax. Box & power supply $95 + tax

M4854
Slimline 5¼" disk drive, Double sides, double density, 96 track/inch, 9621 bits/inch, 1.6 mbytes unformatted, 3ms track to track access, 77 track/side.
$395 + tax. Box & power supply $65 + tax

M4853
Slimline 5¼" disk drive, Double sides, double density, 1 mybyte unformatted, 3ms track to track, 80 track/side, 5922 bits/inch, steel band drive system.
$375 + tax. Box & power supply $65 + tax

S100 CPU Card



GENERAL DESCRIPTION:

- ★ Z80A CPU running at a full 4 MHz
- ★ Battery backed real time clock and calendar
- ★ 2K of CMOS ram as standard
- ★ 2716/2732 Eprom from 2K to 16K
- ★ Z80A CTC with all 4 channels available to user
- ★ 2-RS232 serial ports available
- ★ Software controlled baud rates one each channel
- ★ 16-baud rates from 50-192200 baud available
- ★ 3-8 bit parallel ports via an 8255A
- ★ Centronics compatible printer port via 8255A
- ★ DMA operations supported
- ★ Power on jump to any 4K boundary in memory
- ★ On board memory enable/disable for full 64K operation
- ★ Vectored interrupt chain via Z80 CTC
- ★ Daisy chain interrupts through system full supported
- ★ Comprehensive 2K monitor available
- ★ Complemented by Disk, Memory and Input/output cards
- ★ Local software and hardware support available
- ★ A QUALITY AUSTRALIAN PRODUCT

Bare Board **$180 & tax**
Kit Price **$350 & tax**
Assembled & Tested **$395 & tax**
Manual Available Separately for $15 inc. Postage.

What's Coming

- * 256K Dynamic Ram Card (S100)
- * Intelligent Video Card (S100)
- * Versatile I/O Card (S100)
- * Hard Disc Controller

"Magnetic Media Experts"

We stock a very comprehensive range of diskettes

Verbatim Discs

5¼"SOFT SECTORED
-S- side double density $30.00/10
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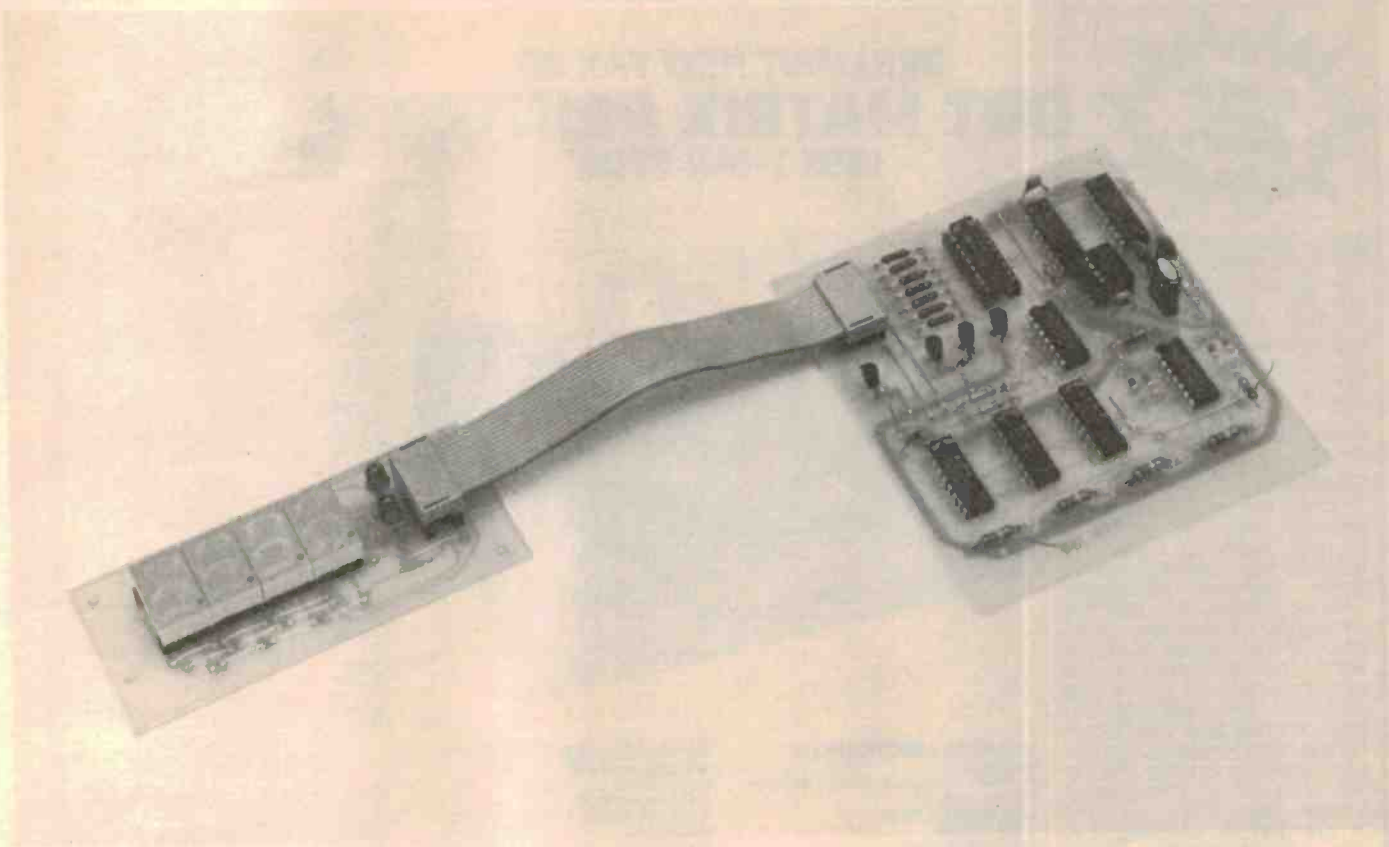

A laboratory standard function and pulse generator

Part 2.

This article covers the design and construction description of the frequency counter and power supply modules. Like the wideband amplifier (ETI-1520) module, these two can also be used in other applications.

David Tilbrook

THE TWO MODULES to be described here, the frequency counter and power supply sections of the Function/Pulse Generator, can be used in applications aside from this project. For the moment, we'll leave the details to you and get on with the project in hand. Both modules have been designed to do the job required, yet keep costs low. No really 'specialised' components have been employed and constructors should have little difficulty obtaining kits or individual parts.

FREQUENCY COUNTER

This is housed on two boards — one containing the counter electronics, the other containing the 4-digit 7-segment LED display and Hz/kHz indicators. The counter board measures 95 x 105 mm, while the display board measures 40 x 100 mm. Spacious component layout is employed on each, easing construction.

A total of nine ICs are employed, but they're all off-the-shelf types and the reference is derived from a low-cost common crystal. The displays finally selected, after a great deal of shopping around, are high-efficiency Stanley types, the NK#-163 series. The # letter signifies the colour — A for amber, R for red, etc. We used the amber displays because they are very 'visible', easy on the eyes and the red displays were unobtainable! (Grr . . . Ed.). Litronix LT-547 displays are physically identical, but do not feature the high efficiency LED segments. ▶

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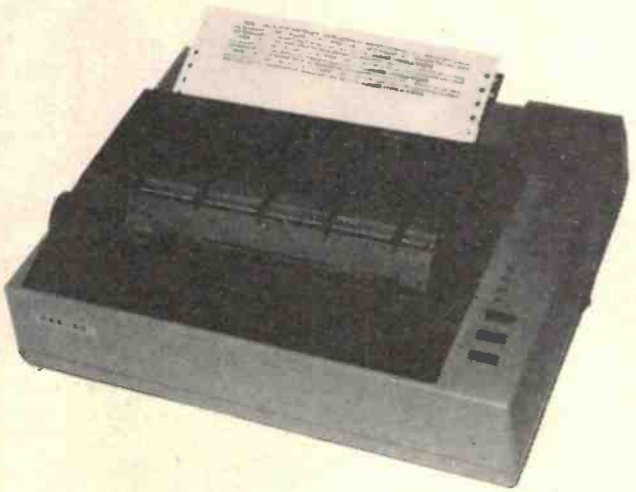
GENERAL INFORMATION
This printer is designed to operate through software control, supplied from any general purpose micro-computer, personal computer, office computer etc. that has provision of printing data out-put that should conform with this specification. It prints upper-and lower-case alpha-numeric characters in both normal and italic letter forms, and graphic characters available on the character code set of this printer beside capability of bit image graphic printing it is also functionated. Additionally, this printer has considerable formatting capability owing to its own internal microprocessor system.



Character set:
228 ASCII characters; Normal and Italic alpha-numeric font, symbols and semi-graphics.
Printing speed:
80 CPS, 640 dots/line per second.
Printing direction:
Normal — Bidirectional, logic seeking. Superscript and bit image graphics — Unidirectional, left to right.
Line spacing:
Normal — 4.23mm (1/6").
Programmable in increments of 0.35mm (1/72") and 0.118mm (1/216").
Columns/line:
Normal size — 80 columns.
Double width — 40 columns.
Compressed print — 142 columns.
Compressed/double width — 71 columns.
The above can be mixed in a line.
Paper feed:
Adjustable sprocket feed and friction feed.
Paper type:
Fanfold. Single sheet.
Paper width — 101.6mm (4") to 254mm (10").

Interface specifications
Interface:
Standard Centronics parallel. Optional RS-232C. (SERIAL).
Data transfer rate:
4,000 CPS max.
Synchronization:
By external supplied STROBE pulses.
Handshaking:
By ACKNLG or BUSY signals.
Logic level:
Input data and all interface control signals are TTL level.

Functional specifications
Printing method:
Serial impact dot matrix.
Printing format:
Alpha-numeric — 7 x 8 in 8 x 9 dot matrix field.
Semi-graphic (character graphic) — 7 x 8 dot matrix.
Bit image graphic — Vertical 8 dots parallel, horizontal 640 dots serial/line.
Character size:
2.1mm (0.083")-W x 2.4mm (0.09")-H/7 x 8 dot matrix.

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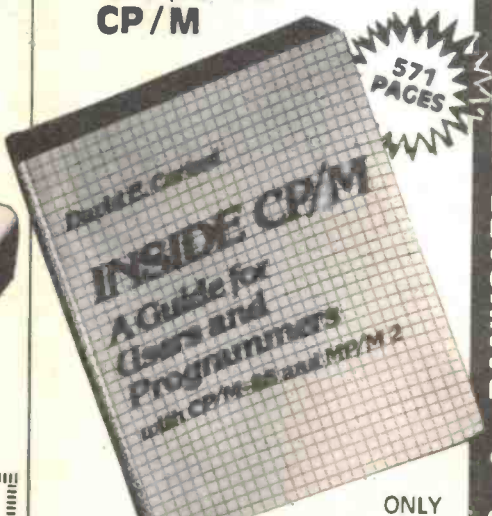

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Penned by international computer expert David E. Cortesi, INSIDE CP/M is divided into a Tutorial Section and a Reference Section. The tutorial is again divided into four sections, one for Novices, Users, New Programmers and Experienced Programmers. The Reference Section is the most comprehensive we have ever seen and this book should sit proudly next to any CP/M system.
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MICRON 12

See Review June EA, p.137.

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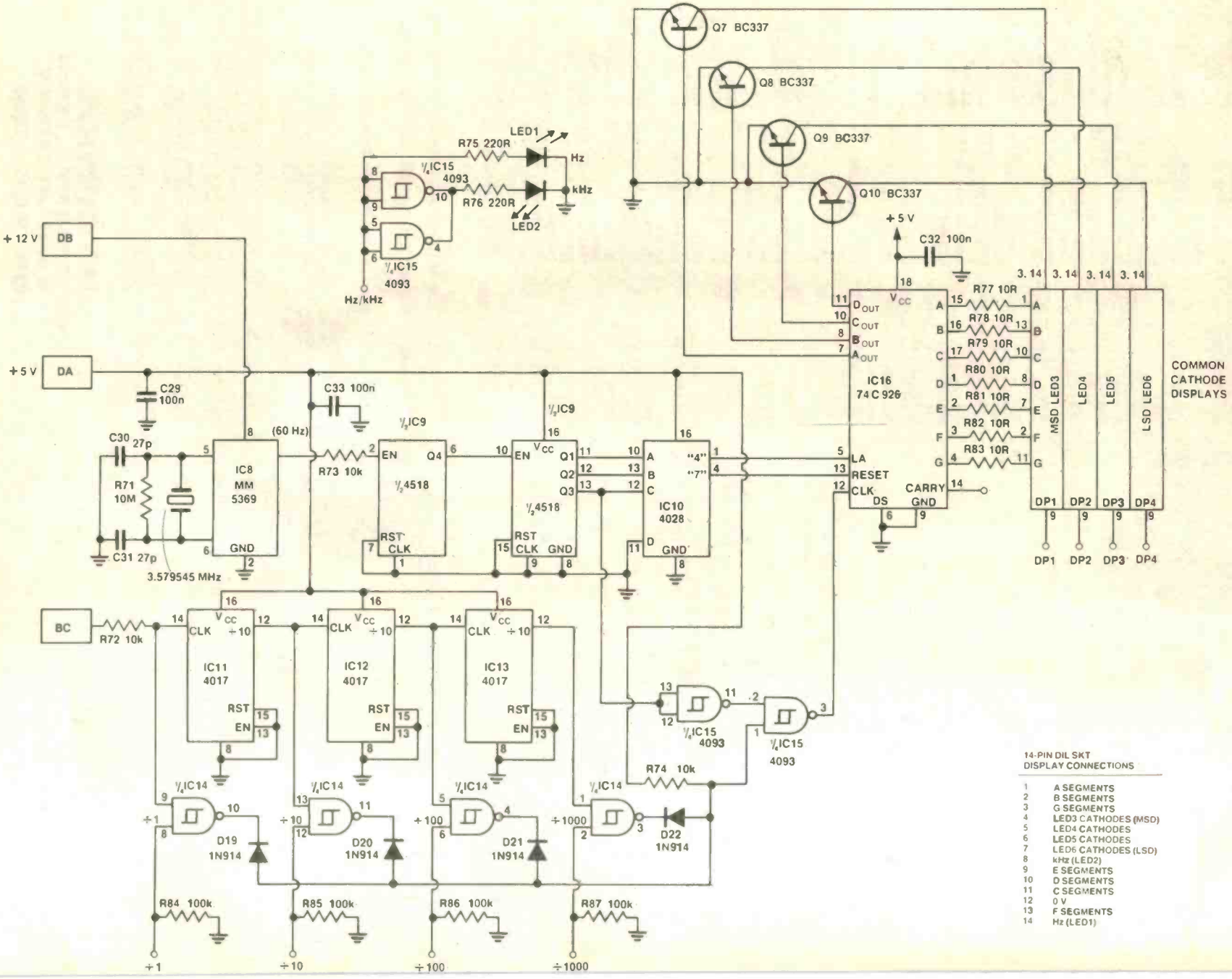
Project 166b,c,d function/pulse generator



14-PIN DIL SKT
DISPLAY CONNECTIONS

1	A SEGMENTS
2	B SEGMENTS
3	G SEGMENTS
4	LED3 CATHODES (MSD)
5	LED4 CATHODES
6	LED5 CATHODES
7	LED6 CATHODES (LSD)
8	kHz (LED2)
9	E SEGMENTS
10	D SEGMENTS
11	C SEGMENTS
12	0 V
13	F SEGMENTS
14	Hz (LED1)

Design

The heart of this counter is a 74C926 counter/display driver IC. A 1 Hz gate period is derived from a 3.579545 MHz crystal using an MM5369A oscillator/17-stage divider IC, which provides a 60 Hz output, followed by a 4518 dual 4-stage counter, half of which divides the 60 Hz to 6 Hz, the other half dividing this to 1 Hz. A 4028 BCD-to-decimal decoder provides the appropriate gating signals to the 74C926.

The incoming frequency to be displayed is gated through to the 74C926 clock input, only for the period for which the counter/display is enabled so that a steady display results.

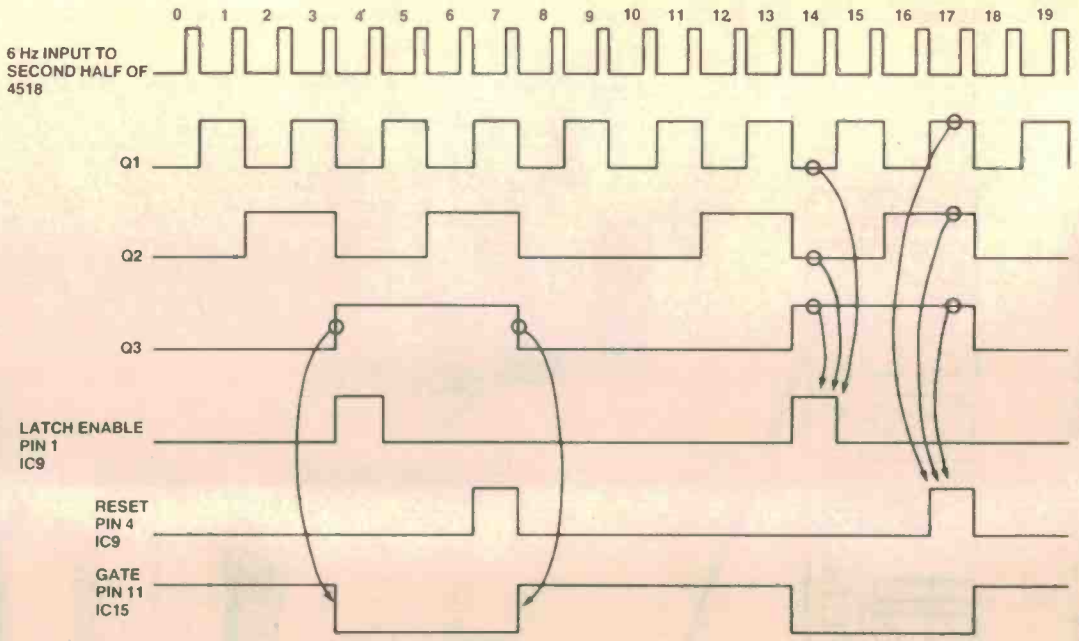
The output of one of a series of 4017 dividers, driven by the input signal, can be selected to provide divisions of 10,100 and 1000. The counter can display input frequencies to 2 MHz, limited by the speed of the CMOS circuitry. Decimal point switching and divider selection is arranged by an external switch — the range switch of the main oscillator. The Hz/kHz indicator switching is also provided by the generator's range switch.

Note that the 74C926 multiplexes the displays. This chip's 'carry' output is brought out to a pad on the counter board so that this module can be used stand-alone as a $4\frac{1}{2}$-digit counter.

Construction

The first thing you should do is check your pc boards, no matter whether you've bought them or made them yourself. Check the tracks for minute 'bridges', particularly where they run between IC pins, and also that there are no minute cracks — many of the tracks are quite fine. See that all the holes are correctly drilled. Fix any problems before proceeding.

Tackle the counter board (ETI-166b) first. The component overlay shows the overall arrangement. Install all the resistors and capacitors first. Mount the capacitors with as short leads as possible. Install the nine links next. Note that one solders to a lead of resistor R74 (near the location of the crystal). ▶



HOW IT WORKS — ETI 166b

The frequency reference is derived from a 3.579545 MHz crystal and a MM5369 oscillator/divider. This combination produces a crystal-locked 60 Hz output which is further divided to provide a 1 Hz gating signal accurate enough to ensure that all displayed digits are meaningful.

A ceramic resonator may have also have sufficed since only four digits are displayed.

The technique of using a mains derived 50 Hz signal instead of a crystal was not used since the short term accuracy of the mains is not sufficient to ensure that all digits displayed are valid.

The output of the MM5369 is fed to one half of a 4518 dual BCD up-counter which is used to divide the input 60 Hz signal by ten. This provides a 6 Hz signal which is used as the input to the second half of the 4518.

This stage, in combination with the 4028 BCD decimal decoder, generates latch-enable, gating and reset signals which are required by the 74C926 seven-segment display driver.

The timing diagram shows the relationship between the control signals and the 6 Hz input to the second stage of the 4518.

Since the 6 Hz signal is derived from the Q4 output of the first stage of IC9, it has a 2:8 mark/space ratio. This input frequency is counted by the second stage of IC9 which provides a BCD output corresponding to the count at any given time.

Notice that the Q3 output is low for exactly six cycles of the input clock i.e: low for one second. This signal is inverted by one gate of IC15 (4093) and used as an accurate 1 Hz gating signal.

This signal is NANDed with the input signal, to be measured in another gate of IC15 so that the input frequency (signal at pin 1, IC15) is counted by the 74C926 for a period of one second. At the end of this time gating stops.

The output of the 4518 is decoded by the 4028 and the '4' output is selected as the latch-enable line. As can be seen from the timing diagram, this line goes high immediately counting ceases and the measured frequency is displayed.

The displayed frequency will not change again until a completely new measurement is carried out one second later.

A short time after the latch-enable signal, the '7' output of the 4028 goes high and this is used to reset the counter within the 74C926, in preparation for the new measurement.

The 74C926 automatically counts the input frequency, converts it to seven-segment code and drives the seven-segment displays. The displays are multiplexed by the 74C926 so that only one is on at any given time to decrease current consumption and power dissipation.

We tried a variety of seven-segment displays and finally chose the Stanley NKA163-B since it is considerably brighter than any other display tried. The pinout on these displays is the same as that on a variety of displays so availability should not be a problem.

The remaining section of the frequency meter is formed by IC11, IC12, IC13 and IC14. This circuitry divides the input by 1, 10, 100 or 1000 to provide range switching. IC11, IC12 and IC13 are decade counters, each providing a ÷10 function. The outputs of the counters are fed to the inputs of successive counters and to the inputs of the NAND gates (IC14).

The desired input prescaling is obtained by taking the other input of the gates to +5 V. The resistors R84, 85, 86 and 87 are used to hold these gates at ground potential unless driven.

The maximum frequency that can be measured is around 2 MHz and this is determined by the first decade counter IC11. If a high frequency is required simply incorporate a TTL ÷10 stage before the input with a 1k pull-up resistor on its output to the +5 V rail. This would enable the meter to measure to around 20 MHz.

JUMP FROM PROGRAM TO PROGRAM

WORLD FIRST FOR AUSTRALIA

Previously businessmen have been only able to use microcomputers and CP/M application software in a serial manner, ie, one program after the other. This limitation has resulted in businessmen being unable to employ microcomputers to their fullest potential in their minute to minute business activities.

In analysing a typical small business it becomes apparent that the majority of businessmen are required to perform many tasks within a variety of disciplines during a typical business day.

They are required to swap randomly from function to function at the drop of a hat. At one moment they may be production controllers, the next moment sales persons, the next promotions managers, then the storeman, and the accountant, etc, etc. By the very nature of office life they seldom get to finish one task before they are interrupted by some other more urgent demand for their time. Thus they have to drop tools to deal with the situation before then can return to the original task.

To date, microcomputer systems have been unable to rapidly jump from function to function directly, and in a way that allows direct return to the previous task. AED have solved this problem is a revolutionary new operating system concept referred to as MPS or Multiple Program Selection. At the press of two special keys the current task and its screen are put into suspended animation and saved. The user then via a menu, selects one of nine other tasks which at an earlier time were suspended. This new task complete with its screen image is placed into the computer memory and released from suspension. The whole operation takes only six seconds which is about twenty times faster than conventional microcomputers. When the new task is completed the operator may return instantly to the original or yet another task.

Swapping programs on conventional microcomputers is slow, requires a large number of keystrokes, and normally there is little or no menu prompting. MPS, however, is extremely fast, requires only three keystrokes, and is completely Menu assisted. Other companies have attempted to provide a similar solution to this problem, eg, Apple's LISA, however, their approach has been to create a suite of application programs that are fully integrated. This approach yields an improvement over more conventional systems though still suffers the problem of slow swap time and only the programs offered by that particular manufacturer are available for the system.

Because the AED MPS system is implemented in the operating system, it offers the fundamental advantages, of speed and ready availability of suitable application programs. Any of the standard CP/M programs from a vast range of vendors, can be used with the MPS system. MPS is currently only available on the AID UNIVERSE Supercomputer IH which is an extremely expandable, High speed, IEED 696 S100, Dual CPU, 8 and 16 bit microcomputer system.

For further Information about MPS or the UNIVERSE Supercomputer II contact:

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PARTS LIST — ETI-166b,c

FREQUENCY COUNTER

Resistors ..... All ¼W, 5% unless noted
- R71 ..... 10M
- R72, 73, 74 ..... 10k
- R75, R76 ..... 220R
- R77-83 ..... 10R
- R84-87 ..... 100k

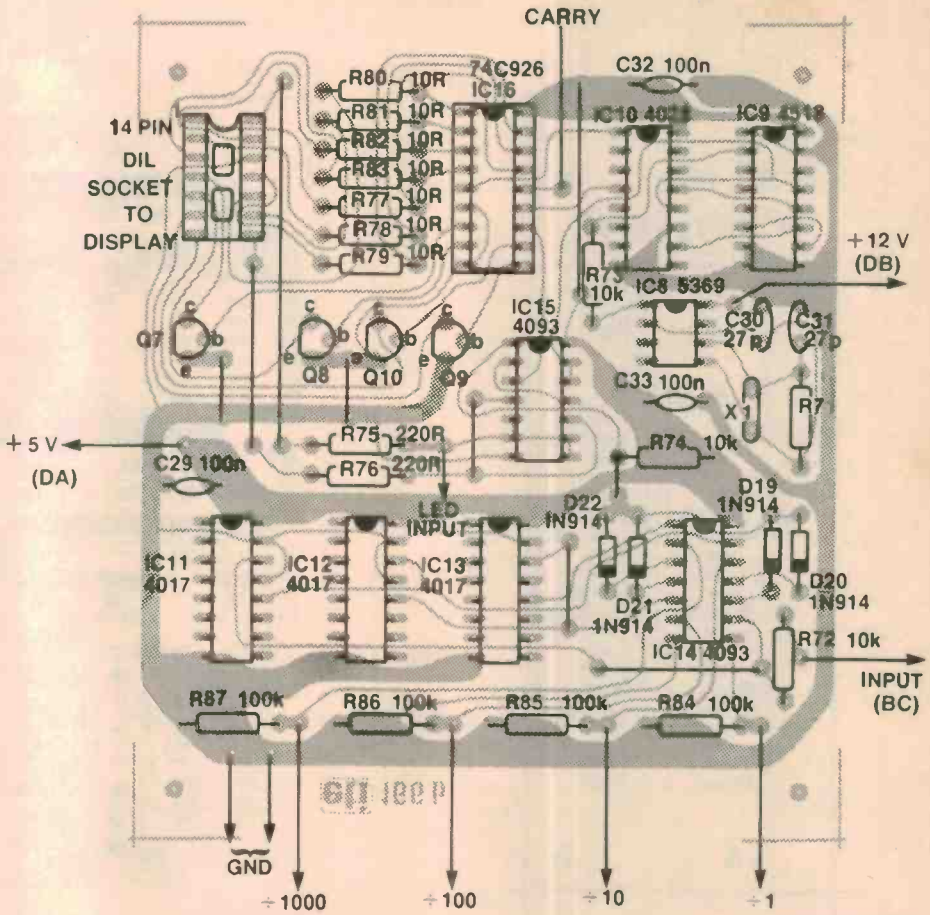
Capacitors
- C29, C33 ..... 100n
- C30, 31, 32 ..... 27p

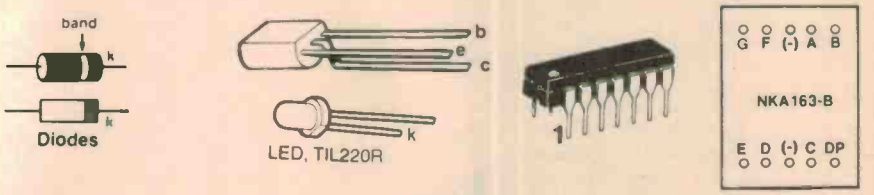
Semiconductors
- D19-22 ..... 1N914, 1N4148
- IC8 ..... MM5369AA (60 Hz model)
- IC9 4518
- IC10 4028
- IC11, 12, 13 4017
- IC14, IC15 4093
- IC16 ..... 74C926
- LED1, LED2 ..... TIL220R
- LED3-LED6 ..... Stanley NKA-163-B, Litronix LT-547R or similar common cathode 7-segment display with DP.
- Q7-10 ..... BC337-BC338

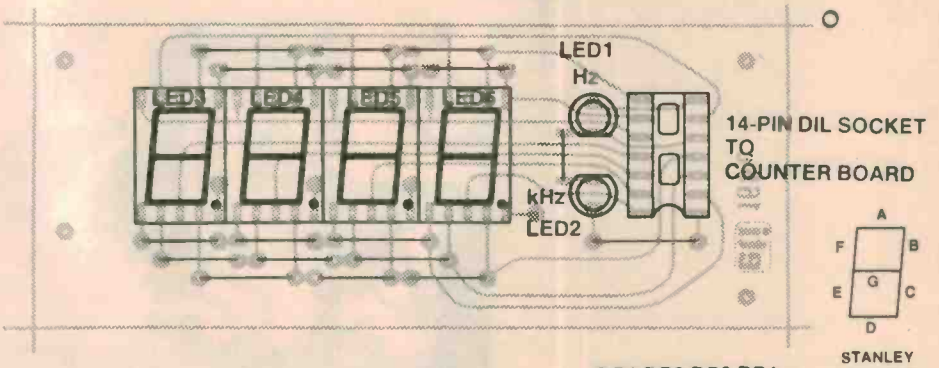
Miscellaneous
- X1 ..... 3.579545 MHz crystal, HC18/U can.

ETI-166b and c pc boards; 2 x 14-pin IC sockets (others if required); 2 x 14-pin IDC plugs; length of 14-way ribbon cable; tinned copper wire; pc stakes, etc.

Price Estimate $42-$48







Solder the four diodes and four transistors in place next. Note their orientation before installation; each set faces the same way.

The ICS can be installed next. The 74C926 (IC16) requires a socket. This is to provide some heat dissipation for it as there is insufficient copper in the tracks around it on the board to provide enough heatsinking. There are no objections to using IC sockets for the rest of the ICs if you so wish. Note that all the ICs face the same way. Install a 14-pin IC socket for the display interconnection.

The crystal should be soldered in place last of all. Mount it right down on the board — it's not good to have it flapping around in the breeze — and take care not to apply too much heat or hold the iron on the leads for longer than about 10 seconds.

The display board can be assembled next. Install the 17 links first. I used a 40-pin IC socket for the displays and this should be installed next, followed by the 14-pin socket for the interconnection from the counter board. Solder the two LEDs in place next, mounting them so that their bases are 9-10 mm above the board. Then plug the four 7-segment displays into the 40-pin socket.

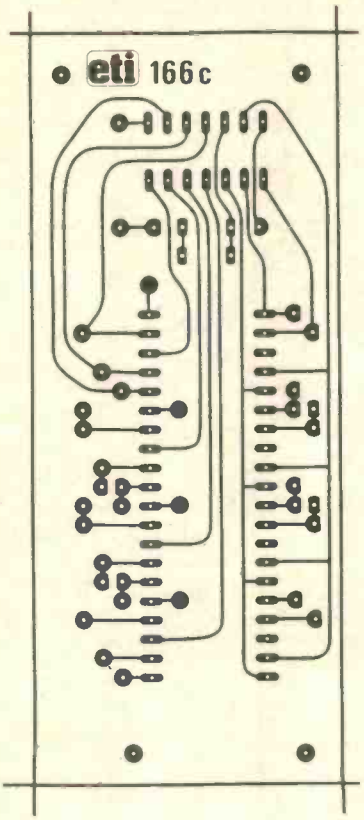
Strip a short length of ribbon cable to leave 14 wires and cut it to a length of at least 125 mm. Install 14-pin insulation displacement connector (IDC) plugs on each end and the counter is ready!

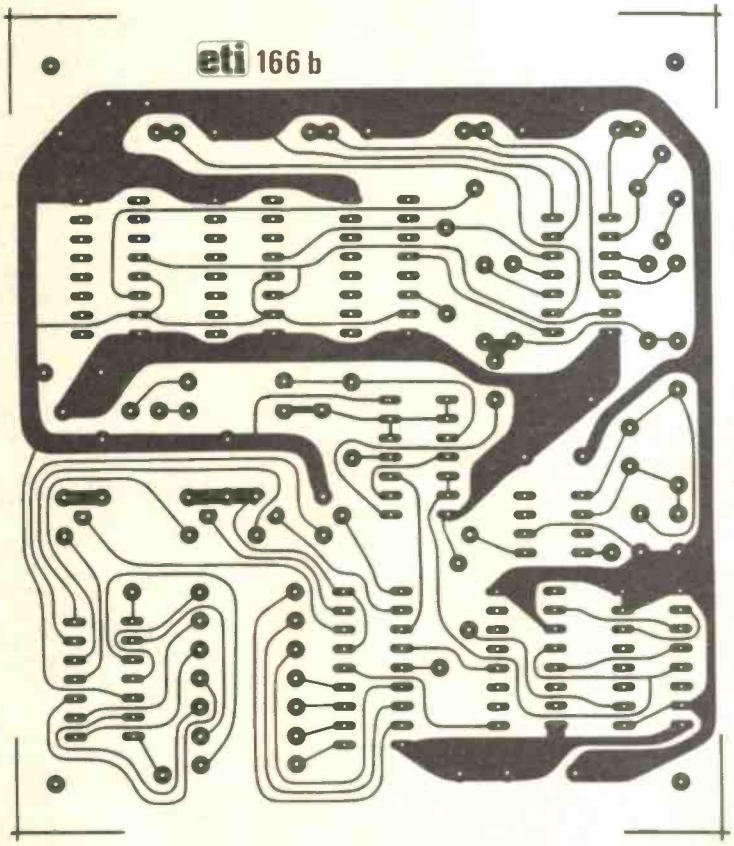
POWER SUPPLY

The power supply board is quite straightforward. It has been designed to use a transformer delivering 15-0-15 Vac at around 1 A and provided three regulated rails — +5 V, +12 V and −12 V.

A 6672 transformer is ideal to drive it. This has a multi-tapped secondary delivering an overall 30 V, tapped at 15, 17.5, 20, 24 and 27.5 volts. The 0, 15 and 30 volt taps are used, the 15 V tap being the centre-tap ('C.T.'). It is rated at 1 A.

Apart from its application in this project, this power supply could be used with many microprocessor and digital or digital/analogue circuits. ▶


eti 166c


eti 166b

eti
166d

Construction

Simple! However, check the board first — mainly to see that all the holes are correctly drilled. Solder the four diodes and three tantalum capacitors in place first. See that they are correctly orientated — check with the overlay diagram.

All external connections to and from the board are made via pc stakes and these should be installed next. Follow by installing the three 3-terminal regulators. Last of all, solder the three electrolytic capacitors in place, making sure you get them the right way round. Mount them right down on the board, it's not good to have them waving around on their leads. ●

PARTS LIST — ETI-166d

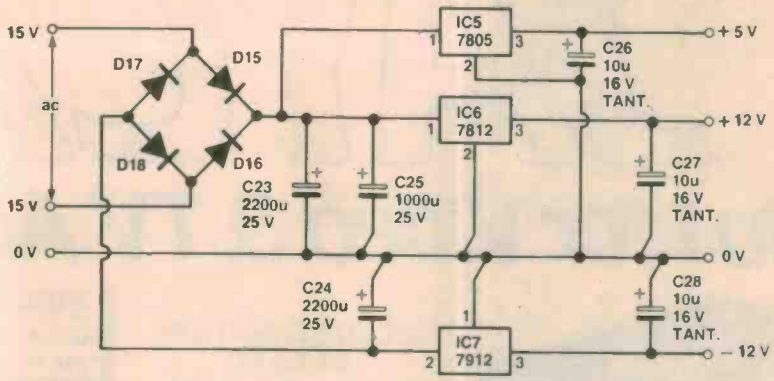
POWER SUPPLY

Capacitors
- C1 ..... 1000u/25 V single-ended electro.
- C2, C3 ..... 2200u/25 V single-ended electro.
- C4, 5, 6 ..... 10u/16 V tantalum

Semiconductors
- D1-4 ..... 1N4001, 1N4002, EM401, etc
- IC1 7805
- IC2 7812
- IC3 7912

Miscellaneous
ETI-166d pc board; small heatsinks for TO-220 devices (e.g.: Thermalloy 6073B or similar; pc stakes, etc.)

Price Estimate $14-$16



HOW IT WORKS — ETI-166d

POWER SUPPLY

The power supply comprises fullwave positive and negative capacitor-input rectifiers followed by three, three-terminal regulators developing a +5 V rail, a +12 V rail and a -12 V rail.

The positive rectifier consists of diodes D2 and D3 plus capacitors C1 and C2. With an input from a transformer secondary delivering no greater than 15-0-15 V at 1 A, the voltage developed across C1-C2 is about 21-22 V under load.

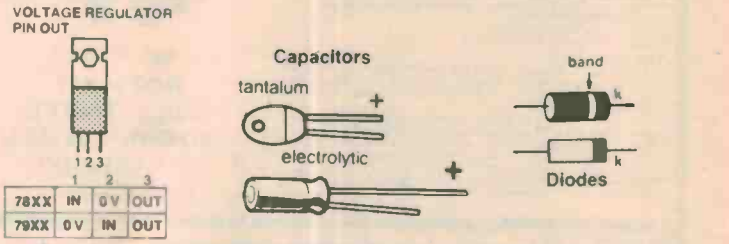
IC1 regulates this to +5 V and a load no greater than 250 mA can be drawn without IC1 being mounted on a larger heatsink. Capacitor C4 lowers the regulator's output impedance and maintains its stability.

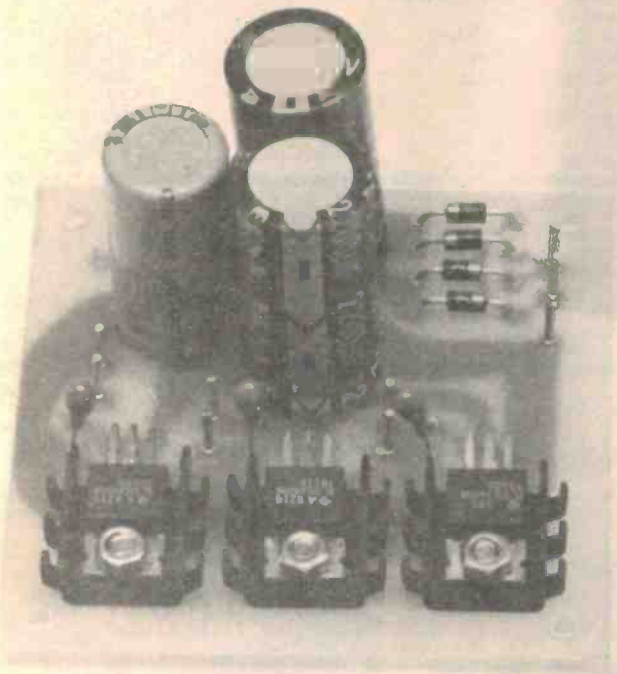
IC2 regulates the positive rectifier output to +12 V and a load of up to 500 mA can be drawn without IC2 being mounted on a larger heatsink. Capacitor C5 fulfils the same role as C4 does for IC1.

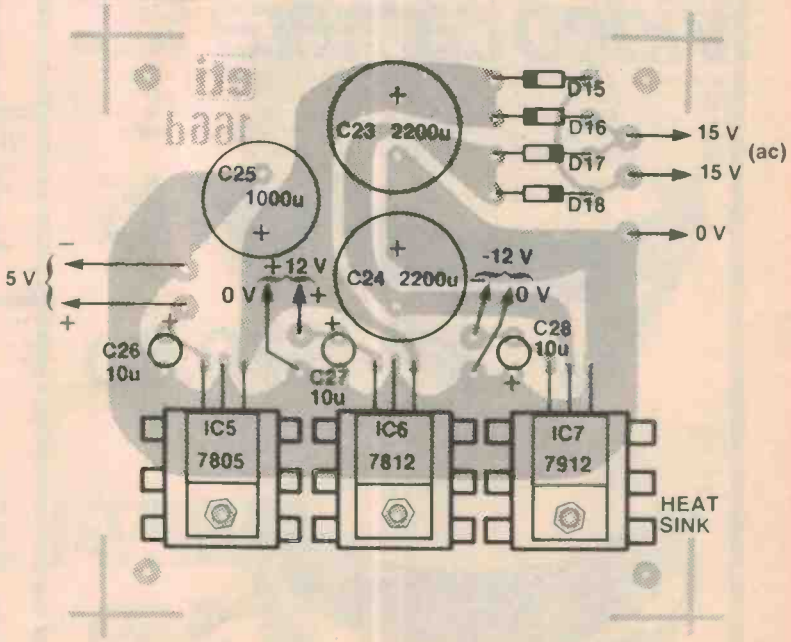
The negative rail rectifier consists of diodes D1 and D4 plus capacitor C3. This also develops around 21-22 V across C3 (negative with respect to the 0 V rail) with 15-0-15 V ac applied to the rectifiers' input.

IC3 regulates the negative rail to -12 V and its load can be no greater than 500 mA without the IC being mounted on a larger heatsink. Capacitor C6 lowers the output impedance of IC3 and maintains stability.

The sum of the load currents on the three supply rails should not exceed the current rating of the transformer.

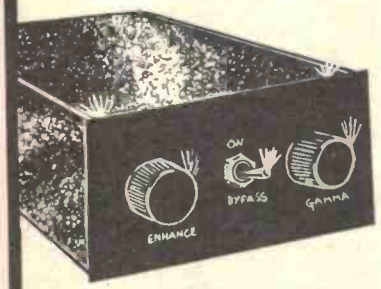






JAYCAR

No 1 for Video & TV Accessories



VIDEO SENSATION
AT LAST
A Video Enhancer/
Distribution Amplifier
designed
EXCLUSIVELY
for AUSTRALIA

Jaycar has had designed a high quality, high performance Video Enhancer which is specifically for the Australian 625 line 50 frame PAL-D system.
As far as we know it is the ONLY Australian-designed, Australian-built unit available!!
But, guess what? The Jaycar AV6501 Enhancer is CHEAPER than its inferior imported Asian counterparts!!
This unit is professionally designed and University tested! It works and it works well.

SPECIFICATIONS
- 1 Maximum enhancement, not less than +8.3dB @ 2MHz
- 2 Enhance disabled (Bypass) response, DC to 5MHz, −0.5+1.0dB,
- 3 Colour Subcarrier 0dB notch frequency, tuneble to 4.43 MHz, −/+ 0.5dB, all settings.
- 4 Amplifier group delay, less than 0.075uS
- 5 Signal handling capability not less than 1.35 volts p-p. (Sync. is clipped first.
- 6 Power 12V AC @ 100mA
- 7 Controls, ON/OFF, ENHANCE, ENHANCE/BYPASS SWITCH, CORE/GAMMA CONTROL
- 8 Input connector, RCA socket
- 9 Output connector, RCA socket x 3

DESIGN FEATURES
- 1 A unity gain notch at the colour subcarrier frequency, whose purpose is to prevent chrominance to luminance errors at high enhance levels.
- 2 A closed loop configuration with lead lag compensation to achieve stable, well defined gain
- 3 DC coupling, eliminating large capacitors in series with the video signal and achieving DC response for applications requiring it.
- 4 Low output impedance prior to termination resistors, enabling up to three outputs to exist and be used or left unterminated.
- 5 A level dependant closed loop response or Gamma control ('Core')
- 6 Clip on negative going signals at −67 volts into 75 ohms to prevent sync errors owing to overshoot.

VALUE
$49.50

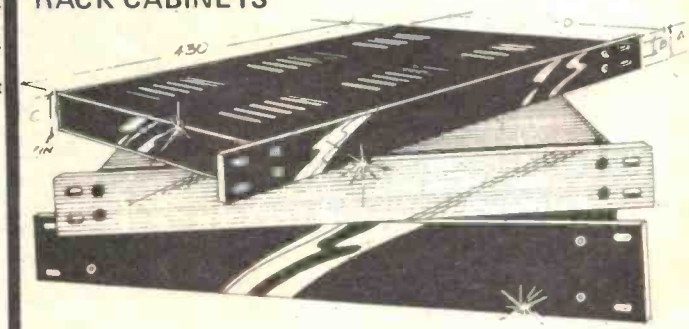
Cat. AV6501
NOT A KIT
BUILT, TESTED
AND GUARANTEED
KIT VERSION
ONLY $39.50

VIDEO STABILISER

As many of you know, many video tapes – especially from the USA have the sync pulses suppressed to prevent unauthorised copying of the original dub. This process is fine because it hinders unauthorised re-recording (dubbing) of material. It is annoying though when you hire the original and find that the "Copyguard" is causing problems with your TV. The AV6502 re-inserts the sync pulses automatically and restores stability.
WARNING! The AV6502 is intended soley for the use above.
Whilst the AV6502 will virtually remove copyguard on a tape copy (and hence restore the picture) it is against the law to unlawfully copy copyright material.
Cat. AV6502

only $79

RACK CABINETS



Beautifully crafted all aluminium rack cabinets with top and bottom removable panels. Plain or black finish. Ventilated lid. Deluxe brushed anodised front panel. Supplied in flat pack but take only minutes to put together. Dimensions conform to International Standard.

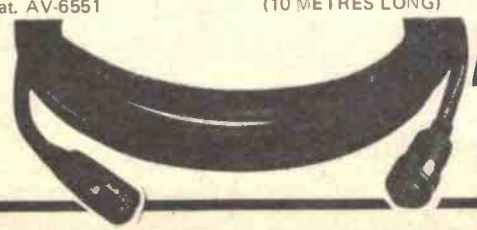
Cat. No.	Finish	Front panel height	Price
HB5411	Plain	44	$39.95
HB5410	Black	44	$39.95
HB5413	Plain	88	$49.50
HB5412	Black	88	$49.50
HB5415	Plain	132	$54.95
HB5420	Black	132	$54.95

Video camera CABLES CABLES

A must for the Video enthusiast. Cheaper and longer than the "accessory" offered by most of the major manufacturers. Each cable comes with a factory-terminated 10 pin video plug on one end and line 10 pin socket on the other end. This connection system is fairly standard on most VHS type cameras.
Cat. AV-6550 (10 METRES LONG) $79.50

VHS
NEW
$79.50

Basically the same comments as above except that this cable has an in-line 14 pin plug and 14 pin socket for use with BETA type camera equipment. Again 10 metres long.
Cat. AV-6551 (10 METRES LONG) $89.50



BETA
$89.50

UHF/VHF DIPLEXER (MIXER)

This unit enables you to have both UHF and VHF Anetnnas connected to the one TV set without having to manually switch between the two.
- INPUT VHF 75 OHMS (ANTENNA)
- INPUT UHF 75 OHMS (ANTENNA)
- OUTPUT 75 OHMS (TO TV)
- CONNECTORS: SADDLE CLAMPS

NEW

Cat. LT-3015 (Not Illustrated) $9.95

This compact unit enables you to switch from either of two 75 ohm inputs to a single 75 ohms output (i.e. to your TV set). Each input has a Belling Lee type input socket. The all-metal case has a switch fitted to the top to conveniently alternate between say TV antenna and home computer, TV game, VCR, etc.
Cat. LT-3016 ONLY $6.95

NEW
LOW COST
COAX ANTENNA
SWITCH. . .
$6.95

Amazing New Prices For . . .
Piezo Horns

Jaycar has broken the price barrier for Piezo Horn Speakers!!
We now DIRECT IMPORT a range of piezo horns at prices that will stagger you. Similar units are used everywhere in P.A., Disco and Hi Fi applications. Only Jaycar, however, can bring you these products at low Jaycar prices!!
We now stock the most popular piezo models at new low prices.

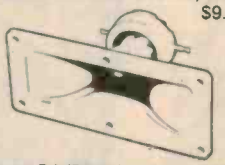
$9.95 Quality

PH 1005A
3½" Square Super Horn for PA's, Disco's etc. Very efficient. Around 50Wrms equivalent capacity.
Cat. AS-3100 $9.95

$9.95 Get the most from your system

PH 1038A
Hi Fi version of the PH 1005A. Slightly less sensitive but a smoother response.
Cat. AS-3102 $9.95

Amazing Value $15



PH 1025A
This design is one of the most popular for high power PA/Disco's around 100W rms equivalent power handling capacity! (6 x 2" rectangular)
Cat. AS-3106 $15.00

Quality Speakers

NOW BACK IN STOCK!

FABULOUS 'CLEF' MICROSYNTH

Equally suited to home, studio or stage use, the Microsynth has resulted from an extensive re-think of what is required from a synthesiser. Its compact and economic design achieves high performance at low cost out sacrificing versatility or musical stability.
A highly efficient switched routing system for signals and/or control voltages is capable of rapid operation for live work, yet unlike other small synthesisers does not restrict the possibilities for complex sound creation. Despite its small size, the Microsynth can produce startlingly rich sounds owing to the number of waveforms available, together with the sub-octave voices. It is capable of advanced effects such as Ring Modulation as well as rhythmic "staircase" or random patterns.
Operates in two modes depending on the configuration of the second oscillator (VCO2), which can either run at audio frequencies or as a voltage controlled low frequency oscillator (LFO). In audio mode, VCO2 will track VCO1 perfectly over its entire range. A Thumbwheel allows manual control of oscillator pitch or filter cut-off frequency, depth of LFO modulation, etc., and internal power amplification will drive headphones or a monitor loudspeaker.

SPECIFICATIONS (BRIEF)
* Keyboard – 2½ octaves (30 notes) may be stepped through 5 octave range from 16' to 1' using the "Range" switch
* VCO1* – 10Hz to 10kHz, triangle output to VCA, ramp and square outputs to VCF * VCO2/LFO – VCO mode 10Hz to 10kHz. LFO mode 0.1Hz to 30Hz. * Sub octaves – 2 divide-by-2 * Noise – white noise source with level control. * Envelope – attack and release times variable 0 to 10 seconds * Retrigger – causes the envelope shaper to retrigger itself with a repeat time equal to the sum of the attack and release times. "Sustain" operates in 3 modes, manual, auto and hold.
* VCF – state variable filter with manual control of roll-off frequency. * VCA – controls output volume of synthesiser
* Sample and Hold – analogue memory samples instantaneous output voltage from VCO2/LFO each time envelope ends.
* Sweep * Thumbwheel – Manual level control * Power amp – output 2 watts into 8 ohms plus headphone socket
* Sequencer socket * Size: 19½" x 14" x 5½". Weight: 10lb. Power: 240V AC 5W.

ONLY $399
Cat. KJ-6602

MICRON DATA CASSETTE

$49.50

At last a Data Cassette Recorder/Player you can afford. The Micron is fully adjustable azimuth (absolutely essential in our opinion) and incorporates tailored audio frequency response audio stage together with low distortion.
Green Screen Monitor
Cat. YM2000 $199

Cat. YD1950

Touch Lamp Timer

Ref: EA Aug 1983

This project is very similar to the EA touch dimmer which has been very popular. Basically, you touch the wallplate and the light stays on for a predetermined amount of time. The same wallplate is used as the dimmer.
As usual the Jaycar kit contains quality components as originally specified, including a quality HPM wallplate.
Cat. KA 1525 $21.00

Video Amplifier/-Buffer

Ref: EA Aug 1983

The answer to a maidens prayer!
This device can be made to fit inside a TV set for 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 are included.
Cat. KA 1527 $14.95

ABS INSTRUMENT CASE

Cat. HB-6012

Jaycar's superb ABS instrument case will give your projects that touch of class that they deserve.
* Internal mounting posts enable a wide range of PCB's, transformers, etc to be accomodated (screws supplied)
* PCB guide rails provided internally allow vertical PCB positioning to several locations.
* Removable front and rear panels. Textured finish on one side and plain on the reverse.
* Great for test equipment and other high grade projects.
* Size (overall) 200(w) x 160(d) x 70(h) mm

Cat. HB-6012 $13.50

240VAC COOLING FANS

Quality Ball Race construction, now you pay no more for quieter, much longer lasting and more efficient ball-bearing fans from Jaycar!
TWO POPULAR SIZES
12 WATTS – 80x80x42(d)
$24.95 Cat. YX2510
13.5 WATTS – 119x119x25(d)
$27.50 Cat. YX2514

"CYALUME" LIGHT STICK

No, it's not electronic. It's not even electric! It's a chemical ("Liquid State"?) device that has 1001 uses. Basically the light stick is a plastic tube filled with liquid. Inside the plastic tube is a glass phial. You bend the tube and the glass breaks mixing two liquids. The reaction causes a strong green glow to radiate from the tube for up to 12 hours!! The light is quite strong and will usefully illuminate a darkened average room. They are perfectly safe. Great in the glovebox. To charge that flat tyre at 2am. Great for Parties, backyard lights at BBQ's or when the fuses blow. Were expensive. Now cheap. Measures 100(l) x 15(d) approx. (Not illustrated)
Cat. XM-9010 $2.95ea

NEW $2.95
Cat. XM-9010

Sheridan th the gauntle competitor

Colourburst Crystals

only $3.00

Going for a song!! These crystals are used in many project and timing circuits. But at this price you can use them for experiments etc. Solder in type 4.433619MHz.

240VAC Motor

SLASHED

Scoop purchase of these high quality open frame motors. Approx 6,000 RPM. Limited stock at this price!!

$2.00 each

were $15.00

Superpower Diodes $12.00 each

5 for $55

Incredible savings on these 100V/250A power diodes from International Rectifier. These diodes normally sell for over $29.00 each, but we have limited stocks at a fraction of the wholesale price. Ideal for high current supplies, isolation circuits etc. Order now to avoid disappointment.

Rheostat: 150ohm/25W

Massive savings on the ceramic body ¼" shaft rheostats. Ideal for speaker attenuators etc. Normally selling for $12.00 each. Get in early at this crazy price.

$2.00 each

Knobs to suit 20¢

normally $12.00

'D' Connectors Lowest Prices in Australia!!

TOP QUALITY

We believe we have the largest and lowest priced range of high quality 'D' connectors in Australia. Let us know if we're wrong!!

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Plug	$4.00
Socket	$6.00
50 Pin	
Plug	$5.00
Socket	$7.00
15 Pin	
Plug	$3.00
Socket	$3.50
25 Pin	
Plug	$3.00
Socket	$4.00
50 Pin	
Plug	$6.00
Socket	$7.00
Covers to Suit	
9 Pin	$1.75
15 Pin	$3.45
25 Pin	$3.00
37 Pin	$4.00

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If you have trouble with the mains interfering with your computer, calculator etc, its time you fitted one of our line filters. Reduces line to line and line to ground interferce dramatically. 3 and 5 amp types.

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AMP Connecting System

Ideal for mounting to PC boards etc. Socket solders to PCB and polythene strip 'zips off' leaving only connector. Price includes the pair (mounting posts and female connectors. 12 way 0.1" pitch. Length of socket 30.1mm.

only $1.00 the pair

rows down t to his s!!

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Experiment with these devices, build light dimmers, controllers and a host of interesting circuits. Contains 24 assorted SCRs and DIACs. Worth many times its cost!! Limited stock on this one so get in early.

$2.00

what a bargain!!

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New Shipment of these superb miniature PC mount relays. Both types have SPDT contacts. Rated at 1A/125V and 2A/30V. Two types: 5V/75ohm coil and 12V/400ohm coil. Quality at a really low price.

$1.75 each $1.50 ten up

Ultra High Quality Keyboards and Numeric Keypads.

German Quality and Engineering at an affordable price!!

These superb keyboards are manufactured by PREH of West Germany to the very highest professional standards. They cannot be compared with the so called QWERTY keybaords others are offering!! Using superior membrane technology they provide full travel keying – essential in demanding applications. Now you can afford a true professional keyboard or keypad.

Connectors available $4.00 each

Note: Keyboards supplied have all brown keys, not brown and white as shown.

Model NK20 MF19 Numeric Keypad $37.95

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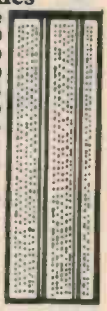
- Full
- technical data
- available on request

A-TEK Solderless Breadboards Best Prices in Sydney!!

The perfect way to build up your prototypes. Ultra high quality construction for perfect connections. If you are an experimenter you will find developing and testing circuits can be done much quicker and without chance of damage which occurs with soldering. With A-TEK Modules you can build up to exactly what you need.

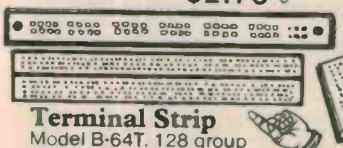
Standard Breadboard Modules

Model	(L)	(W)	Tiepoints	Price
B-011	172mm	52mm	740	$12.50
B-012	172mm	65mm	840	$13.00
B-123	220mm	150mm	1580	$30.50
B-124	220mm	150mm	1680	$26.95
B-135	240mm	195mm	2420	$37.50
B-147	260mm	240mm	3260	$63.00
B-212	150mm	220mm	840	$22.00
B-512	80mm	59mm	390	$8.00



Distribution Strip

Model B-64D. 4 bus of 25 tie points. 100 holes. 172mm x 13mm. **$2.70**



Terminal Strip

Model B-64T. 128 group of 5 tie point. 640 holes. 172mm x 39mm. **$8.00**

Monster Component Pack

1 Kilogram !! of useful components: switches, capacitors, slide pots, rotary pots, relays, tag strips, etc. Worth over $20.00!!

only $4.00

RF Power $3.50 Transistor Bargain

Type BLV10. This NPN silicon epitaxial transistor is intended for use in class A, B and C operation in HF and UHF transmitters working from a nominal 13.8V. It is guaranteed to withstand severe load mismatch and over voltage supply to 16.5V.

⅜" flange envelope with ceramic cap. All leads are isolated from the flange.

Operation at 175MHz with a P_L of 8W.

Limited stock at a super bargain price. **were $6.00**

Pushbutton Memory Phone

Don't pay $59.00 for a memory dialler when you can get a complete phone for less!! We have limited stocks of these high quality pushbuttom memory phones from PYE/TMC. 10 memories, full pushbutton operation, plug and manual. We're clearing them out so get in early.

$49.00

GRAB ONE

Not Telecom Approved

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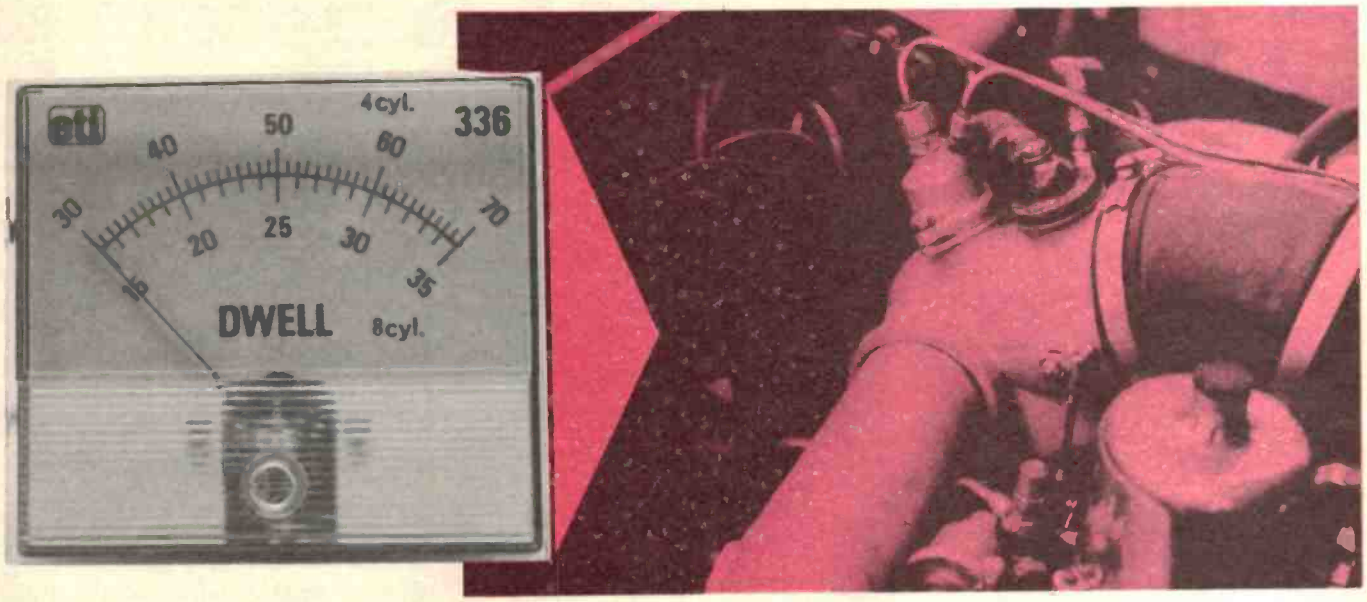


Low-cost dwell meter for vehicle tune-ups

You can do your own vehicle tune-ups at home and save the cost and inconvenience of sending it to the garage. Just about the most useful device you could have is a dwell meter. They can be bought 'over the counter', but you save even more money and increase your personal satisfaction by building your own.

Jonathan Scott

THE FACT THAT you've started to read this article means you probably know quite well what *dwell* is, and the advantages of owning a dwell meter, rather than letting your regular mechanic do the adjustment periodically. (If not, please see the section explaining dwell in automotive ignition systems, because that is where the automotive content of this article is dealt with.)

You are possibly also aware that one can readily buy a tacho/dwell meter in local automotive or electronic shops for around $25-$30, which is marginally more than the cost of this project, box and large meter included. So why describe a project that merely reads dwell?

The reasons are threefold: First, if you have ever dissected one of the commercial units, you may be aghast to note the lack of any transistors — often they rely on diodes alone, and a few quarter-watt resistors on a small board. The circuit, though ingenious, is rather simple and does not inspire this author to praise the accuracy or long term stability.

This project, once calibrated carefully (emphasis on this, as there are pitfalls, outlined later), will be as good as the components you use, which is comparatively very good. In addition, if you have built the thing yourself, it is easy to repair should anything go wrong, from a blown transistor to a crushed meter, and there is a good chance of that if you throw it around like other car tools.

Secondly, this project can be quite cheap. The major expense is the meter, so if you wish to build it as an addition to a multimeter and house it in something cheap, or not at all, it becomes very economical. None of the components is critical, except those resistors specified as high-stability types (readily available these days), so it can be a junk-box job if you need.

All you require in addition is a microamp-to-degrees conversion scale (see later) and you're away.

A second advantage occurred to me as I wandered from car to car-testing the prototype. The board is sufficiently cheap that you could leave one connected permanently to the car (it does not affect the running) and, if you are into stacks of dials on your dash, have another one!

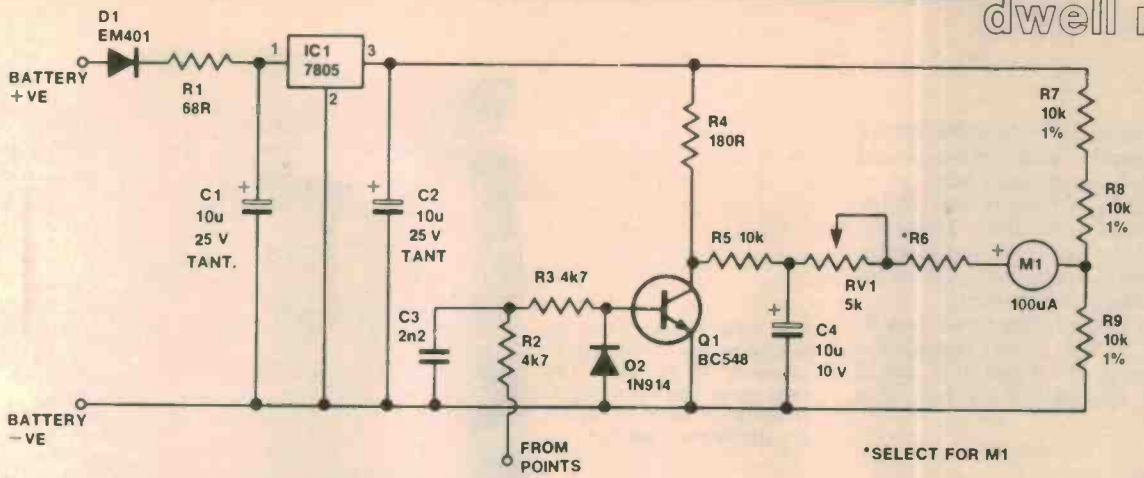
Finally, many cars have tachometers of the electronic genre already, and offer more accurate rpm indication than the cheap commercial tacho/dwell units anyway. If you have such a car, there is no incentive to have a second tachometer function which clutters up the scales, etc.

If you want to add a tachometer function to the dwell meter circuit described here, it is an elementary task to fit the circuitry of one of our previous projects in the same box, using the same meter which, as I have said, is the major cost of the whole thing.

Having justified the usefulness of this design, let's get on with it!

Construction

Construction of the Dwell Meter is very straightforward. The first step, if you are going to mount it in a case, is to cut the



HOW IT WORKS — ETI 336

The dwell meter is simply a 'duty cycle' meter with a zero offset and suitable scale markings on the metre face. It measures the closed-to-open ratio of the vehicle points.

Referring to the circuit diagram, D1 and R1, in conjunction with IC1, provide a reverse polarity protected +5 volt supply from the car battery. Capacitors C1 and C2 remove interfering pulses and ensure that IC1 remains stable.

The square wave voltage created by the 'points' opening and closing is filtered to remove the inductive 'spikes' by R2, R3 and C3. Diode D2 protects Q1 from negative voltages which may appear at the input. The square wave is then inverted and set to a fixed amplitude by Q1, which alternately turns hard on (saturates) and cuts off as the points open and close, respectively.

The average voltage appearing on the collector of Q1 is thus proportional to the time the points spend closed, ranging from almost zero for open points to +5 volts when the points are closed. Resistor R5 and capacitor C4 filter this square wave to reveal a relatively steady level. Metre M1 and surrounding components are set to give a minimum scale reading of 33 % and a FSD reading of about 78%. This corresponds to a range of 30-70 for four cylinder engines, 20-47 for six cylinders, 15-35 for eight, 24-56 for five 10-23 for twelve, etc. It is simple to calculate the duty cycle given the formula:

% duty cycle = (Degrees of Dwell) x (No of cylinders) x (100/360).

Resistor R7 is selected to allow for the internal resistance of the meter. The meter type used in the prototype had a resistance of about 1800 ohms. The sum of meter resistance and R7 should equal a little under 3000 ohms. The trimpot, RV1, is set to calibrate the meter full-scale deflection (FSD). Meter zero is held correct by the resistors R7, R8 and R9 which provide an 'offset' voltage.

Without the points connected, the meter needle goes to full scale as the positive terminal is returned to +5 V via R4, R5, RV1 and R6, while the negative terminal is at a lower voltage via the R7-8-9 voltage divider. This will not damage the meter.

meter mounting holes. Once you are satisfied that the case is prepared, check the printed circuit board to ensure that the holes on it are of a suitable size. If you intend to mount the board on the rear of the meter itself, as I intended, ensure that the meter connection holes are large enough to fit the meter posts.

Once prepared, mount the components on the pc board, taking care to orientate the IC and other semiconductors correctly. Also check that the electrolytic and tantalum capacitors are the correct way around. Reversing C4 could produce devious and subtle problems! While attaching the components, tin the copper areas around the meter mount holes so that the meter post nuts make good contact on to ▶

DWELL IN AUTOMOTIVE IGNITION SYSTEMS

The distributor in the standard type of car has two functions. First, it 'distributes' the spark energy from the ignition coil to each spark plug in turn by means of the rotor and cap of the assembly. This is the most obvious job of the distributor, and the one from which it gets its name. But it is not the most critical, or the one requiring the most attention and adjustment.

It also contains a mechanism for opening and closing the points, which interrupt the ignition-coil primary current and generate the spark itself.

These points are subject to considerable wear and, as they affect both the spark strength and its timing, they are perhaps one of the weakest links in the ignition system.

The lower assembly of the distributor must open and close the points once for each cylinder for each two revolutions of the main engine shaft. Each time it is responsible for ensuring that the coil has enough time to build up primary current, and that the opening occurred at the correct moment, accounting for engine RPM and possibly also the degree of vacuum fed to it down a small pipe from the inlet side of the engine carburettor.

The two functions which must be adjusted are dwell and timing. These are analogous to the duty cycle and phase of the square wave (current) generated by the regular opening of the points. Dwell actually means the amount of time, per revolution of the distributor shaft, which the points spend closed.

Timing means the relative phase, referred to the moment when the piston is at the position of maximum compression (top dead centre or 'TDC'), of the moment of delivery of the spark energy. The latter can be set statically by aligning marks at various positions, and the former by judicious use of feeler gauges on the points, but neither method is as accurate as the electronic methods.

A stroboscope is used for the timing adjustment, and a duty-cycle meter, called a dwell meter, with special scales, is used for the dwell measurement.

Dwell is specified, not by the kind of figure that an electrical engineer would expect — namely a % duty cycle or a number of electrical degrees — but by the actual number of mechanical degrees traversed by the distributor shaft while the points are closed.

Thus, although the actual duty cycle may be similar in all engines, irrelevant of number of cylinders, the degrees of dwell specified appears to change with the number of cylinders. This is because the distributor must deliver one spark for each cylinder in each 360 degrees of revolution.

A four-cylinder car has 90 degrees (360/4) of revolution, so a specified figure of 50 degrees of dwell means 50/90 or 56% duty cycle. A 12-cylinder car has only 30 degrees per cylinder, so 17 degrees of dwell means about the same duty cycle.

Clearly, it is possible to convert any quoted dwell figure into duty cycle by knowing the number of cylinders, then a universal scale of duty cycle on a duty cycle meter would suffice. However, it is usual practice to have several scales on the meter face to achieve the same thing.

Also, since doubling the number of cylinders merely means that the scale reads twice the actual mechanical reading, scales for four and six cylinders enable easy use on eight- and 12-cylinder cars, merely by halving the read value.

Equations for converting dwell into duty cycle and vice versa are given in the 'How it Works' section, so if you happen to have an engine with an unusual number of cylinders you may construct a scale for yourself, or convert the manufacturers specified dwell for, say, a five-cylinder car into what the meter will read on the scale for a four-cylinder car.

the board. If you do not do this, the lacquer put on the pc board to stop corrosion could insulate the meter posts completely.

Connect lengths of hookup wire to the battery and points connections. These will be led out of a hole in the case, and alligator or other suitable clips attached to them for connection to the car electricals.

Next fit the meter in the case, then fit the pc board to the meter, leaving the trimpot accessible. Final assembly should be left until the calibration has been completed.

Calibration

A known calibrating signal will be required to set up the meter. It is not advisable to use a sinewave source (such as from a low-voltage mains transformer) as this can introduce some error. A square waveform is desirable. This must be of known duty cycle. If you have a signal generator which delivers a known duty cycle square wave, typically 50%, set it to deliver 10 to 30 volts peak-to-peak output, and adjust the trimpot for the correct reading.

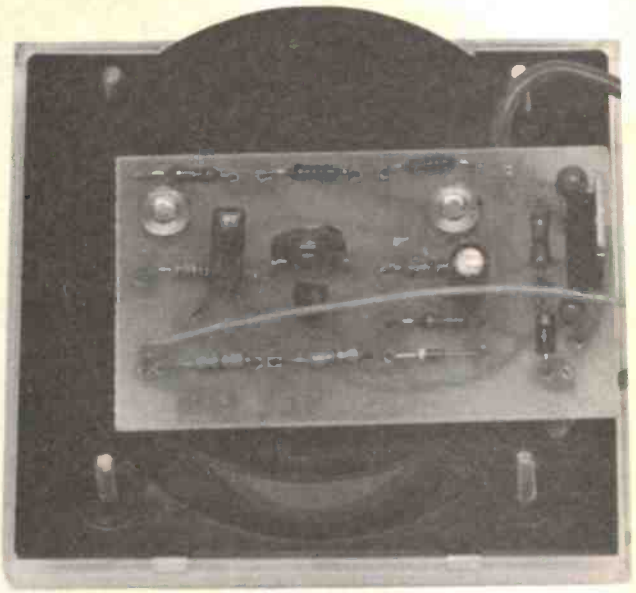
The calibrating signal must have a duty cycle of between 40% and 78%. The higher the better, for accuracy.

If you do not have access to a suitable source, proceed as follows. You will need a sinewave of between 20 and 50 volts peak. If you have a transformer delivering nominally between 7 and 20 volts RMS, it will do nicely. Connect the transformer to put the full ac voltage between the 'batt-' terminal and the 'points' input. Adjust the trimpot for a reading of 50% duty cycle, or 45° dwell on the four-cylinder range. If an oscilloscope is available, it may be used to check the duty cycle at the collector of Q1, and the trimpot used to set the meter to agree with the measurement taken by the oscilloscope. The frequency of the input is not important, of course, provided it is less than a few hundred Herz. (The mains is 50 Hz.)

Using It

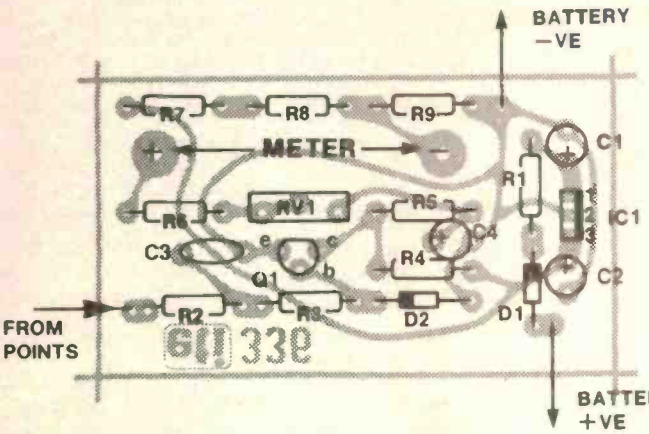
Use of the dwell meter, if you have never used one before, is elementary. Simply place the meter in a convenient location near the engine bay. Note that the typical panel meter changes its calibration when it is moved from the horizontal to the vertical, *so it should be used in the position in which it was calibrated initially.*

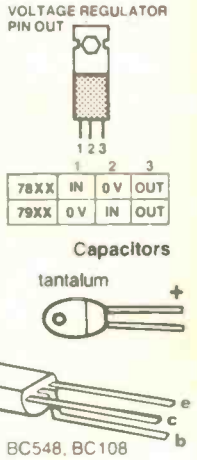
Connect the 'batt+' lead to the car battery positive terminal, and the 'batt-' lead to the battery negative connection. Connect the points lead to the junction of the ignition coil and the points in the distributor. When the car is running the meter reads dwell. Adjustments should be made according to the manual for the particular car, but in an emergency all cars are likely to have dwell specifications which lie roughly at the half-scale point on the meter.



Rear view. The board mounts directly on the terminals of a University TD-86 meter. On other types, use heavy-gauge tinned copper wire to secure the board to the meter terminals.

See Shoparound in this issue for suppliers of kits and components for this project.





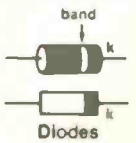
PARTS LIST—ETI 336

Resistors	all ¼W, 5% unless noted
R1	68R
R2, R3	4k7
R4	180R
R5	10k
R6	1k selected, see text
R7, R8, R9	10k 1% or 2%
RV1	5k min. trimpot
Capacitors	
C1, C2	10u/25V tantalum
C3	2n2 greencap
C4	10u/10V single-ended electro.
Semiconductors	
D1	EM401, EM402, 1N4001, 1N4002 etc
D2	1N914, 1N4148 etc
IC1	7805 or 78L05 etc
Q1	BC108, BC547/8/9 etc
Miscellaneous	
M1	100uA panel meter, e.g: Minipa MU-65, University TD86

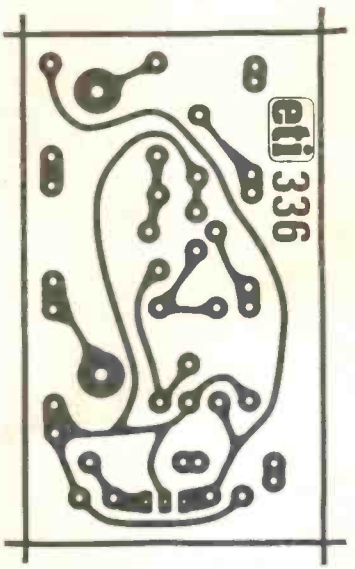
ETI-336 pc board; case to suit; three alligator clips; hookup wire; meter scale to requirements, etc.

* R6 selected so that R6+meter resistance equals a little under 3k.

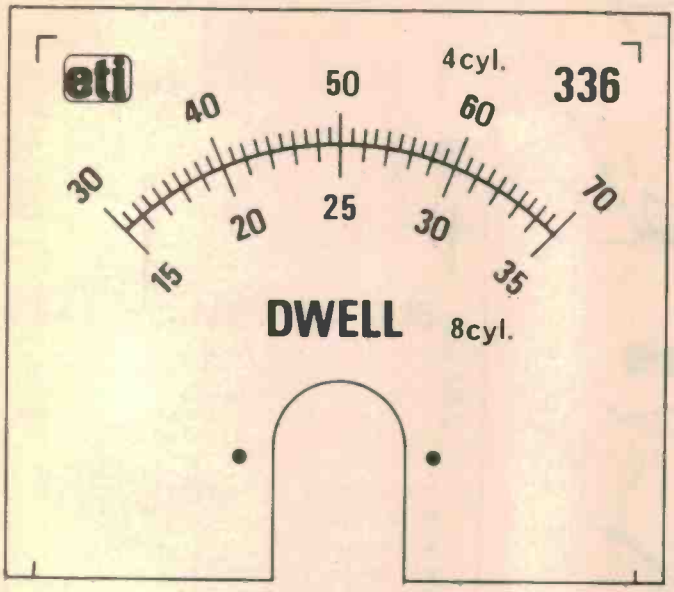
Estimated cost: $16-$24

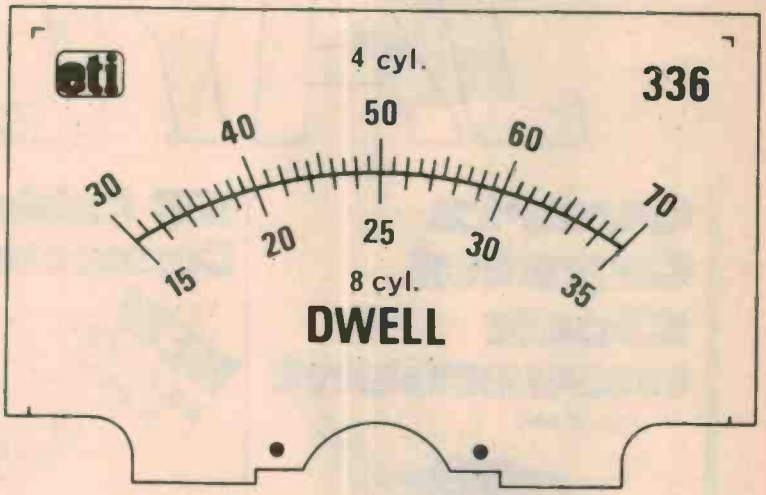


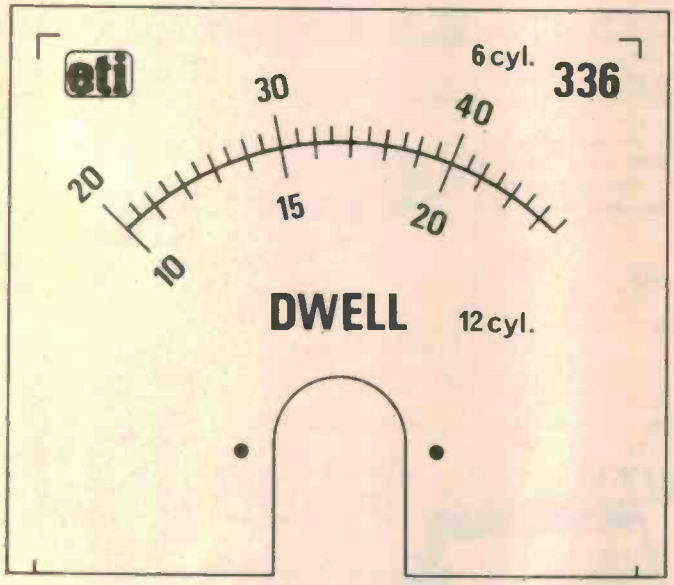
Artwork. Full-size reproduction of the printed circuit board, copper side.

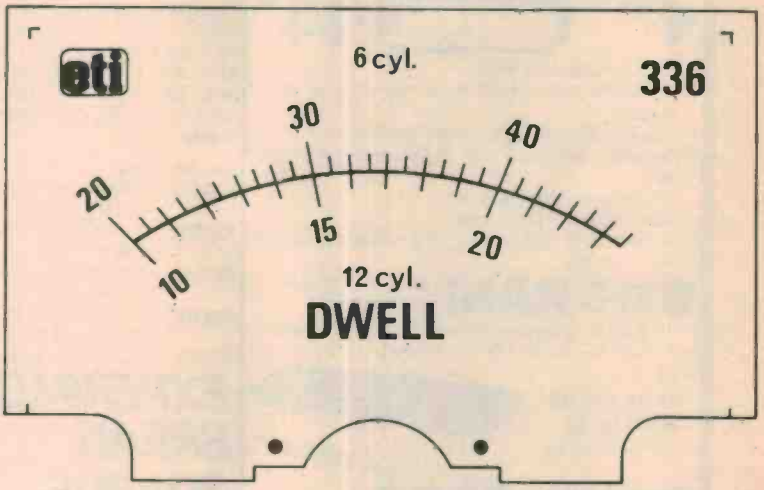


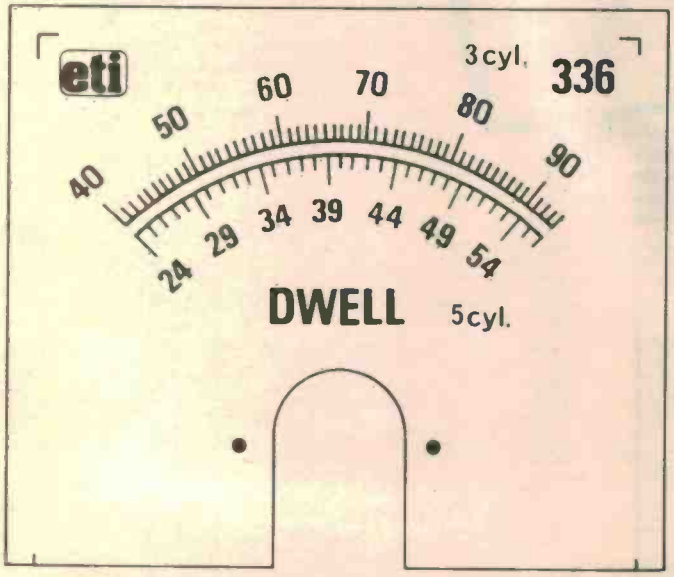
Meter scales. Full-size reproductions of scales for University TD-86 and Minipa MU-65 meters.

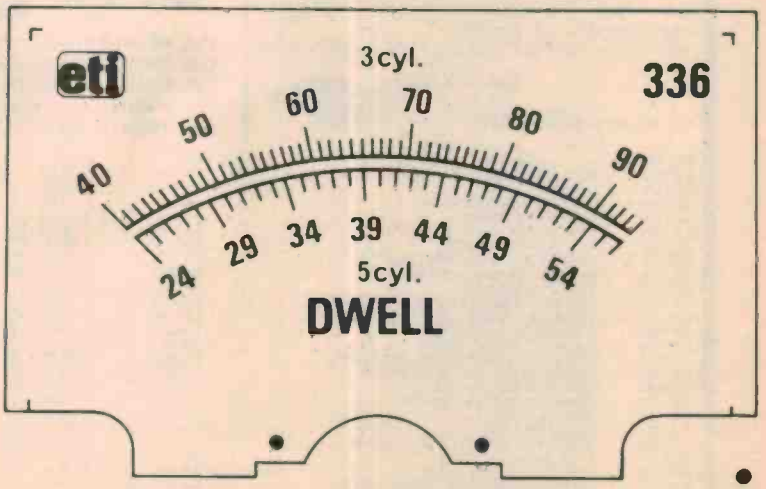












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Cat. ZX7022

(8 amp 650V SCR)

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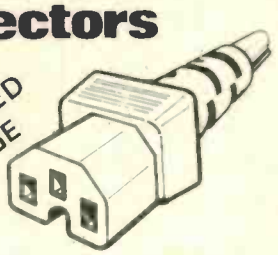

Most imported equipment these days now uses IEC-320 style AC power inlet connectors. Indeed, the electronics mags will soon be specifying these connectors on many of their mains-powered projects to simplify (and therefore make safer) mains wiring. Jaycar now stocks a range of ELECTRICITY AUTHORITY APPROVED mains line cords.

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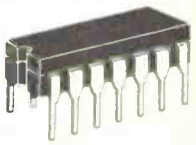

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KA1346	PC BIRDIES SHORT FORM
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KA1400	METRONOME
KA1402	EPROM PROGRAMMER
KA1406	CUOLIPP CRICKET SHORT FORM
KA1408	OIGITAL STORAGE CRO AOAPTOR
KA1430	VOCAL CANCELLER
KA1432	VOX RELAY SHORT FORM
KA1450	GUITAR BOOSTER
KA1452	SUBWOOFER MOSFET AMP
KA1454	SUBWOOFER ENCLOSURE
KA1476	STEREO SYNTHESISER SHORT FORM
KA1478	STEREO SYNTHESISER COMPLETE
KA1482	POWER UP KIT COMPLETE
KA1484	SUPER SIREN SHORT FORM
KA1490	BOGGLE GOGGLES
KA1492	PH METER LCO
KA1494	PROBE FOR PH METER WITH BUFFER
KA1498	AM WIOEBANO TUNER
KA1500	LEO HEAO SHORT FORM
KA1510	STEREO SYNTHESISER SHORT FORM
KA1515	ALIGNMENT KIT AM TUNER
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EA 9/81	$ 29.50	KE4092	AUDIO LIMITER	ETI 446 $ 12.00
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EA 9/82	$ 49.50	KE4410	POWER SUPPLY 13.8 VOLT/10 AMP	ETI 160 $ 79.50
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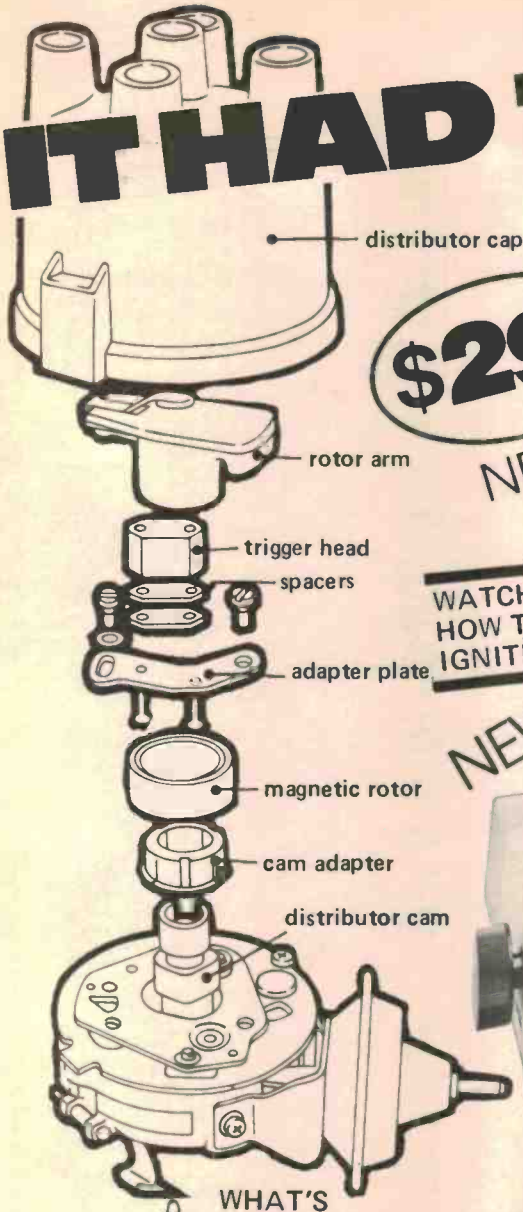
EA 12/82	$ 9.50	KE4554	VIOEO MOOULATOR	ETI 760 $ 12.99
EA 12/82	$ 69.00	KE4560	LOW OHMS METER	ETI 158 $ 29.50
	$ 69.00	KE4570	POWER SUPPLY 0 - 30 VOLTS 1 AMP	ETI 162 $ 49.50
EA 12/82	$249.00	KE4600	MODEM SHORT FORM	ETI 644 $169.00
EA 1/83	$ 9.95	KE4602	MODEM COMPLETE	ETI 644 $189.00
EA 4/83	$ 11.95	KJ6502	SYNTOM ORUM SYNTHESISER KIT	$ 36.50
EA 3/83	$ 7.95	KJ6508	CHORUS GENERATOR KIT	$ 69.95
ETI 400	$ 23.00	KJ6510	SHORT FORM IONISER KIT	$ 14.50
		KJ6511	FULL IONISER KIT	$ 29.50

IT HAD TO HAPPEN



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- INSTRUCTIONS (SIMPLE-TO-FOLLOW) INCLUDED!

This set is designed to fit most European and Japanese cars. In fact it will also fit many Australian cars fitted with Lucas, Bosch, Motorcraft, AC Delco or Autolite electrics. If you wish to check first, please send SAE for car/distributor list.
Because we have no way of knowing, you get the fitting set for ALL of the distributors available. Basically you end up with a jar full of parts that you don't need to use! (Perhaps for your next car?)
Quite frankly, we are amazed that we can supply such a comprehensive kit for this price. To produce a kit that will adapt to the dozens of different distributors around is amazing!
Remember, once you have installed a breakerless system it will never wear out and that part of your system will remain in tune FOR EVER.
We expect this kit to sell well. To ensure that you receive one, check with us early!
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FUNCTIONAL SPECIFICATIONS

Printing method:	Serial impact dot matrix
Printing format:	Alpha-numeric — 7 x 8 in 8 x 9 dot matrix field Semi-graphic (character graphic) - - 7 x 8 dot matrix Bit image graphic — Vertical 8 dots parallel, horizontal 640 dots serial/line
Character size:	2.1mm (0.083") W x 2.4mm (0.09")- H/7 x 8 dot matrix
Character set:	228 ASCII characters, Normal and Italic alpha-numeric fonts, symbols and semi-graphics
Printing speed.	80 CPS, 640 dots/line per second
Line feed time:	Approximately 200msec at 4.23mm (1/16").line feed
Printing direction:	Normal — Bidirectional, logic seeking Superscript and bit image graphics — Unidirectional, left to right
Dot graphics density:	Normal - - 640 dots/190.5mm (7.5") line horizontal, Compressed characters — 1,280 dots/190mm (7.5") line horizontal
Line spacing:	Normal — 4.23mm (1/16") Programmable in increments of 0.35mm (1/72") and 0.118mm (1/216")
Columns/line:	Normal size — 80 columns Double width — 40 columns Compressed print — 142 columns Compressed/double width — 71 columns The above can be mixed in a line
Paper feed:	Adjustable sprocket feed and friction feed
Paper type:	Fanfold. Single sheet. Paper width — 101.6mm (4") to 254mm (10")
Number of copies:	Original plus 3 copies by normal thickness paper

MECHANICAL SPECIFICATIONS

Ribbon:	Cartridge ribbon (exclusive use), black
MTBF:	5 million lines (excluding print head life)
Print head life:	Approximately 30 million characters (replaceable)

INTERFACE SPECIFICATIONS

Interface:	Standard Centronics parallel
Data transfer rate:	4,000 CPS max.
Synchronization:	By external supplied STROBE pulses
Handshaking.	By ACKNLG or BUSY signals
Logic level.	Input data and all interface control signals are TTL level

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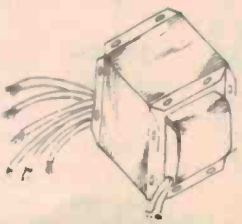

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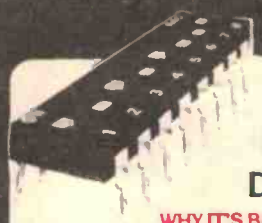

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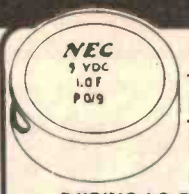

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4013	30c	7410	23c	7490	45c	74LS85	30c
4015	55c	7411	30c	7493	45c	74LS90	30c
4042	45c	7413	45c	74121	45c	74LS93	30c
		7414	45c	74LS11	23c	74LS123	30c
7400	23c	7420	23c	74LS12	23c	74LS157	30c
7402	23c	7430	23c	74LS14	55c	74LS174	30c
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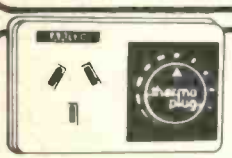

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TYPE	SERIES No.	SECONDARY RMS Volts	Current
	1X010	6+6	2.50
30 VA	1X011	9+9	1.66
70x30mm	1X012	12+12	1.25
0.45Kg	1X013	15+15	1.00
	1X014	18+18	0.83
Regulation	1X015	22+22	0.68
18%	1X016	25+25	0.60
	1X017	30+30	0.50
	2X010	6+6	4.16
50VA	2X0011	9+9	2.77
	2X012	12+12	2.08
80x35mm	2X013	15+15	1.66
0.9 Kg	2X014	18+18	1.38
	2X015	22+22	1.13
Regulation	2X016	25+25	1.00
13%	2X017	30+30	0.83
	2X028	110	0.45
	2X029	220	0.22
	2X030	240	0.20

	3X010	6+6	6.64
	3X011	9+9	4.44
80 VA	3X012	12+12	3.33
	3X013	15+15	2.66
90x30mm	3X014	18+18	2.22
1 kg	3X015	22+22	1.81
	3X016	25+25	1.60
	3X017	30+30	1.33
Regulation	3X028	110	0.72
12%	3X029	220	0.36
	3X030	240	0.33
	4X010	6+6	10.00
	4X011	9+9	6.66
120 VA	4X012	12+12	5.00
	4X013	15+15	4.00
90x40mm	4X014	18+18	3.33
1.2 Kg	4X015	22+22	2.72
	4X016	25+25	2.40
	4X017	30+30	2.00
	4X018	35+35	1.71
Regulation	4X028	110	1.09
11%	4X029	220	0.54
	4X030	240	0.50

	5X011	9+9	8.89
	5X012	12+12	6.66
160 VA	5X013	15+15	5.33
	5X014	18+18	4.44
110x40mm	5X015	22+22	3.63
1.8 Kg	5X016	25+25	3.20
	5X017	30+30	2.66
	5X018	35+35	2.28
Regulation	5X026	40+40	2.00
8%	5X028	110	1.45
	5X029	220	0.72
	5X030	240	0.66
	6X012	12+12	9.38
225 VA	6X013	15+15	7.50
	6X014	18+18	6.25
110x45mm	6X015	22+22	5.11
2.2 Kg	6X016	25+25	4.50
	6X017	30+30	3.75
	6X018	35+35	3.21
	6X026	40+40	2.81
Regulation	6X025	45+45	2.50
7%	6X028	110	2.04
	6X029	220	1.02
	6X030	240	0.93

	7X014	18+18	8.33
	7X015	22+22	6.82
300 VA	7X016	25+25	6.00
	7X017	30+30	5.00
110x50mm	7X018	35+35	4.28
2.6 Kg	7X026	40+40	3.75
	7X025	45+45	3.33
	7X033	50+50	3.00
Regulation	7X028	110	2.72
6%	7X029	220	1.36
	7X030	240	1.25
	8X017	30+30	8.33
	8X018	35+35	7.14
500 VA	8X026	40+40	6.25
140x60mm	8X025	45+45	5.55
4.0 Kg	8X033	50+50	5.00
	8X042	55+55	4.54
Regulation	8X028	110	4.54
4%	8X029	220	2.27
	8X030	240	2.08

	9X017	30+30	10.41
	9X018	35+35	8.92
625 VA	9X026	40+40	7.81
	9X025	45+45	6.94
140x75mm	9X033	50+50	6.25
5.0 Kg	9X042	55+55	5.68
	9X028	110	5.68
Regulation	9X029	220	2.84
4%	9X030	240	2.60

IMPORTANT. Regulator references - All voltages quoted are FULL LOAD. Please add regulation figure to secondary voltage to obtain off load voltage

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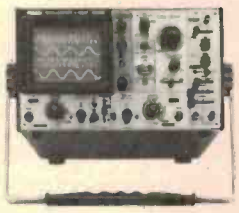
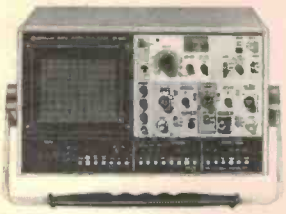

V-1050F

V-422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E. Smeda

I NEEDED a voltage regulator with very low dropout voltage, capable of supplying 5 V at about 3 A. Since many three-terminal regulators have a dropout of 2.5 V or more, the circuit described here was devised using discrete components.

Although very simple, its performance was found to be comparable to that of IC regulators. The circuit of my prototype is shown in Figure 1, and it gave the following results:

Dropout voltage (@ 3 A)	0.75 V
Load Regulation (0-3 A)	less than 10 mV
Line regulation (Vin 6 — 15 V)	less than 10 mV
Ripple rejection (@ 3 A)	−63 dB
Output (no load)	4.96 V

Changes in the output voltage due to ambient temperature variations will be entirely dependent on the characteristics of the zener diode, ZD1 and transistor Q3. Thus, these should be kept clear of heat producing sources, e.g.: the heatsink for Q1 and the power transformer.

The circuit, as it stands, has no well-defined current limit, but this feature can be included with the addition of the components shown in Figure 2. Doing this, however, causes the dropout voltage to increase by 0.5 V. An alternative method of providing current limit without increasing the dropout voltage is to load the output to the required maximum output current and gradually increase the value of the resistor R1 until the output voltage just starts to drop. The disadvantage with this method is that R1 must be selected on test and will need to be re-adjusted if Q1 is ever replaced. Thus, if current limit is desired and a slight increase in dropout voltage can be tolerated, the method shown in Figure 2 is the preferred one.

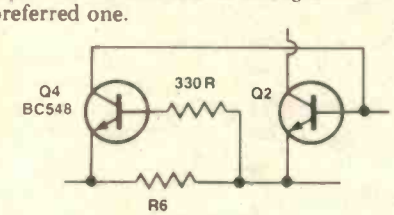

Figure 2. Adding current limit.

Another characteristic of the circuit is that, should a heavy load cause the output voltage to drop below approximately 1.2 V, the regulator will automatically shut itself off and can be restarted by removing the input voltage (or switching off at the mains), waiting several seconds, and then re-applying power. Merely removing the load will not allow a restart.

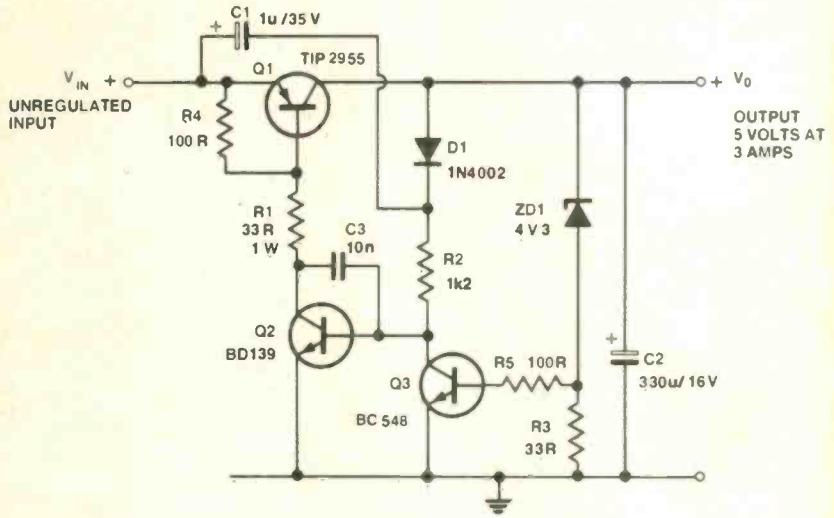

Figure 1. Circuit of the low dropout regulator. Design information is given so that the circuit can be arranged for other voltages.

Components C1 and D1 are the startup components and allow reliable starts even with heavily capacitive loads. In order that the circuit may be adapted for any voltage and current (up to about 5 A), the following simplified design procedure is given.

(1) Select the output voltage, Vo (5 V)
(2) Select the maximum current, Io (3 A)
(3) Select a suitable transistor for Q1 (TIP2955 70 V, 10 A)
(4) R1 max. = $Vo/(Io/h_{FE\ min}\ Q1)$
= 5/(3/20) = 33.3
use 33R
(5) Dissipation of R1 = $Vo^2/R1$ = 25/33
= 0.75 W (use 1 W)
(6) Select a suitable device for Q2 (BD139 80 V, 1 A)
(7) R2 max. = $Vo/(Ioh_{FE\ min}\ Q1 \times h_{FE\ min}\ Q2)$
= 5/(3/20×40) = 1300
use 1k2
(8) Dissipation of R2 = $Vo^2/R2$
= 25/1200
= 21 mW
(use ¼ W)
(9) Select a suitable device for Q3 (BC548 25 V, 100 mA)
(10) Select a suitable zener diode, ZD1.
Voltage = Vo − V_{be} (Q3) = 5−0.65
= 4.35 V (use 4V3 zener)

As the current flowing in Q3's base will usually be very small, it may be ignored. Thus, a low wattage, 400 mW or 1 W, zener may be used.

R3 should be chosen to bias the zener well into its operating region. A good rule of thumb is to select the current through the zener (I_z) to be a fifth of its maximum.

$R3 = V_{be}\ (Q3)/I_z$
$I_z = 0.2 \times (P_z/V_z)$ (P_z = zener power, V_z = zener voltage)
= 0.2 × (0.4/4.3) assuming 400 mW zener
= 18.6 mA.
Thus, R3 = 0.65 V/18.6 mA
= 35 ohms (use 33R, ¼ W)

(11) R4 ensures Q1 is not turned on by leakage. Its value is not critical. 100 ohm, ¼ W is usually suitable here.
(12) R5 is used as a precaution, preventing excessive current through Q3's base; 100 ohms is suitable.
(13) C1 is the startup capacitor. Any value between 1u and 4u7 should be satisfactory. Its voltage rating should exceed Vin.
(14) C2 should always be used for stability. A value of 100u per amp of load current is suitable. 330u was used in the prototype. Its voltage rating should exceed the output voltage rating.
(15) C3 is required for stability. 10n should suit.
(16) Mount Q1 on a suitable heatsink, according to the power it dissipates. (This should be low if Vin-Vout is low). ●

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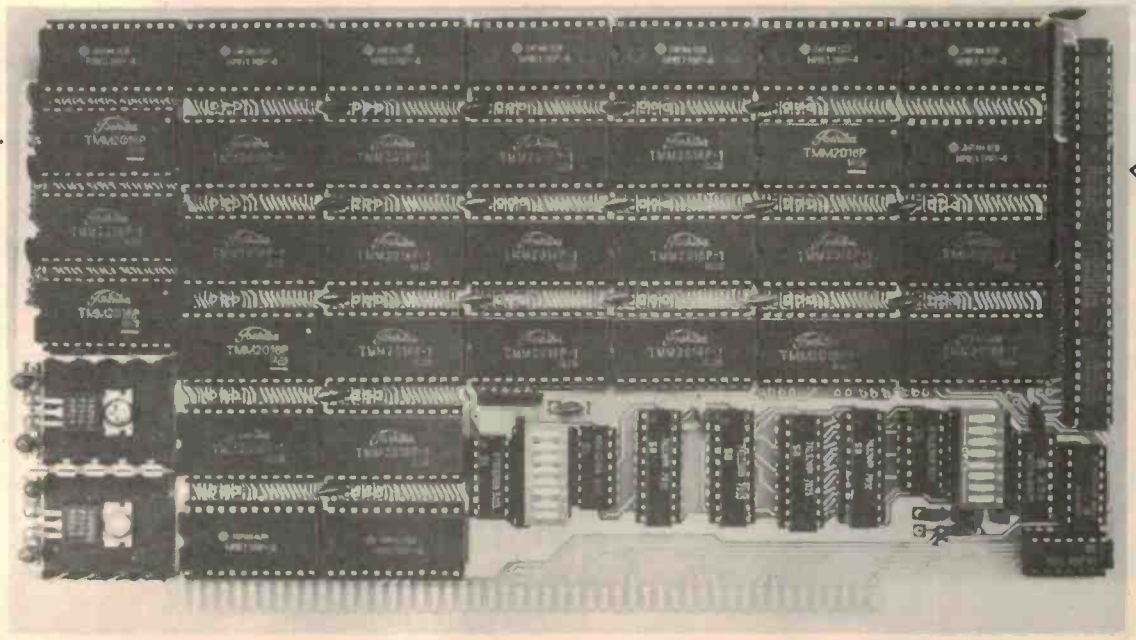

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- ★ 200 NS RAMs are standard. (TOSHIBA makes TMM 2016s as fast as 100 NS. FOR YOUR HIGH SPEED APPLICATIONS.)
- ★ SUPPORTS PHANTOM (BOTH LOWER 32K AND ENTIRE BOARD).
- ★ 2716 EPROMs may be installed in any of top 48K.
- ★ Any of the top 8K (E000 H AND ABOVE) may be disabled to provide windows to eliminate any possible conflicts with your system monitor, disk controller, etc.
- ★ Perfect for small systems since BOTH RAM and EPROM may co-exist on the same board.
- ★ BOARD may be partially populated as 56K.

FOR 56K KIT $349 + S.T.

16K STATIC RAMS?

S.T. **20%**

The new 2K X 8, 24 PIN, static RAMs are the next generation of high density, high speed, low power, RAMs. Pioneered by such companies as HITACHI and TOSHIBA, and soon to be second sourced by most major US manufacturers, these ultra low power parts feature 2716 compatible pin out. Thus fully interchangeable ROM/RAM boards are at last a reality, and you get BLINDING speed and LOW power thrown in for vrtually nothing.

RITRONICS WHOLESALE PTY LTD,
425 HIGH STREET, NORTHCOTE, VIC, 3070. TEL 489 8131
48-50 A'BECKETT ST, MELBOURNE, 3001. TEL 347 9251

FERGUSON TRANSFORMERS

PRINTED CIRCUIT BOARD MOUNTING TRANSFORMERS

PL9/5VA	$7.95	PL24/5VA	$7.95	PL18/12VA	$10.50
PL12/5VA	$7.95	PL30/5VA	$7.95	PL24/12VA	$10.50
PL15/5VA	$7.95	PL40/5VA	$7.95	PL30/12VA	$10.50
PL18/5VA	$7.95	PL161/5VA	$10.50		

LOW PROFILE CHASSIS MOUNTING TRANSFORMERS

PL12/20VA	$14.75	PL12/60VA	$19.50	PL24/40VA	$16.50
PL15/20VA	$14.75	PL15/60VA	$19.50	PL30/40VA	$16.50
PL18/20VA	$14.75	PL18/60VA	$21.50	PL40/40VA	$16.50
PL24/20VA	$14.75	PL24/60VA	$21.50	PL30-9/40VA	$23.50
PL30/20VA	$14.75	PL12/40VA	$16.50		
PL40/20VA	$14.75	PL15/40VA	$16.50	PL30/60VA	$21.50
PL1.5-18/20VA	$23.50	PL18/40VA	$16.50	PL30-9/60VA	$25.50

CONVENTIONAL CHASSIS MOUNTING TRANSFORMERS

PF3577	$33.90	PF3993	$23.90	PF4362	$57.90
PF3783	$79.50	PF4244	$46.50	PF4363	$57.90
PF3787	$21.50	PF4354	$49.50	PF4405	$44.50
PF3788	$43.50	PF4361/1	$49.50		

BELL TRANSFORMERS

PPB4/1000	$15.50	PPB8/1000	$15.50	PPB12/500	$15.50

AUDIO TRANSFORMERS

MT552	$28.50	OP590	$46.50	OP592	$36.90

D.C. POWER SUPPLIES

PPA3DC	$12.90	PPA6DC	$12.90	PPA9DC	$12.90
PPA4.5DC	$12.90	PPA7.5DC	$12.90		

BUILD YOUR OWN SPEAKERS WITH PHILIPS

Part No.	Price
ADO 1610 T8	$16.95
ADO 2160 SQ8	$49.50
AD70601 W8/620	$28.50
AD 12250 W8	$83.00

P.C. EDGE CONNECTORS

S100 gold plated wire wrap	$8.50
S100 solder tail	$7.90
D2 Motorola bus 43 86 solder tail	$8.50
43 86 gold plated wire wrap	$11.50

10 TURN POTENTIOMETERS

Stock resistance values

50R 100R 200R
500R 1K 2K 5K
10K 20K 50K
100k

Spectrol model 534 x shaft
Price 1 9 **$12.50**
10+ values may be mixed **$11.50**

DIP PLUGS

Ideal for use with flat ribbon cable or to mount components on

14 pin $1.50 — 24 pin $2.90
16 pin $1.90 — 40 pins $5

POWER TRANSFORMERS

SPECIALLY DESIGNED FOR MICROCOMPUTERS

- Good regulation electrostatic shield
- RI 810 8V @ 10A x 15V @ 1A **$36.50**
- RI 820 8V @ 20A 15V @ 1A 15V @ 3A **$43.50**

20 TURN CERMET TRIM POT

SPECTROL 43P ACTUAL SIZE

STOCK RESISTANCE VALUES

10R 20R 50R 100R 200R 500R 1K 2K 5K 10K 20K 50K 100K 200K 500K 1M 2M

1 9	$1.80
10 99	$1.60
100	$1.30

Values may be mixed

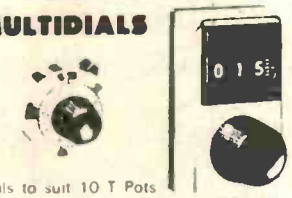
Hexadecimal Keypad

$42.50

19 key pad includes 1-10 keys ABCDEF and 2 optional keys and a shift key

Ideal for dream project

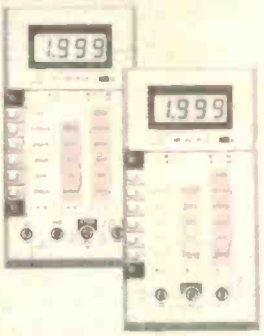
MULTIDIALS



Dials to suit 10 T Pots

Model 21 1.8" dia	$24.50
Model 16 9" dia	$19.50
Model 18 1" x 1.75" dia	$27.50

RITRON DIGITAL MULTIMETERS



- 28 Ranges
- Push Button Operation
- Auto Polarity
- Low Battery Indicator
- Full Overload Protection
- Finger Guards on Probes and Shrouded Plugs for Safety
- Accuracy: 1 year 18°C to 28°C (+ % of reading + No. of Digits)

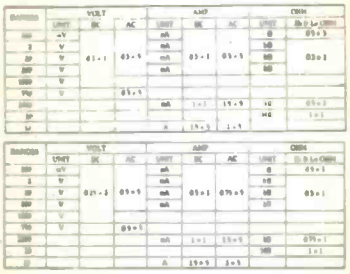
200 hour battery life

Q16010 specifications

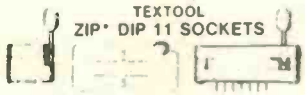
1-4	5+
$59.95	$54.95

Q17040 specifications

1-4	5+
$89.95	$84.95



TEXTOOL ZIP* DIP 11 SOCKETS



16 Pin Zip* Dip 11	$11.50
24 Pin Zip* Dip 11	12.50
40 Pin Zip* Dip 11	17.50

Zero Insertion Pressure

DIP SWITCHES SPST

P.N	No. of Switches	Price
SD3	3	$1.60
SD4	4	1.70
SD5	5	1.90
SD6	6	2.30
SD7	7	2.40
SD8	8	2.50
SD9	9	2.70
SD10	10	3.00

DIP SWITCHES SPST

cermet single TURN TRIM POT

Spectrol model 63P ACTUAL SIZE

STOCK VALUES

10R 20R 50R 100R 200R 500R 1K 2K 5K 10K 20K 50K 200K 500K, 1M 2M

1 9	$1.20
10 99	$1.00
100	$0.90

Values may be mixed.

HEATSINKS

High Thermal Capacity Black Anodised

	1-4	5-9	10-49	50-99	100-499	500 plus
	$	$	$	$	$	$
HS1 — 38mm	1.85	1.75	1.50	1.35	1.00	0.90
HS2 — 75mm	3.00	2.90	2.50	2.00	2.00	1.50
HS3 — 150mm	5.80	5.40	4.90	3.80	2.90	2.70
HS4 — 225mm	8.10	7.60	7.10	5.90	4.50	4.30
HS5 — 300mm	8.90	8.40	7.90	6.50	4.90	4.60

Unanodised

HS11 — 38mm	1.40	1.20	1.00	0.90	0.80	0.70
HS12 — 75mm	2.50	2.20	1.90	1.60	1.25	1.20
HS13 — 150mm	4.90	4.50	4.00	3.20	2.45	2.40

RS232 & "D" TYPE CONNECTORS

PART NO	DESCRIPTION	1 9	10 25	25+
DE 9P	9 PIN MALE	$3.50	$3.50	$3.10
DE 9S	9 PIN F MALE	4.50	4.20	3.90
DE 9C	9 PIN COVER	2.20	2.10	1.90
DA 15P	15 PIN MALE	4.50	4.20	3.90
DA 15S	15 PIN F MALE	5.10	4.90	4.70
DA 15C	15 PIN COVER	2.30	2.10	2.00
DB 25P	25 PIN MALE	5.90	5.60	5.10
DB 25S	25 PIN F MALE	6.90	6.60	6.10
DB 25C	1 pc Grey Hood	2.40	2.20	2.00
DB 25C2B	2 pc Black Hood	2.80	2.70	2.50
DB 25C2G	2 pc Grey Hood	2.70	2.50	2.40
DC 37P	37 PIN MALE	7.90	7.50	7.10
DC 37S	37 PIN F MALE	10.90	9.90	9.10
DC 37C	37 PIN COVER	4.90	4.50	4.10
DH S	Hardware set (2 Pairs)	2.10	1.90	1.80

BLANK CASSETTES T.D.K.

TDK ADC60	1 for $3.60	10 for $26.00
TDK DC60	1 for $2.10	10 for $18.00
TDK ODC60	1 for $3.50	10 for $31.00
TDK SAC60	1 for $3.50	10 for $31.00
TDK SAXC60	1 for $5.70	10 for $46.00
TDK DC90	1 for $2.40	10 for $21.00
TDK ADC 90	1 for $3.50	10 for $30.00
TDK SAC 90	1 for $4.20	10 for $39.00
TDK ODC90	1 for $4.70	10 for $45.00
TDK SAXC90	1 for $5.50	10 for $49.00
TDK DC120	1 for $4.50	10 for $37.00
TDK ADC120	1 for $5.40	10 for $46.50

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Name
Signature

Post & Pack $2.50 small kits, heavier kits add extra postage.
Prices subject to change without notice. Send 60c and SAE for free price list and inclusion on all future mailing lists.
MAIL ORDERS: PO Box 235, Northcote, Vic 3070. Min P & P $1.00.
Ph: (03) 489 8131. ERRORS AND OMISSIONS EXCEPTED

ROD IRVING ELECTRONICS

425 HIGH STREET, NORTHCOTE 3070, MELBOURNE, VICTORIA. Ph (03) 489 8131 Telex No. 38897

48–50 A'BECKETT STREET, MELBOURNE (03) 347-9251

SHOPAROUND

This page is to assist readers in the continual search for components, kits, printed circuit boards and other parts for ETI projects and circuits. If you are looking for a particular item or project and it is not mentioned here, check with our advertisers.

ETI-336 Dwell Meter

This is just the sort of gadget you should keep in your toolkit or around the garage for that regular tune-up of the family vehicles. Although any 100 uA meter of a convenient size can be used, we've produced scales for the two commonly available meters — the University TD-86 and the Minipa MU-65. We purchased our University meter at **Radio Despatch Service** in Sydney. The Minipa meters are widely stocked. All the other components are off-the-shelf items so constructors should experience few problems getting parts.

Printed circuit boards will be available from any of the suppliers listed in this column last month. If you're making your own pc board and require a positive or negative transparency, send $1.00 to: ETI-336 Artwork, ETI Magazine, P.O. Box 21, Waterloo NSW 2017. Make cheques or money orders payable to 'ETI Artwork Sales' and ensure you ask for a positive or negative as required by the type of resist you're using.

Kits for this project will probably be stocked by **All Electronic Components** and **Rod Irving Electronics**, both in Melbourne.

ETI-649 Microbee light pen

A good add-on project for the 'Bee bugs. Kits for this project will be stocked by **Altronics** in Perth and **Electronic Agencies** in Sydney. You might also try **All Electronic Components** and **Rod Irving Electronics** in Melbourne.

There's nothing particularly special about the electronics employed in this project, but you may have to hunt around for a suitable phototransistor. Two types can be used, the Fairchild FPT100 or the Philips/Signetics BPX25. As Fairchild have closed down their Optoelectronics Division, the FPT100 will soon become 'extinct'. Any phototransistor having a similar, or better, sensitivity should work in this project. **Dick Smith** stores currently hold stocks of the FPT100 (cat. no. Z-1950) and **Tandy** stores stock a similar type (cat. no. 276-130).

The case we used is by the US company General Specialities Corporation (GSC) and is known as the CTP-1 Logic Probe case. **Jaycar** stocks this. It's the single most expensive item in the whole project, but the only suitable ready-made case we could find. We even investigated having a case specially made for the project, but the cost was prohibitive. Nothing ventured, nothing gained, but it just couldn't be done.

The curly cord we bought from **Electronic Agencies** — and it's only $2.60! A similar one may be obtainable from other suppliers, though. DB15 plugs are common these days, but note we used a right-angle, pc-mount type which we purchased from **Jaycar**, though many suppliers stock similar types.

The keyswitch we used came from a pack of four, so we ended up with three spares — good stock for the junk box! These are widely stocked and come in both round and square styles. As round holes are easier to drill, we suggest you obtain the round style.

The two pc boards can be obtained from any of the suppliers listed in this column last month. If you're making your own and require positive or negative transparencies, the set will cost $2.00, post paid, from: ETI-649 Artwork, ETI Magazine, P.O. Box 21, Waterloo NSW 2017. Make cheques or money orders payable to 'ETI Artwork Sales' and ensure you request positives or negatives according to your requirements.

ETI-166, part 2

The saga continues. This month it's the power supply and frequency meter. Complete kits for the whole project won't be available until the final article appears and, at this stage, only **All Electronic Components** in Melbourne has indicated they'll be stocking kits.

Nevertheless, if you're building the project in parts as we go, then components should not be hard to obtain. The pc boards will be available from the suppliers listed in this column last month. Transparencies for the frequency meter boards (ETI-166b and c) can be obtained from us for $3, while the power supply board (ETI-166a) can be obtained for $1. The set costs $4. Write to: ETI-166 Artwork, ETI Magazine, P.O. Box 21, Waterloo NSW 2017. Make sure you request the artwork you require by the board number and state whether you want a positive or negative, according to the type of resist you are using.

FOR A GOOD-LOOKING KIT . . .

"Our kits cost more . . .", says Jack O'Donnell of Altronics, and they do. But it seems there's a good reason for it — you get that 'bit extra' for the money you pay. A good example is the ETI-668 Microbee EPROM Programmer. We obtained one recently because we needed a spare. The Altronics kit could only be described as " . . . the complete box and dice".

Ours came with a metal Scotchcal front panel (designed and produced by Altronics), a jiffy box, 24-pin Textool ZIF socket, ribbon cable and IDC-type DB15 plug (no fiddly soldering), all the nuts and bolts, power cord, plug and cable clamp — even solder!

So that the ZIF and 'personality' sockets can protrude through the front panel, Altronics provides long-pinned wire-wrap IC sockets that are mounted high off the board.

The kit comes complete with instructions so you don't have to ruin your magazine having it open on the bench while you build your project. Certainly a well turned-out kit.

Insurance

Buying kits and bits by mail order is popular among electronics hobbyists — particularly those who live outside the major cities. If you buy your requirements by mail order frequently, then you don't want the risk and inconvenience of something 'going astray', particularly if you've spent a lot of money.

Jaycar in Sydney now offers free insurance on mail order purchases to the value of $200, or more where registered mail (i.e: the parcel is signed for on delivery) is used.

DON'T MISS OUT

on these DICK SMITH BENEFITS

- You save a fortune due to our low Direct Import prices . . . cutting out the middle-man.
- We stock the widest variety of quality electronics for the hobbyist and professional alike.
- We proudly stand behind every item we sell and back this up with our exclusive 7 day satisfaction guarantee.

That's the DICK SMITH GUARANTEE

Limited Stock

THE DICK SMITH Multi Test METER

This large, easy to read, ultra high sensitivity multimeter features both fuse and diode protection. Also measures capacitance in two ranges ... 50pF to 50uF, has a transistor checker and much more! Complete with batteries test leads and instructions, this multimeter does just about everything.

Cat Q-114

$76.50

Ideal for students

TI-30 SLIMLINE

SCOOP PURCHASE

Texas Instruments packs more into this budget priced slide - rule calculator than most other manufacturers do at twice the price ! From elementary arithmetic, through the most complicated situations, this feature machine handles the lot!
Cat Q-3737

$23

MULTIMETER/RF PROBE

Extend the useful range of your multimeter way up into the RF range with this neat probe. Frequency response is 150kHz to 30MHz (ref. 500kHz). Comes equipped with 4mm banana plugs for direct multimeter connection. Ideal for use with our Q-1140, Q-1136, Q-1120, or Q-1024 multimeters.
Cat Q-1138

$18.95

WORLD TV RADIO HANDBOOK 1983

An authoritative directory of international radio and television, up-dated for 1983; it contains information on the world of radio and TV, includes addresses, frequencies, call signs, identifications, transmission times, plus lots more.All the articles written by specialists. Plus a time table to calculate between local and Greenwich Mean Time.
Cat B-2083

$22.50

Quality Carry Case

More than just protection for your valuable multimeter, it keeps your leads and instruments neat, clean & tidy. There is also room for you to store notes and ciculits etc.
Cat Q-1137

$17.50

DICK SMITH CRO BNC ADAPTOR

Own a Dick Smith CRO? Use this great little adaptor to convert it for BNC plugs. Limited stock ! ! !
Cat Q-1281
WAS $9.95 NOW $4.95

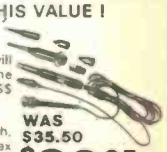
DATA MOS MEMORY

Involved in digital circuit design? Maintenance? You'll need this one in your library ! Fairchild's complete technical description of MOS memory product line. Package outlines, electrical behaviour, etc are included.
Cat B-2043

$7.25

CRO OWNERS LOOK AT THIS VALUE !

CRO PROBE



This incredibly versatile probe set will suit virtually any CRO and give you all the features of a probe set you would pay $$$ more for !
Here's what you get:
Basic probe with inbuilt x1/x10 switch, 1.5 metres of cable, complete with coax type CRO connector and wandering earth lead with alligator clip.
Cat Q-1245

WAS $35.50
$29.95

PLESSEY FOSTER SPEAKERS

Famous brand Plessey Foster Speakers at a ridiculous bargain price ! Huge scoop purchase of distressed stock... you reap the benefit 8 ohms impedance, handles 6 watts. Fantastic replacement, ideal for new projects too.
Cat C-2050

SCOOP **$4.95**

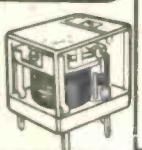
27 MHz TX / RX TESTER

This tester has been specially developed for the servicemen to facilitate the location of faults in hand held transceivers, etc. It can also be used on base stations up to 5 watts.

$69.50

FEATURES:
● Measure power output up to 5W ● Standing Wave Ratio, VSWR from 1:1 to 1:3 ● Modulation percentage 0-100% ● Relative field strength ● Generate 27MHz RF for receiver tuning ● Check crystal activity ● Generate af modulated 27MHz ● Generate a 100Hz signal for audio testing ● Act as a dummy load for testing transmitters up to 5W.
Cat Q-1380

Miniature Relay



Small in size , but very handy contact rating. The silver plated SPDT contacts will handle up to a massive 2 amps (at 24V DC or 100V AC). Nominally 8 to 12V operating, but will work OK up to 15 volts.
Cat S-7120

$2.25

NEON BULB

Small pigtail type neon bulb as used in indicators timing circuits, oscillators, etc, etc. Striking voltage 70-90 volts at 600 uA. For 240V operation use 270k 1/4w resistor (other voltages can be worked out from Ohm's law.)
Cat S-3862

40¢ 10 up 35c

SPST LAMP SWITCH

Has many many uses but is ideally suited to replacement of desk light switches.
Cat S-1205

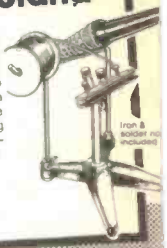
$1.40

DPDT SWITCH

Body 13mm x 13mm, clearance 17.5mm.
Cat S-1174
10 up $1.95

$2.45

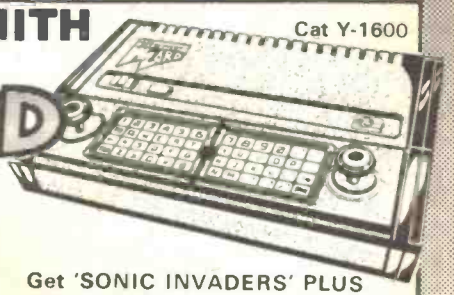
Multi Purpose Stand



● Holds boards and components firmly in rubber faced vyce ● Angle of vyce may be varied widely in three dimensions for greatest accessibilty to board ● Convenient soldering iron holder also adjustable ● Adjustable spool holder for solder and desoldering wick ● Ideal for hobbyist or professional ● Leaves both hands free
Cat T-5700

$24.50

BUY A DICK SMITH WIZZARD and Get 3 FREE Cartridges ONLY $295



Cat Y-1600

Get 'SONIC INVADERS' PLUS ANY other 2 games cartridges FREE

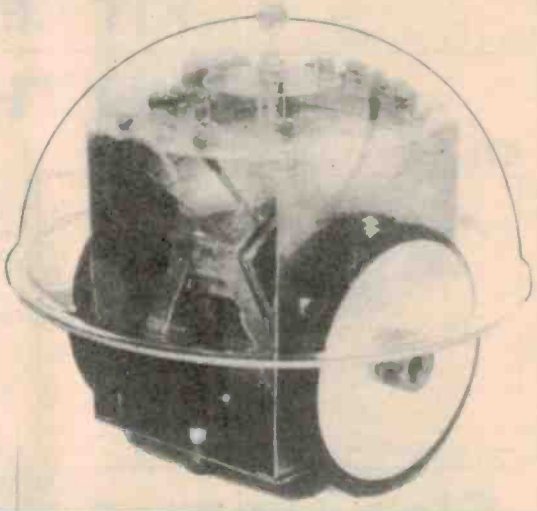
For a limited time only, buy the incredible Dick Smith Wizzard, and receive the popular 'Sonic Invaders' cartridge PLUS any other 2 games cartridges of your choice...FREE!

That's $119.85 worth!

JAYCAR

Robot Turtle Hebot II

The HEBOT II turtle is not just a fun device, it is a positive aid to education, it takes programming out into the real 3 dimensional world instead of the flat two dimensional world of the VDU. When connected to the I/O ports of your computer and given a DC supply of 9–15V the turtle runs around under computer control moving forwards, backwards, right and left with independent control of each wheel, it has blinking eyes, will bleep with a choice of two tones and when ordered by the computer, presses down a pen to chart its progress and provide hard copy of the results of the program. When set free to run around the turtle discovers its enviroment. When the turtles shell bumps into an unmovable obstacle touch sensors send back data to the computer for it to calculate evasive or exploratory action.
If the computer has no I/O ports it doubtless has an expansion bus and the turtle can be controlled and listened to using this bus together with the universal computer interface board. This board enables the turtle to be treated as a memory mapped I/O device.



COMPLETE "HEBOT II" KIT INCLUDING ALL HARDWARE, DOME, WHEELS etc. Cat XR1020

$399 inc tax

Brand new

UNIVERSAL INTERFACE CARD KIT Cat. XR1022

Clue M-S-T-RM-N-D **$39.50**

Digital Delay Line KIT

400ms VERSION

ONLY **$449** COMPLETE

The Digital Delay Line is designed to produce a huge variety of electronic effects. It works very well but the amazing thing is the low, low price!
The effects depend on the time delay selected and some of those included are: Phasing, Flanging, Chorous, ADT (Automatic Double Tracking), Echo, and Vibrato. The delay time can be varied from 0.32ms to 1.6 seconds! Because the signal is stored in digital form there is, unlike analog systems, no degeneration of the signal with time and unlimited repetition is provided by use of the Freeze control.
All the controls mount directly upon PCB's to eliminate wiring and to further simplify construction the main board is 'plated-through' i.e. there are no wire links or link-through pins. The whole of the memory whether for the basic 400ms machine or the fully expanded 1.6 second model all fits on the main board. The cabinet, which is free standing but also suitable for 19" rack mounting, is fully finished to a very high standard. The panel is deep blue whilst the cover is sprayed with a durable black enamel. The kit is available right now from Jaycar at only $449 – compare that with inferior units that can cost over $2,000!!
Cat. KJ6621 $449

BRILLIANT!!!

New range of Super-Bright LEDs! Due to the incredible demand for our 200mCd super-bright LED, we have increased the range available. Now you can get super-bright in green & yellow as well as a new massively powerful 500mCd red! This new red LED will give you 500mCd @ 20mA or -wait for it - ONE CANDELA of light at 40mA! Remember, a typical 15 cent 5mm red LED gives only 1.8mCd at 20mA, the difference is staggering!

Cat No.	Description	1-9	10+
ZD1790	200mCd SB Red LED	$ .69	$ .62
ZD1792	500mCd SB Red LED	$2.95	$2.50
ZD1794	80mCd SB Green LED	$ .95	$ .85
ZD1795	160mCd SB Yellow LED	$ .95	$ .85

FM Transmitter Module

We have been working on this one for years!!
Basically we wanted something akin to the $6.50 kit "wireless microphone" transmitter but with greater signal strength and far, far greater frequency stability.
WE NOW HAVE IT!
Basically the (potted) unit measures a small 90 x 22 x 15mm and has connections for power, antenna and input. An AC signal between 20 and 15kHz will modulate the transmitter. The signal can be coded single or multiple frequency tone bursts etc.

FEATURES
- Ultra low noise output (–60dB or better attainable with a suitable tuner)
- Excellent frequency stability
- Not a kit – ready for immediate use
- Connections required
  (a) Power supply or battery
  (b) Antenna
  (c) Audio input
- Full instructions supplied
- Suits any application where a stable low noise FM link is required

SPECIFICATIONS
- Frequency – 88 - 108MHz adjustable
- Useable range – 50 metres
- Supply – 6 to 9V at 20mA
- Input sensitivity – adjustable – maximum 30mV
- Pre-emphasis – 50µ second standard
- Dimensions – 90 x 22 x 15mm (approx)

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codemaster*

Many of you know the clever parlour game that uses coloured tokens to stretch the brain to work out a hidden code in a minimum number of moves.
The people that came up with the game used a descriptive name which no-one else can use. It is a popular game and is well known under this name. Our game is similar to this game but - naturally - its electronic!! And, what's more, you can play against the machine - alone.
Each XM7015 Codemaster measures 140(l)x85(w)x25(d) looks similar to a pocket calculator and runs off a standard 9V cell. Provision is made for a mains adaptor as well.
The Codemaster once sold for $29.50 but Jaycar has made a huge scoop purchase. You save a fortune!
Grab one now for only $4.98
* (For a further clue to the origin of this game read this page carefully)

CMOS SENSATION

Huge scoop buy of the scarce 4026AE device means that you save!
For years the 4026 decade counter/7 segment decoder driver has been one of the most difficult parts to obtain. Jaycar has made a scoop purchase of this device in the "AE" form (we are not certain that it was ever made as a "B" suffix device). It has been largely replaced by the 4426 (which is not an exact equivalent). The 4426 sells for $2.20 and so to does the 4026 when it is available but for JULY only the 4026 price has been slashed. Cat. ZC4026. Prices INCLUDES sales tax.
1 – 9 $1.50 each 10 – 99 $1.25 each 100+ ONLY 99 cents each

SEE JAYCARS OTHER ADS FOR ADDRESS DETAILS

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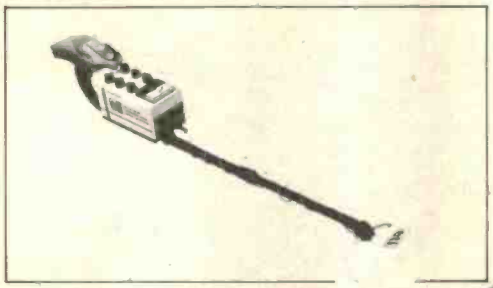

Superb unit featuring:

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- Pre-wound search heads.
- Very professional unit.
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HOUSE ALARM

ETI 582

This complex alarm system is quite easy to construct.
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These are only a few of the many popular kits we have. Call in and see our comprehensive kit catalogue.

IDEAS FOR EXPERIMENTERS

These pages are intended primarily as a source of ideas. As far as reasonably possible all material has been checked for feasibility, component availability etc, but the circuits have not necessarily been built and tested in our laboratory. Because of the nature of the information in this section we cannot enter into any correspondence about any of the circuits, nor can we produce constructional details.

Modification of the ETI-330 car alarm

Noel Nelson of Christchurch New Zealand wrote that he found the ETI-330 excellent except for one flaw.
If an inside switch was used to turn the unit on and off one could get in the car, shut the door and not trigger the alarm because the inside light would be extinguished and C1 would no longer be charging.

So I added a courtesy light extender (Figure 1) which holds the light on for about three seconds after the door is shut. This simply wires straight across the door switch and can easily be concealed in the roof lining above the courtesy light. Q1 doesn't dissipate much heat as it is only on for three or four seconds. (This circuit is not an original.)

The exit delay then needed to be extended; this was simply done with a 555 timer and a PNP transistor. See Figure 2. This also means that you don't have to make such a hurried exit when you're carrying armfuls of shopping.

I also wanted to fit switches under the bonnet and in the petrol cap but didn't want any delay in the tripping of the alarm (so the battery lead couldn't be cut). The modification shown in Figure 3 requires 12 V, from anywhere in the car, to be switched to a common 'instant trip' wire.

The exit delay and instant trip circuits were easily placed on the same size pc board beside Q3 and IC3 respectively.

After having a set of driving lights stolen, I designed Figure 4 for protecting their replacements. The circuit uses the earth path through the lights to hold the non-inverting input of a 741 low. When either the earth path or the 12 V line to the lamp is cut, the 741 changes output state (to 12 V) and is used to trigger the instant trip facility.

The 741 and associated circuitry have no effect on the lights or the alarm sensitivity.

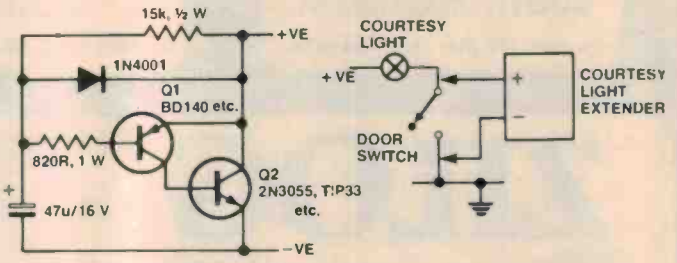


Figure 1. Courtesy light extender.

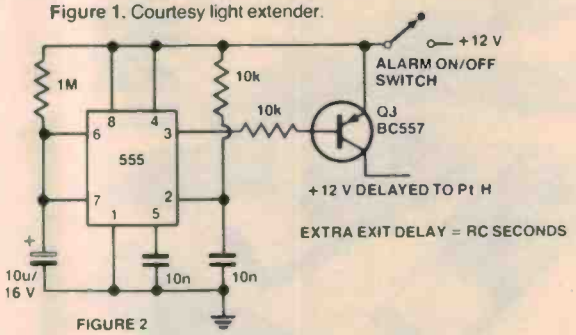


Figure 2. Alarm exit delay.

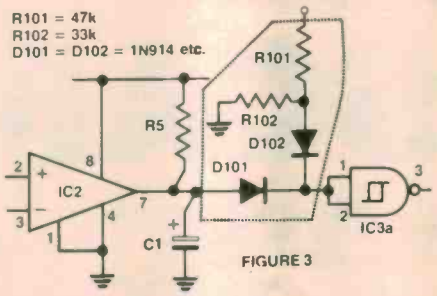


Figure 3. Instant trip modification.

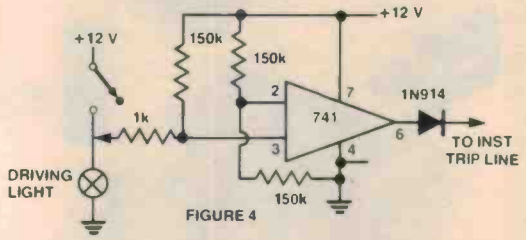
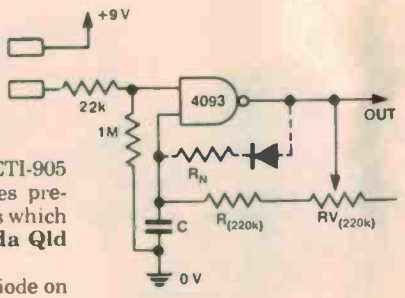


Figure 4. Driving light protector. Two are needed for two lights if double pole relay contacts are used.

Rich harmonics for ETI-905



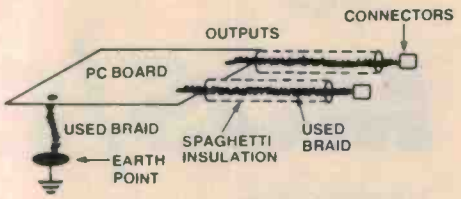
The original circuit for the ETI-905 polyphonic organ produces predominately odd harmonics which **P.M. Connor of Kuranda Qld** found a bit boring.

An extra resistor and diode on each oscillator are all that is required to make the mark/space ratio uneven, producing a rich range of even as well as odd harmonics.

The exact mark/space ratio chosen is a matter of taste, but about five to one is reasonable.

The new circuit is shown with the added components dotted in.

If the new mark/space ratio is to be 5:1, R_N should be about 47k and the value of C should be approximately doubled to achieve the same note.



Reuse spent solder braid

Don't throw away those used pieces of 'Solder Blotter' or other brands of desolder braid. **Peter Alter of Glen Iris Victoria** has found that it is an excellent, very low resistance conductor.

It can be used as an earth strap from circuit boards and connectors to the chassis or central earth point. Covered by spaghetti or heat shrink tubing, it makes an ideal low impedance lead for power supplies and amplifiers etc.

It has much lower resistance than hook-up wire, doesn't cost anything, and being rigid makes a good supporting strengthener for the pc board.

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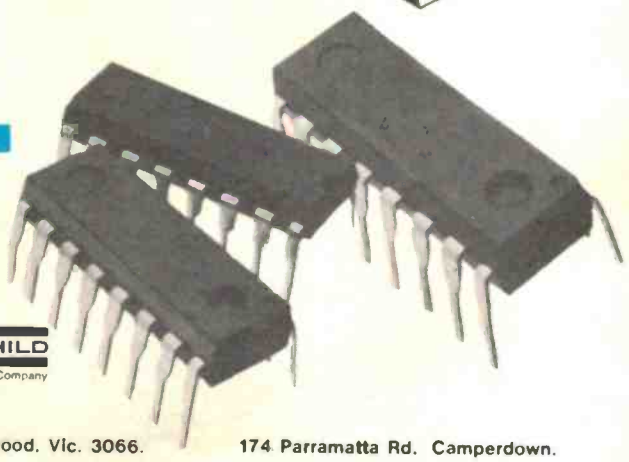

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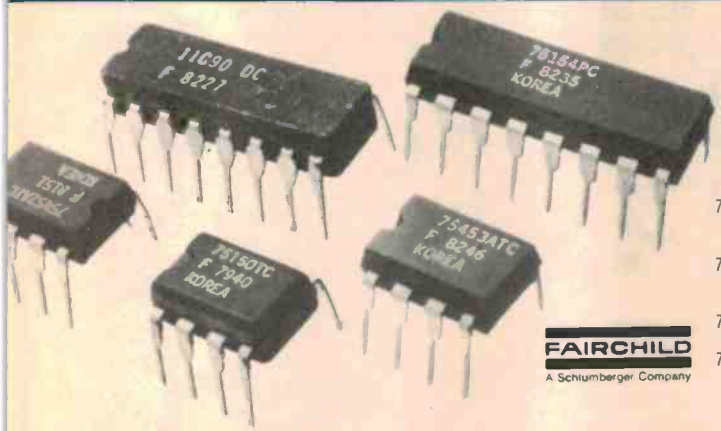

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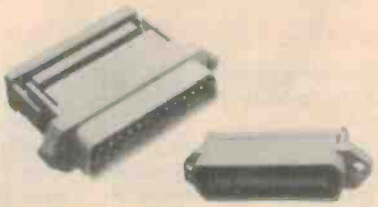

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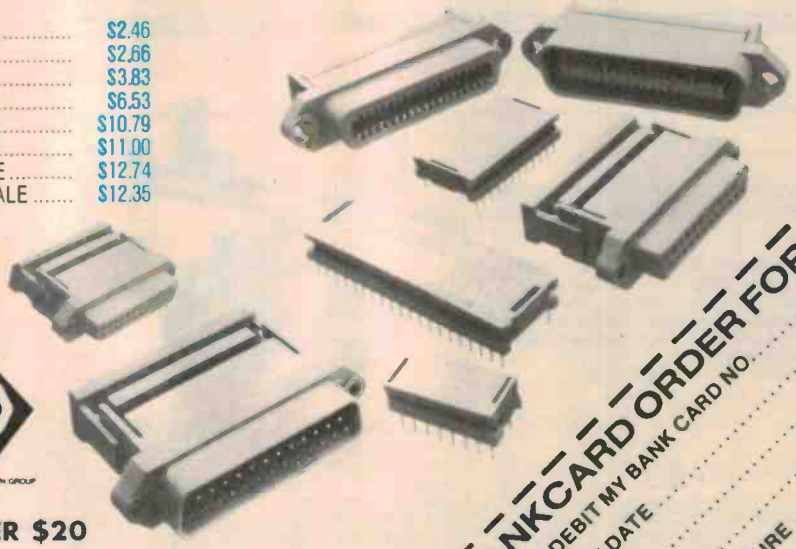

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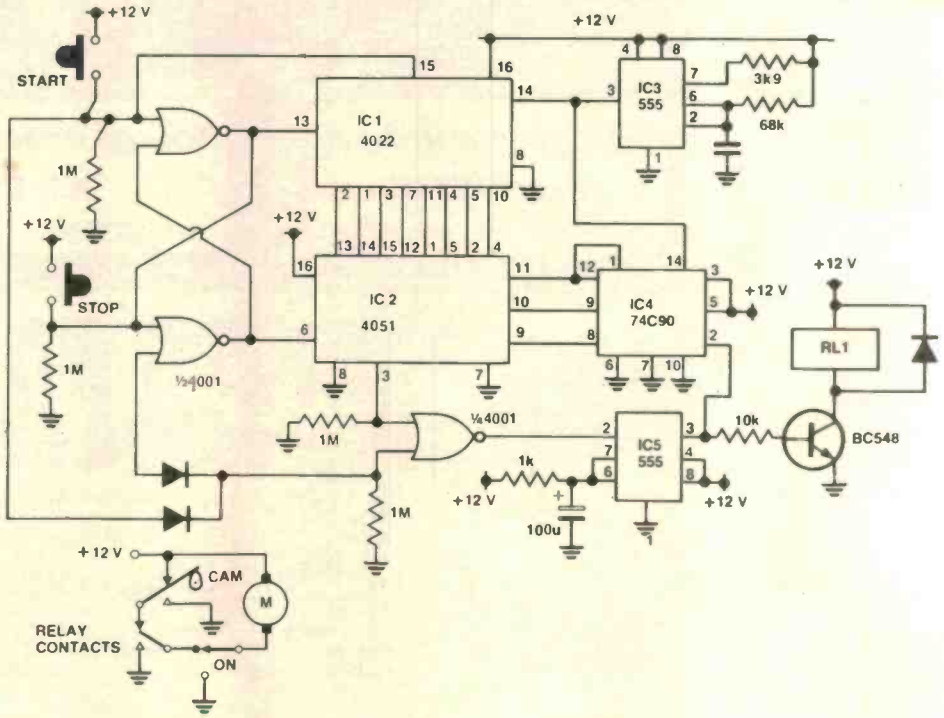
IDEA OF THE MONTH



Pushbutton wiper delay

Patricia Vandermost, East Brighton Vic.

This circuit is designed to pulse a relay to initiate the wipe sequence.

IC3 is connected as an astable to advance the Johnson counter IC1 and the decade counter IC4.

IC4 is used to address the multiplexer IC2. IC5 is connected as a monostable to give a short pulse when triggered.

When the 'start' button is pressed the flip-flop will reset, enabling IC1 and disabling IC2. This will also trigger IC5 and pulse the relay, initiating a wipe. A momentary reset will also be applied to IC1.

The outputs of IC1 will begin to go high in turn (every two to three seconds) from one to eight until the 'stop' button is pressed. This will set the flip-flop, disabling IC1 and enabling IC2. IC5 will be triggered and another wipe will be initiated.

The pulse will also reset IC4. IC4 will continue to count up from zero until the output of IC2 reaches the high output on IC1.

IC5 will then trigger again, initiating a wipe and resetting IC4.

This programmed time interval will continue until the 'start' button is pressed again to either increase or decrease time between wipes.

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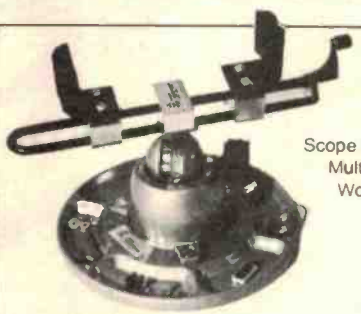

Scope Panavise Multi-purpose Work Centre.

Scope Laboratories, who manufacture and distribute soldering irons and accessory tools, have offered to sponsor a contest with a prize to be 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. Each month we will be giving away a Scope Panavise Multi-purpose Work Centre, Model 376/300/312, comprising a self-centering head (376), standard base (300) and tray base mount (312), all worth about $90! Selections will be made at the sole discretion of the editorial staff of ETI Magazine. Apart from the prize, each winner will be paid $10 for the item published. You must submit original ideas of circuits which have not previously been published. You may send as many entries as you wish.

RULES

This contest is open to all persons normally resident in Australia with the exception of members of the staff of Scope Laboratories, Federal Publishing Company Proprietry 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 prior to and including the date of the last day of the month.

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

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.

Contestants must enter their names and address 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.

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Replacement Tips:		
Medium Chisel	Cat T-2002	$3.20
Thick Chisel	Cat T2004	$3.20
Fine Conical	Cat T-2006	$3.20
Replacement Sponge: Cat T-2010		$1.50

MULTITAP TRANSFORMER

Cat M-2155 **$5.90**

Primary: 240V, 50Hz
Secondary Voltage 6.3 7.3 8.5 9.5 12 & 15V.
Secondary Current: 1 Amp
Terminations: Solder Lugs

CANNON PLUGS & SOCKETS

3 PIN LINE SOCKET P-1620	$4.95
3 PIN PANEL PLUG P-1622	$3.75
3 PIN LINE PLUG P-1624	$3.75
3 PIN PANEL SOCKET P-1626	$4.20

NEON TESTER SCREWDRIVER

Standard flat blade screwdriver, with neon indicator to warn of dangerous voltages. Cat T-4005 **$1.20**

FUSE HOLDERS

INLINE HOLDER (3AG)

Suits 3AG fuses, complete with 600mm lead at no extra charge. Spring loaded for sure connection.
Cat S-4277 **90¢**

SAFETY FUSE HOLDER (3AG)

This is a professional looking black square panel mounting fuse holder with a coloured 'push-in' insert. The fuse carrying insert is released at the touch of a screwdriver for easy replacement of blown fuses. Gives projects a modern finish.
Cat S-4204 **$1.15**

TOP VALUE HEATSINKS

Powerfin for TO-3

It has a unique fin design that gives a very high air to metal ratio (thermal rating approx. 5 degrees C/Watt). Measures only 50mm square x 25mm high, pre-punched to suit TO-3 case.
Cat H-3400 **$1.95**
10 up $1.80

Round TO-5

Manufactured to exacting tolerances to ensure a snug fit and best possible heat transfer on TO-5 cases.
Cat H-3412 **55¢**
10 up 50¢

Heatsink Clip Set

Spring loaded, plier grip clips for heat sensitive components and leads. Made of aluminium for high thermal conductivity. 2 types, one straight and one angled, both 75mm long.
T-2620 **$1.60**

Extra heavy duty Powerfin Heatsink

The big one! For when you've got to get rid of a lot of heat. Huge 725mm long, radial fan pattern for optimum efficiency.
Cat H-3426 **$9.75**

Versatile Power Heatsink

Mount it either flat on a panel, or at right angles. The side fins have a tongue and groove so they may be joined sideways. Drilled takes 2 x TO-3's. Size is (mm) 78 x 110 x 33
Cat H-3460 **$5.75**

Flag Type

Flag type heatsink suits older style germanium transistors (TO-1) OC74, AC128, etc.
Cat H-3480 **20¢**

FANTASTIC VALUE

FLASHING LEDS

Amazing! Inside this standard size (5mm) Red LED is a tiny microcircuit which causes it to flash! All you do apply voltage. Think of the dozens of applications where a flashing warning is needed. WAS 45c NOW **35¢**
Cat Z-4000
Ask for FREE Flashing Led Data Sheet containing circuit ideas PLUS specifications!

DICK SMITH ALKALINE LONGLIFE BATTERY

At last! An alkaline long life battery you don't have to pay the earth for! Dicks' own long life-quality made in Japan, and guaranteed 'fresh as a daisy'! At present only size available is AA (penlight), but we hope to introduce more sizes shortly. Come in blister packs of two batteries.
Cat S-3281 **$1.75**

ROCKER SWITCHES

ILLUMINATED DPDT (240V Neon lamp)

Positive action, handsome black body, bright red illuminating rocker switches, 15 amps! The terminating lugs on the switch will accept standard utilux spade clips. Mounting is push in snap lock.
Cat S-1506 **ONLY $2.95**

ILLUMINATED SPDT (240V Neon lamp)

Attractive oblong shape black switch with red illuminating rocker. Terminal lugs accept Utilux spade quick connectors. Mounting is snap lock.
Cat S-1503 **NOW $3.50**

DICK SMITH ELECTRONICS

WELCOME

Welcome to 'Scanners' World'. If you're interested in the exciting new hobby of scanning, then this column is for you.

Got anything interesting to report? — then we'd like to hear from you. Heard any interesting DX (long distance reception)? Tell others about it — date, time, frequency, location, etc. Found a new and interesting channel? — other scanners would like to know.

Importers/distributors/retailers — readers would like to know about your products. Everything the scanning enthuslast needs — from the scanners themselves to antennas, mod. kits, rotators, whatever.

Send all information to: **The Editor, 'Scanners' World', ETI Magazine, P.O. Box 21, Waterloo NSW 2017.**

SYDNEY AIR TRAFFIC

The AM Aircraft Band around 120-130 MHz is not the only place to hear aircraft traffic, according to a contribution from a reader identified as Bob from Sydney. There's plenty to hear around 450-470 MHz, apparently. Try these channels:

454.175 MHz	FM	Ansett
454.700 MHz	FM	Ansett
463.150 MHz	FM	UTA Airlines
463.400 MHz	FM	Singapore Airlines
465.300 MHz	FM	Pan Am
465.825 MHz	FM	Thai Airlines
468.355 MHz	FM	TAA

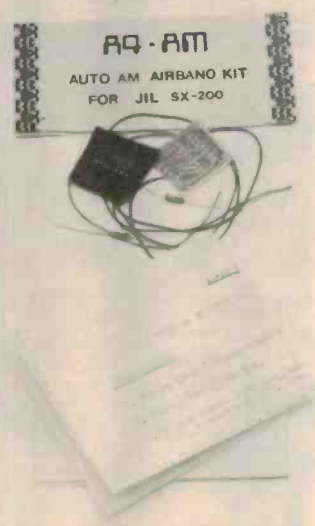
Auto-AM operation for the SX-200 scanner

A simple, low cost modification kit provides automatic AM operation for the popular J.I.L. SX-200 scanner on the VHF aircraft and 27 MHz CB bands.

The kit comprises a small printed circuit board, an IC, two resistors, wire and instructions. Assembly, installation and wiring up are a breeze, following the clear step-by-step instructions.

Known as the "A4-AM Kit", it is sold by the SX-200 importers, GFS Electronic Imports. When installed, operation is quite simple. With the AM/FM switch in the FM position, the SX-200 will operate in the FM reception mode on all bands except for the 27 MHz marine and CB channels and the 108-140 MHz VHF band, for which it will automatically operate in the AM mode.

The A4-AM kit costs $32 and is obtainable from **GFS Electronic Imports, 15 McKeon Rd, Mitcham Vic. 3132. (3)873-3939.**



MELBOURNE MARITIME

You can find some pretty interesting 'traffic' on-air from time to time around the bay area. The following list is courtesy of G.F.S. Electronic Imports.

155.100 MHz	FM	Sorrento & etc rescue squads
155.125 MHz	FM	Elwood Life Saving Club
155.195 MHz	FM	Westernport Safety Council
156.375 MHz	FM	Marine weather & working chnl
156.675 MHz	FM	Marine weather & working chnl
156.800 MHz	FM	Marine distress & general calling
415.415 MHz	FM	Port emergency
415.475 MHz	FM	Port emergency
416.075 MHz	FM	Port emergency

Antenna rotator from Imark

The Alinco EMR-400 medium duty antenna rotator, available from Imark Pty Ltd, is designed for light to medium duty operation and is ideal for VHF and UHF antennas.

It is sturdily constructed with Melamin-coated diecast aluminium and is waterproof. Noise and wear is reduced by the use of tempered low speed gears and Duracon moulded high speed gears. A total of 94 ball bearings are used to distribute the load evenly and to ensure smooth operation and longevity.

Rotation of 360°, +5°-0°, is provided, limited by a mechanical stopper. The two-piece adjustable clamp permits perfect centering and both pieces are grooved to ensure maximum mast grip. All stainless steel screws are used to prevent rust.

The control box provides the 24 Vac power source for the rotator and has a large, easy to read lighted azimuth meter which is calibrated in degrees either side of North. Left or right rotation is controlled by the 'easy action' paddle switch. Rotation time is 60 seconds for 360°.

Further details are available from **Imark Pty Ltd, 167 Roden Street, West Melbourne Vic. 3003. (03)329-5433.**

SIGNALS FROM SOUTH AUSTRALIA

This month we have a contribution from **P.D. Crompton** at Murray Bridge in S.A. who uses an SX-200 with a multitude of antennas, including 62 and 75 MHz quarterwave groundplanes.

Being only about 30 km from Adelaide, he receives city base stations quite regularly. On **73.225 MHz** he reports stations signing 'Wentworth base' and 'Renmark base' talking to outstations, both bases and mobiles using the callsign 'river'.

Mr Crompton also caught a 'sports programme' on **166.360 MHz**, which turned out to be Channel 10, after 2.20 am local time — when all the TV stations were off the air!

OK all you scanning enthusiasts out there, how about some more contributions? Just write all the details down and post to: **The Editor, Scanners' World, ETI Magazine, P.O. Box 21, Waterloo, NSW 2071.** ●

TO THE ELECTRONICALLY MINDED. (Professionals, Hobbyists, Students & Enthusiasts.)

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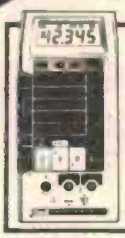
For over 40 years Radio Despatch Service has been serving the electronics industry. Our team of sales personnel can assist you with your requirements. We carry an extensive range of components, switches, batteries, connectors . . . and the popular Texas Instruments Home Computer & Software.



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- FLUKE

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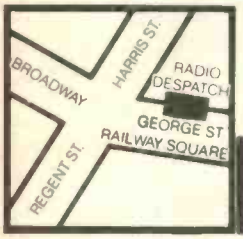

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Standard as shown.
Centre Height - 50mm.
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Cast Iron Bed. Options -
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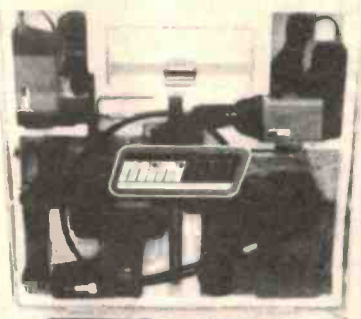
Taper Turning, Screw Cut, etc.

MD-1H — 2 SPEED
8000 — 12000 R.P.M.

$198.00 + S/Tax
Incl. Vice & Chuck.

TOYO **MINI DRILL**
240 V AC.
SECV Appr.
MD-1 — 6 SPEED
850 — 3100 R.P.M.

WORKSHOP KIT $200.00
000.62.90X - Carry case. Power supply, Pistol drill, Drill stand, Orbital sander, Jigsaw, flexible Shaft unit, spare Blades, Table clamp, Platform table.



DRILL STAND
000.62.493 $39.22
Accepts Pistol Drill & Angle Grinder.

PISTOL DRILL
000.62.402
7,000 R.P.M.
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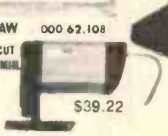
0 to 6.5mm.

ANGLE GRINDER IN DRILL STAND

Circ. Sawblades for Wood & Metal available.

ORBITAL SANDER
000.62.206
5000 R/MIN.
$39.22



JIG SAW 000.62.108
10mm CUT
5,000 R/MIN.
$39.22

Gravilo
Self contained hand engraver
18000 R.P.M 12V DC $30.74
Engraving points for glass, metal ceramic & plastics available also patterns.

FLEXIBLE SHAFT & GRIND STICK
000.62.804
7,000 R.P.M.
$47.70

Platform Table inc. in Kit. Extra as individual item.

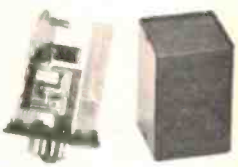
Jigsaw Workbench
100.62.153 $5.00

000.62.251
2 Speed PISTOL DRILL.
TORQUE + $47.00

POWER SUPPLY 240V
000.62.608 12V.1A.
$17.40

NEW!!

NEW!!



MODULE CASES

80mm H. x 50mm Sq.
With 8 Pin (Octal) Base $4.55
With 11 Pin Base - $4.65
Power Supply G.P. P.C.B. $3.20
General Purpose P.C.B. - $3.20
240V-24V AC 1VA Trans. $5.87
Relay - 10A 240V Contacts
24V DC Coil C/O - $6.30

Board Connectors Pins, Sockets & Components available.

CIGAR LIGHTER ADAPTOR AVAILABLE: 000-62-073 $6.44

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2 metre transceivers . . . below cost!!!

Unbelievable! If you want a top quality Yaesu transceiver, here's your chance to grab a real bargain! Last few left in stock are actually BELOW COST! Hurry – they won't last long at these crazy prices!

FT227 RB

One of the most popular two metre transceivers ever made. Ten watts output, ideal for working around the city (great with repeaters!) and has four memory channels to choose from (in addition to the PLL scanner). Originally $379... Here's your chance to get into two metres really cheaply.
Cat D-2891

Very limited stock
First come – first served!

WAS ~~$379~~

NOW ONLY **$260**

FT720 RVH

25 watts output with full PLL 144-148MHz band coverage. Sneaky design can 'split apart' for room problems. Sold for $450 back in 1982 ... look at the price now!
Cat D-2890

WAS ~~$345~~

NOW ONLY **$275**

SAVE $$$ ON THE 101 'FM'

The last of the fabulous '101's – the transceivers that made Yaesu famous with amateurs! Full 160 to 10 metre band coverage (WARC) and this one has an FM board – great for 10m or transverting. Cat D-2872

SPECIFICATIONS:
- Frequency coverage: 160, 80, 40, 30, 20, 17, 15, 12 and 10m.
- Modes of operation: FM, LSB, USB, CW.
- Input Power: 180W DC (SSB/CW) 50W DC (AM).
- Sensitivity: 0.25uV for 10dBS/N (SSB/CW) 0.4uV (AM)
- Selectivity: 2.4kHz (-6dB) 4.0kHz (-60dB).
- Operating Voltage: 100 – 240V AC (13.5V with optional conv.).

WAS ~~$825~~

NOW ONLY **$765**

HURRY – VERY LIMITED STOCK NEVER-TO-BE-REPEATED PRICES!

Colour Computer

the incredible DICK SMITH VZ-200 Personal Colour Computer

Here it is at last – the breakthrough you've been waiting for! A personal colour computer with all the right features: colour graphics, sound, standard Microsoft BASIC for easy programming, a whopping 8K bytes of RAM memory, the ability to work with a standard TV set, and much more. Yet thanks to modern electronics and our buying power, the Dick Smith VZ-200 will cost you only $199 – far less than any comparable computer!

INCREDIBLE VALUE **$199**

16K MEMORY EXPANSION MODULE: Cat X-7205 $79.00

PRINTER INTERFACE MODULE: Cat X-7210 $49.50

DATA CASSETTE: (Stocks due soon) Cat X-7207 $69.50

Software

A great range of software is now available: Games, Educational and Financial; all for the one low price!

ALL ONE PRICE **$12.50**

DICK SMITH Electronics

THE AUSTRALIAN COMPANY

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Thanks

Dick Smith and Staff

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Kit Support For the Microbee

Altronics' unique combination as Australia's leading kit supplier and also as distributor for the sensational Microbee computer, allows us to present a range of unsurpassed quality kits suitable for use with the Microbee and other Z80 based microcomputers. Rather than just supply "a bag of bits", Altronics constructs the kits we sell and make improvements to ensure that you, the kit constructor have a professionally appearing, correcly functioning unit.

EPROM PROGRAMMER

(ETI JAN. '83)

K9668 ..... **$55.00**

Versatile, low cost and easy to build. Plugs straight into the microbee I/O port. Suitable for 2716, 2732, 2532, 2732A and 2764 Eproms. Burn your games programmes and eliminate cassette loading time.
KIT FEATURES ☆ Sockets for all other IC's ☆ 1 x 2716 supplied — get started straight away ☆ Front Panel and Mains (SEC approved) transformer ☆ 28 pin and 16 pin wire wrap sockets to flush mount personality plugs (2 included) and ZIF socket (included) ☆ DB 15 Plug ☆ Complete to last nut and bolt.

(See Review ETI AUGUST 1983)

RADIOTELETYPE DECODER

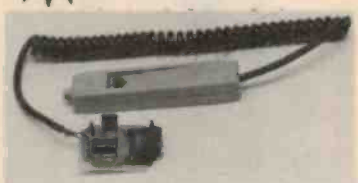
(ETI APRIL '83)

K9733 ..... **$19.50**

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.

NEW MICROBEE LIGHT PEN

(ETI AUGUST '83)



PROVIDES DIRECT PERSONAL CONTACT WITH YOUR BEE!

K9649 ..... **$19.95**

AT LAST — a light pen for the Bee. This pen works in the low-resolution graphics mode and connects directly to the I/O port. ☆ Complete kit including DB15 and backshell, 2m CORD ☆ Fully documented with software examples.

GO ANYWHERE 12-240V POWER

MASSIVE 300 WATTS

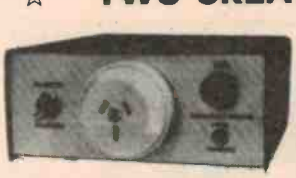
These great inverter kits enable you to power 240V appliances from a 12V DC power source. Tremendous for camping, fishing etc. Install into your Car, Boat or Caravan.

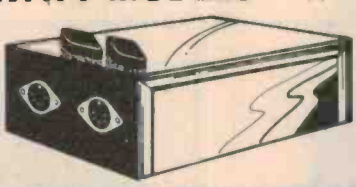
A fully regulated and overload protected design, featuring XTAL locked frequency. Use to power hi-fi, TV sets, even electric drills for short time periods.
MANY OF THESE KITS ARE NOW IN USE FOR EMERGENCY LIGHTING PURPOSES.
ALTRONICS' KIT features ☆ Gold plated edge connector and PCB fuss ☆ Low age rate XTAL ☆ Sockets for all IC's ☆ High Efficiency Transformer.

K6750 ..... (EA JUNE '82) ... **$199.50**

($10 DELIVERY AUSTRALIA WIDE)

☆ TWO GREAT 40 WATT MODELS ☆





GENERAL PURPOSE

Suits small appliances, ie. Turntables, Tape Decks, Shavers etc. Variable frequency adjustment enables speed control of turntables. Works as a trickle charger when mains power is available.
EASY CONSTRUCTION ☆ VALUE PLUS

K6700 ..... **$55.00**

FLUORESCENT LIGHTING

Operates above the audible frequency range and is capable of driving one 40 watt or two 20 watt fluorescent tubes to 150% of their normal 240V efficiency. Install permanently into caravans. **COMPLETE BOXED KIT, INCLUDING ALL WINDING WIRE.**

K6505 ..... **$37.50**

PRESTIGEOUS NEW TOUCH LAMP DIMMER

HALF THE COST OF COMMERCIAL UNITS

Great new kit from EA. (April '83). Based on new Seimens ICS576A Light Dimmer IC.
Instantly turn lamps on and off with just a light touch on a wall panel, or provide mood lighting by touching the panel for a few seconds.
The Altronics kit is complete in every way, including satin silver touch plates for that touch of class.

K6320... (10UP$18.50)... **$19.50**

REMOTE CONTROL FOR K6320

This kit enables extra dimmer/switches to be installed in conjunction with the dimmer kit. Includes satin silver touch plate.

K6321 ..... **ONLY $9.00**

ELECTRONIC FLUORO STARTER

(SEE EA OCT. 1982)

Save a fortune on fluoro Tubes.
- ★ Extends the life of your fluoro tubes by 1,000's of hours.
- ★ Instant "ON" — no more flickering at switch on.

K6300 (10UP$4.50) **$4.95**

• FOR DESPATCH P&P CHARGES AND ADDRESS DETAILS PLEASE REFER TO OUR AD. ON PAGE 83 •

ROD IRVING ELECTRONICS

425 HIGH STREET, NORTHCOTE 3070, MELBOURNE, VICTORIA. Ph (03) 489 8131. Telex No. 38897

THIS MONTHS KITS

ETI-649 LIGHT PEN FOR THE MICROBEE

Another for the 'Bee bugs! This simple, low-cost device just plugs into the parallel port and works on the lo-res graphics.

ETI-336 DWELL METER

Save money and tune-up your own car. This simple to build project can be used on engines with 3-4-5-6-8 or 12 cylinders with the appropriate meter scale.

ETI-268 NICAD FLOAT CHARGER

$9.00 ETI MARCH '83

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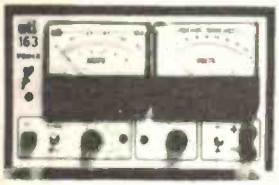

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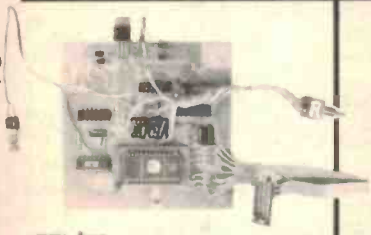

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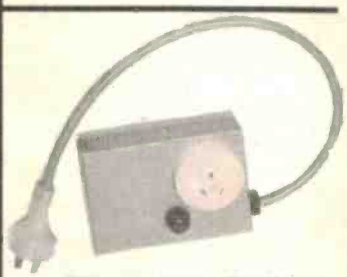

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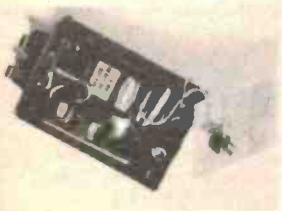

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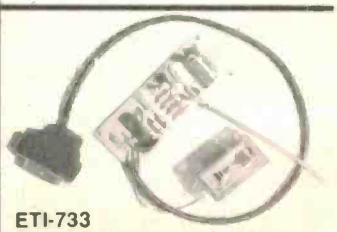

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KITS — KITS — KITS —

NSW Wireless Institute Division enters a 'new era' at Amateur Radio House

The NSW Division of the Wireless Institute of Australia celebrated the official opening of its new headquarters in Parramatta on May 28 after 21 years at its well-known previous quarters at Crows Nest.

The opening was officiated by Mr Gary Punch, MP for Barton, standing in for the Minister for Communications, Mr Neil Duffy. Mr Punch delivered a brief eulogy to the role of amateurs in the historical development of communications and the work of the WIA.

Special guests attending were Mr Stan Dickson, Mayor of Parramatta, Mr John Milton, State Manager (NSW) from the Department of Communications and WIA Federal President, Bruce Bathols, VK3UV.

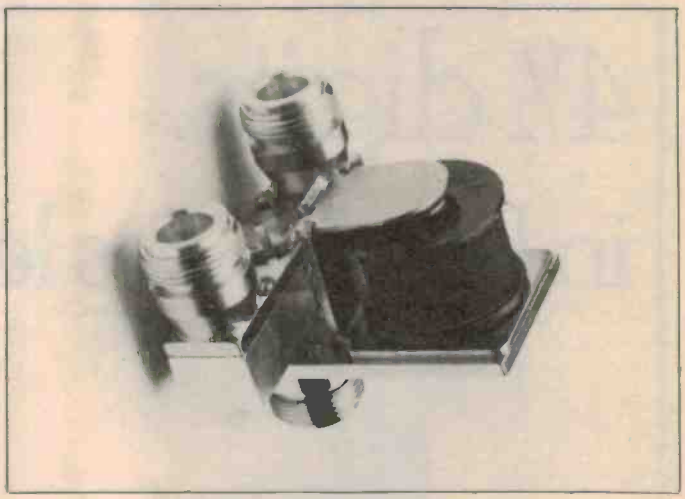
Among invited guests were as many past Divisional Presidents as could be mustered, as well as past and present office bearers. The speech in reply was given by current Divisional President, Sue Brown, VK2BSB. Some 150 members, wives and friends attended.

The whole event was 'covered' on amateur television (in living colour), broadcast live on 426MHz courtesy of Dick Norman VK2BDN and Geoff Campbell VK2ZQC.

Amateur Radio House is located at **109 Wigram St, Parramatta NSW 2150 (P.O. Box 1066)**. It consists of two stories and includes a spacious library reading room, an activities room, offices, storage and the station of VK2BWI. The Division's main transmitting facilities are located at Dural.

New JRC commercial receiver

Applications in the maritime mobile, land mobile, aeronautical, point-to-point and monitoring services are predicted for JRC's new NRD-95 commercial receiver.



All the local frequencies in the receiver are supplied from the fine-step synthesizer, phase locked with a highly stabilised reference crystal oscillator of 10 MHz. Any receiving frequency from 90 KHz to 29.9 MHz is designated and displayed in 10 Hz steps.

A fine-step clarifier control with digital readout enables the operator to tune the receiving frequency in 1 Hz steps.

The receiver features tunable input filters, which suppress intermodulation effects and provide high effective sensitivity in the crowded HF communications bands.

The microprocessor incorporated into the unit allows flexibility of operation, such as remote control, internal preset channels and pass-band shift.

For further information, contact **Vicom International, 57 City Road, South Melbourne Vic. 3205. (03)62-6931.**

High-spec coaxial relay switch

Toyo Tsusho's new coaxial relay switch, the CX-520-D, is a high-specification switch for use with antenna feedline systems up to frequencies of 2500 MHz.

The CX-250-D will handle 1 kW up to 30 MHz and 300 W up to 1000 MHz. The magnetic switch is operated by low-voltage DC (12 V nominal) and draws only 160 mA at 12 dc. Switching time is less than 20 mc.

The unit features low insertion loss, better than 50 dB isolation at 1000 MHz, and has a circuit impedance of 50 ohms.

Its dimensions are 53 mm wide, 53 mm deep and 50 mm high, and the weight is 200 g. The operational temperature range is −50°C to +70°C.

For further details, contact the importer, **Imark, 167 Roden Street, West Melbourne Vic. 3003. (03)329-5433.** ▶

Communications NEWS

High-power 30 MHz transistor

Motorola's range of RF components has been boosted with the addition of the MRF448, a 250 W NPN transistor which is believed to be the highest power device available at this frequency.

Intended for operation in the 30 MHz band with a 50 V supply, the MRF448 features 14 dB(typ) of gain, 65% efficiency and intermodulation distortion of 33 dB(typ).

The MTF448 is designed primarily for high-voltage applications in linear amplifiers, and is suitable for marine and base-station equipment.

For more information, contact **Motorola Semiconductor Products, 250 Pacific Highway, Crow's Nest NSW 2065. (02)438-1955.**

AEA's South Australian agent

Melbourne-based Antenna Engineering Australia has named Titan Electronics as the distributor of AEA products in South Australia.

The full range of the AEA antennas and clamps will be carried by **Titan Electronics**, which is located at **170 Magill Road, Norwood SA 5067. (08)42-4955.**

Marine VHF for under $400

At $399, the new Dick Smith VHF marine transceiver is claimed to be the lowest priced small-ships VHF transceiver available in Australia.

Designated Model D-1401, the transceiver is of all solid-state design, and has been endorsed by the Overseas Telecommunications Commission (OTC) to be used with its new Sealink service, which is linked to the normal telephone network.

The unit has all 55 international VHF marine channels fitted in the 156 to 163 MHz marine band.

It is supplied with mounting brackets, microphone, power cable and full instructions. ●

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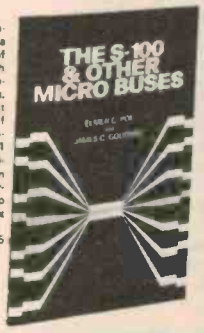

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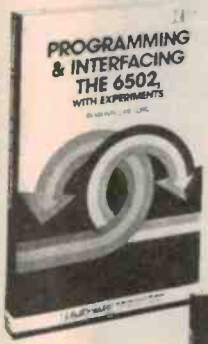

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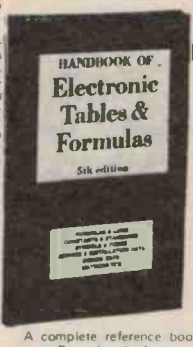

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The 3002 operates on six AA nicad or alkaline batteries or may be powered by an optional AC adapter/charger. A flip-up leg allows you to view the LCD display and operate controls easily while the unit is on a work bench.

In the lab or in the field — the 3002 Autoranging Capacitance Meter will give you portability, convenience and precision.

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DSE/A557/JW

Measuring receiver performance by the SINAD method

By far the best way to measure receiver performance, especially during alignment, is to employ the "signal plus noise and distortion", or SINAD, technique. This article explains the technique and the pitfalls of 'traditional' methods and introduces a newly available instrument to speed the task.

Peter D. Williams
Vicom International

THERE SEEMS TO BE a general lack of appreciation, even carrying through to some at the engineering levels, about the importance of receiver sensitivity degradation in total communications system performance. A lot of it is caused by the fact that receiver sensitivity is specified in microvolts across a given input resistance, while transmitter power is given in watts.

Few service technicians would let a 30 W transceiver out of the shop that only delivered 15 W output. At the same time, many would not consider the sensitivity unduly low if it measured 0.5 microvolts in a set rated at 0.35 microvolts. Bringing the transmitter back to specifications is likely to require replacement of an expensive power transistor, but bringing the receiver back to specifications will usually require nothing more than a little alignment correction.

The typical land-mobile repairman will always measure transmitter power output before a radio leaves the workshop — and managers insist on pretty good accuracy in their RF power meters. Receiver sensitivity measurement, however, is often merely estimated by ear.

Time and money are part of the reason for this neglect. Sensitivity measurements take time and commercial organisations are facing increasing crises in hiring enough skilled technicians to keep up their business. Even those operated by a government entity, or a large company doing their own communications maintenance — are seeing the pinch. But the number of radios to maintain continues to increase faster than the number of technicians required to support them.

SINAD — the most meaningful

It is pretty well acknowledged that the SINAD method is the most meaningful one for measuring FM receiver performance. It has the basic requirements of any good performance measurement: (1) it is repeatable; (2) it is quite insensitive to variations in technique by those making the measurement; and (3) the measurement relates directly to the actual, practical performance of the receiver.

The SINAD measurement is generally accepted by industry. Sensitivity requirements as stated in Department of Communication specifications gives SINAD as the way of stating useful sensitivity. You seldom see the old 20 dB quieting methods in manufacturer's specifications any more, except as back-up to the universally stated "12 dB SINAD".

Let's review the procedure for making a 20 dB quieting measurement on a receiver. The receiver squelch is set "open", and an ac voltmeter is connected to the speaker terminals to read the level of "thermal" noise delivered by the receiver. The volume control is set to obtain a handy reference level on the ac voltmeter (usually 0 dB). An unmodulated (CW) signal on the channel frequency is then introduced at the receiver input and increased in level until the noise output at the loudspeaker drops to one-tenth (20 dB) of its previous level.

The trouble with this method is that it only measures the ability of the receiver to receive a CW signal. A receiver must receive voice-modulated signals if it is to be useful in land-mobile applications. In order to receive a modulated signal, the receiver must have an adequately flat bandwidth to properly receive the components of the modulated signal.

Poor design, component aging or failure, or improper alignment can result in a peaked response that admits the CW signal nicely but will not permit effective reception of the modulated signals. A signal with a peaked response may seem exceptionally good when measured by the 20 dB quieting method.

The SINAD method, on the other hand, provides an unambiguous measure of the ability of a receiver to receive a modulated signal. Unfortunately, this method has the reputation for being a pretty time-consuming procedure.

The SINAD method

To measure sensitivity by the SINAD method, a signal generator is connected to the receiver antenna terminals and set exactly on the channel frequency. (See Figure 1). The generator signal is modulated by a 1000 Hz tone, and the peak modulation deviation is set at 3 kHz (for receivers used in systems with 5 kHz deviation). The receiver volume control is adjusted to deliver the receiver's rated ▶

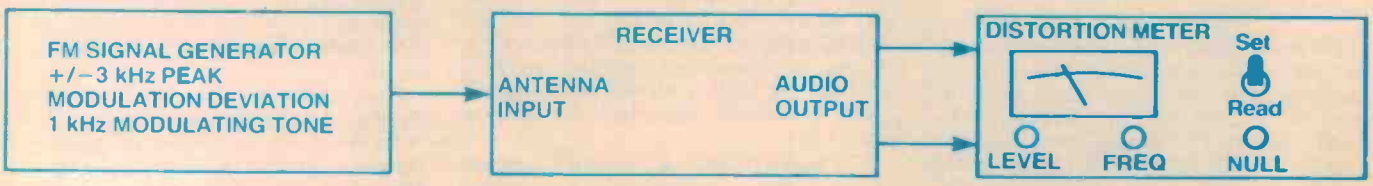
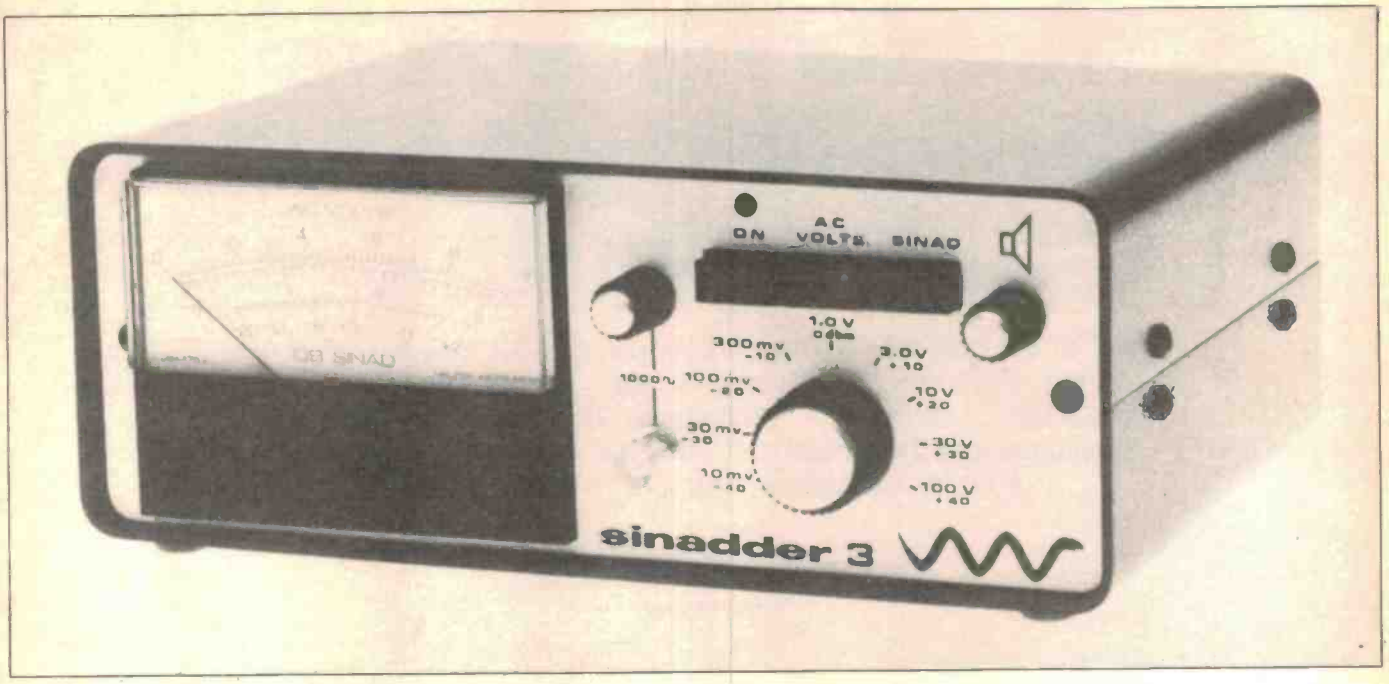


Figure 1. The 'standard' setup for measuring SINAD performance of a receiver.



audio output power, and the distortion meter is connected to the audio output terminals. The distortion meter reference level control is set and the meter is then switched to read distortion. The frequency and null adjustments on the meter are adjusted to null out the 1000 Hz tone. The signal-generator attenuator is then adjusted to obtain a distortion meter reading of 25% (corresponding to 12 dB). The microvolts reading on the signal-generator attenuator is then the "12 dB SINAD sensitivity" of the receiver.

The basis of this procedure is the following: The distortion meter is being used as an audio voltmeter. When the reference level control is being set, the voltmeter is reading all of the components of the audio output of the receiver.

This audio output consists of: (a) the 1000 Hz tone (corresponding to the wanted speech intelligence signal to be received in actual operation); (b) harmonics of the 1000 Hz tone (distortion); and (c) noise — the thermal noise you hear when a weak signal is being received.

When the distortion meter is switched to the "distortion" position, a null circuit filters out the 1000 Hz tone, leaving the distortion products and the noise. The meter is usually calibrated in per cent (%).

When a distortion meter is used as above in a SINAD measurement, it is giving the answer to the following equation:

$$\text{Meter reading (\%)} = \frac{\text{(noise and distortion)} \times 100}{\text{(signal + noise and distortion)}}$$

Distortion meters are usually calibrated in per cent distortion, but SINAD measurements are customarily stated in decibels. A 25% reading corresponds to 12 dB, and a 10% reading corresponds to 20 dB. The 12 dB SINAD sensitivity is almost universally used. This 12 dB level is especially appropriate for land-mobile receivers because incoming signals become usefully understandable at levels above about 12 dB SINAD. That is, 12 dB SINAD represents a minimum for an intelligible signal.

As you can see, SINAD measurement can be time-consuming. Most workshops that use SINAD measurement don't worry about adjusting the receiver to its rated audio output. This is a justifiable shortcut, because the audio distortion in any decent audio system will make a minor change in the measurement. Even with this time saving, however, there is still a lot of knob twiddling to do. One problem is that the total output of the receiver may vary somewhat at low signal levels, making it necessary to check or reset the reference level control several times during a measurement.

Knob twiddling removed

An instrument is now available which removes the knob twiddling and has a meter reading directly in SINAD. A very stable active notch filter preset at 1 kHz (by EIA definition, the SINAD test frequency) is internally provided to eliminate frequency and null controls. A tight AGC circuit permits the instrument to operate over an input voltage range of from 30 millivolts RMS to over 4 V RMS while maintaining a constant reference level, thus eliminating the level set control and reference-distortion switch. This leaves an on-off switch as the only control on the panel. The unit draws less than 5 W and can be left on indefinitely. To measure SINAD with this instrument, all you have to do is connect it to the receiver loudspeaker leads and feed a measured, 1 kHz modulated signal into the receiver front end.

The 'SINADDER', as it is called, is made by the Helper Instrument Co. and proves to be just as much of a time saver as expected. Figure 2 shows the procedure for measuring 12 dB SINAD sensitivity using the instrument. Assuming a 3.2 ohm loudspeaker, the meter will read correctly from a receiver output level of a quarter of a milliwatt to over five watts. That is plenty of range when you consider that the lower level would be hard to hear and the higher level would probably drive everybody out!

As an alignment aid

Although the instrument was designed to measure SINAD sensitivity, it is also a tremendous alignment aid. It is this use that should make it popular in a lot of service shops. Typical alignment procedures for FM receivers consist of dc metering at specified meter points. Usually a weak signal is injected and the alignment adjustments are made to maximize the meter readings. Alignment "by-the-meter" as most technicians know, is not always the optimum alignment.

These by-the-meter procedures give the alignment for maximum gain of the various stages, but this is not necessarily the alignment for optimum signal-to-noise performance. It is often possible to improve on a by-the-meter alignment by touching up a few of the adjustments in the front end for optimum signal-to-noise.

Although a few of the old hands can get good results doing this touchup by ear, the SINADDER makes the touch-up procedure really practical — and fast! By retuning for optimum SINAD, it is almost always possible to squeeze a decibel or so extra sensitivity out of a receiver, and a 3-to-5 dB improvement is not at all unusual.

The automatic reference level control circuits in the SINADDER make the "alignment for best SINAD" procedure possible. After the receiver is roughly aligned by the usual methods, the signal generator is set to provide a 1 kHz

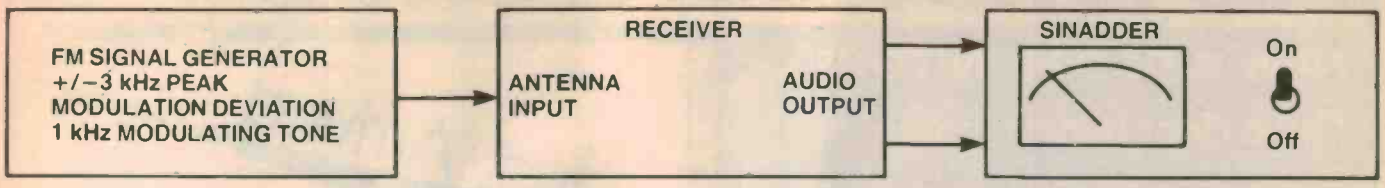


Figure 2. Using the 'Sinadder 3'. Note that there are no adjustments to make on the Sinadder, hence 'knob twiddling' is removed.

modulated signal of the correct deviation and the alignment adjustments are touched up to obtain minimum deflection on the SINADDER meter.

As the procedure progresses, the signal generator is backed off to keep the SINAD reading at about 12 dB. This procedure avoids the peaked response that often occurs in the ordinary meter-tuning methods. It results in a better bandpass alignment of overcoupled circuits and crystal filters than is obtained with the ordinary limiter-meter procedures.

"Needle nose" aligning

One of the recurring problems in connection with receiver alignment concerns the occasional receiver that ends up with a "needle nose" bandpass. This can be caused by faulty receiver design, or by aging of bypass components, or a host of other reasons. Although it would be best to get truly to the bottom of the problem, the pressure of time often makes it necessary to get on the next job, and it is usually possible to arrive at an alignment adjustment that results in normal performance.

If the alignment of one of those "needle nose" jobs is touched up for optimum SINAD, normal performance can often be achieved. This procedure is aided if the modulation deviation on the signal generator is set at about 5 kHz instead of the 3 kHz that would be used for a SINAD measurement.

Modern receivers are making increasing use of quartz crystal filters. Sometimes these have tuning or matching adjustments associated with them. In general, they cannot be tuned by the usual adjustment for maximum limiter current. Some manufacturers specify a procedure that requires a sweep generator and a 'scope'. It takes quite a bit of time just to set up everything for the sweep alignment. It is possible to arrive at proper alignment of these crystal filters with the SINADDER.

Set the signal generator for 5 kHz modulation deviation, reduce the signal generator output until the SINAD indication is about 12 dB, then adjust the tuning controls for minimum deflection on the SINADDER meter. The resulting alignment is superior to the one obtained by the sweep method. This is because the sweep method arrives at the adjustment for a flat amplitude characteristic in the passband, whereas the SINADDER adjustment leads one to the most linear phase characteristic — which is more important to the FM detector.

Frequently, a technician is confronted with a receiver that needs alignment and the radio is a model with which he is unfamiliar, and the instruction manual is not on hand. Alignment then becomes a pretty tricky proposition. Using the conventional limiter-metering approach, it's easy to go astray because you are never sure whether you are twisting an adjustment that is located after the test point you are observing, or whether some intervening limiter is masking the effect of the tuning.

The whole thing is a lot less tricky when you align the receiver for optimum SINAD. You know where the antenna input and the loudspeaker terminals are, so you can't make the metering mistake mentioned above. If you are trying to do one of these "blindfold" alignment jobs, you should proceed carefully and not make any radical changes in any of the adjustments. The main pitfall to avoid is one of those oscillator circuits which tune with a "cliff" on one side, and won't start when peaked up to the maximum. Otherwise you can usually obtain a pretty good alignment without the book.

AM and SINAD

One final note: if you have been thinking about using the SINAD method of sensitivity measurement for those AM receivers in your shop, you're right; it is just as meaningful as with FM. The 10 dB SINAD sensitivity of a decent receiver is surprisingly close to the 10 dB signal-plus-noise-to-noise specification often seen with AM receivers. You can also use the "alignment by SINAD" method to get the last bit of sensitivity out of the AM receiver. Any touch-up of the IF tuning probably won't gain much, but the front-end touch-up will usually show a worthwhile improvement. ●

THE SINNADER 3 — A BRIEF REVIEW

Roger Harrison

I couldn't resist the opportunity to get hold of a Sinadder and try it for myself. Having done quite a few SINAD receiver measurements over the years with the 'usual' collection of gear — RF signal generator, audio oscillator and noise-and-distortion meter, I just had to see if this unit would deliver what it promised.

The Sinnader 3 comprises a 1 kHz precision oscillator, an ac voltmeter and a SINAD measuring circuit. The latter consists of a gain-controlled amplifier, which maintains a constant average output level for inputs ranging between 10 mV and 10 V RMS, followed by a 1 kHz notch filter and a precision rectifier driving a calibrated meter. A loudspeaker amp. stage is also included.

The ac voltmeter section consists of an input attenuator followed by a x100 amplifier stage driving the precision rectifier and calibrated meter.

The 1 kHz oscillator employs a low-distortion three-stage phase-shift circuit followed by an amplifier/buffer stage.

A voltage-regulated mains power supply is provided but the unit can be powered from an external 12 V(nom) source.

Three interlocked pushbutton switches on the front panel select the function. The 1 kHz oscillator output is brought out to a BNC socket on the front panel. Both the oscillator output level and the internal speaker level can be adjusted by front panel controls.

The input lead comes through the rear apron, via a clamp grommet, and consists of a shielded cable about one meter long with alligator clips on the end. The SINAD input level can be between 20 mV and 10 V RMS for correct operation; input impedance is given as 100k and accuracy in SINAD mode is quoted as ± 1 dB. The ac voltmeter has nine ranges from 10 mV to 100 V in 10-30-100-300 etc steps. The input impedance is given as 1M and accuracy quoted as ± 3% of full scale, ± 0.25 dB, 100 Hz to 20 kHz.

The 1 kHz oscillator is quoted as being within ± 1 Hz, output 1.5 V RMS into a 500 ohm load.

The unit measures 222 mm wide by 82.5 mm high by 178 mm deep. It is manufactured by the Helper Instruments Co of Florida, USA, and distributed in Australia by Vicom International, 57 City Rd, South Melbourne Vic. (03) 62-6931. Recommended retail price is $395, plus tax.

The instruction manual supplied with the unit is comprehensive and covers use of the instrument in detail, together with some background on SINAD measurements. A complete circuit and board overlay of the instrument is included along with a description of its operation. Warrany is for 12 months.

The Sinadder 3 is just so damned easy to use compared to what I've been used to. As a trial, I set up a new UHF CB rig we have in for review and measured the receiver SINAD sensitivity figure using our Hewlett-Packard 8654B RF signal generator and AWA F242A N&D meter. It took me 22 minutes (I'm out of practise!).

I then switched to the Sinadder 3, hooking its 1 kHz internal oscillator into the H-P generator's external FM input. The two readings were within 0.01 uV of each other. The receiver measured 0.26 uV SINAD (a pretty commendable performance). With the Sinadder 3, it took me just 10 minutes (no practise!).

The Sinadder 3 represents excellent value for money and would be a useful tool in any RF experimenter's workshop, communications service workshop or even a communications field serviceman's toolkit. Recommended.

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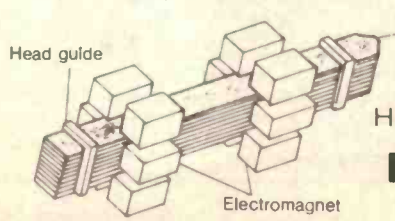

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1. Functional specifications

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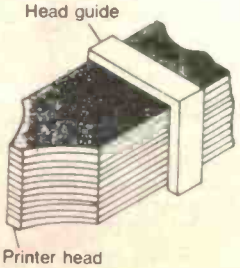
2. Mechanical specifications

Ribbon: Cartridge ribbon (exclusive use) black. *MTBF:* 5 million lines (excluding print head life). *Print head life:* Approximately 30 million characters (replaceable). *Dimensions:* 377mm (14.8")-W x 295mm (11.6")-D x 125mm (4.9")-Hincl. sprocket cover. *Weight:* Approximate 5.3Kg. (11lb). *Power requirement:* 100VA max. *Temperature:* Operating — 5 to 40 degree C (41 to 104 degree F). Storage — minus 30 to 70 degree C (−22 to 158 degree F). *Humidity:* Operating — 5 to 90% RH, no condensation, Storage — 0 to 95% RH, no condensation. *Shock:* Operating — 1G (less than 1 msec). *Vibration:* Operating — 0.25G, 55Hz max. Storage — 0.5G, 55Hz, max. *Insulation resistance:* 10 Meg ohm between AC power line and chassis. *Dielectric strength:* Between AC power line and chassis, AC 1KV (RMS) 50Hz or 60 Hz, during one minute and no abnormal condition shall be observed.

3. Interface specifications

Interface: Standard Centronics parallel. Optional RS-232C. (SERIAL). *Data transfer rate:* 4000 CPS max. *Synchronization:* By external supplied STROBE pulses. *Handshaking:* By ACKNLG or BUSY signals. *Logic level:* Input data and all interface control signals are TTL level.



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NB: Printers are slightly different to the photo.

LETTERS

Dear Sir,

I have just purchased the May issue of your magazine and am appalled to find that you no longer intend to publish the pc board artwork for your projects. Nor do you intend to provide it free of charge on receipt of a stamped self-addressed envelope (which is a big enough nuisance), but you intend to charge for it, the price depending on the size of the board.

This is totally unacceptable as far as I am concerned, as your magazine already costs more than Electronics Australia (the only other electronics magazine that I purchase regularly). That magazine can include the pc board artwork in the magazine and they haven't made a big deal about the blue page behind the artwork, which was supposed to make it easier for the hobbyist to make his/her own boards using the photographic method.

If I wished to construct the three projects in the latest issue for which the price of the artwork is quoted, I would have to pay $5.50 just to obtain what is printed as a matter of course by your opposition. I believe it should also be printed by you, as I'm sure most constructors would rather spend that money on components for the project.

I also have a tendency to construct a project anything up to ten years after it has been described in a magazine, so can you guarantee that after that length of time you can still supply the artwork? You may not, because your magazine may no longer be published at that time as hobbyists may opt for a magazine that doesn't try to rip them off with pc board artwork and front panels, and instead publishes it along with the project description.

I have purchased and enjoyed your magazine since it was first published. But in recent years I have been annoyed by your tendency to make snide remarks about the opposition while at the same time the quality of your own publication has been deteriorating.

This decision about the artwork is the final drop in quality that has caused me to decide not to purchase your magazine in the future. I may reconsider this decision if you once again start publishing the artwork, but that is up to you to reverse your decision first.

I realise that this letter won't be published since it appears that you don't like to make public your readers' views. But I hope you will consider reversing your decision and publish the artwork for the projects and concentrate more on what you're doing rather than on what the opposition is or might be doing.

If you do that, you may be able to return to the fine standard of magazine I have read in the early years of your publication.

Bruce Bull
Woodville, SA.

I am distressed that you construed from my May issue editorial that we no longer intend to publish artwork or provide prints free of charge. Such was *never* my intention. Making film positives and negatives available is, in fact, an *additional* service.

An unfortunate thing has occurred, however, in that no artwork for May issue projects happened to be published — but this was not because we wished to *make* readers buy film, but purely due to space restrictions that occurred when laying out the magazine. This may have contributed to your, quite natural, conclusion that we were ceasing publication of pc board and panel artwork.

Such is *not* the case, let me assure you as strongly as possible. There is no decision to be reversed, here.

I note that you say you have become annoyed by our "... tendency to make snide remarks about the opposition while at the same time the quality of your own publication has been deteriorating." I must take exception to that and challenge you to substantiate your charge.

Roger Harrison
Editor, ETI.

Dear Sir,

We refer to our telephone conversation on the subject of the article titled Video Cassette Recorder Head Cleaners which appeared in ETI May on pages 118 through to 129.

The statement under the heading 'What Distributors Say' and the paragraph under the National Panasonic photo, with a sub paragraph attributed to GEC Australia, is not correct.

To make it quite clear to you and your readers, GEC do not recommend or sell the National VFK-0185 head cleaner. This head cleaner is extremely abrasive and is only to be used by a skilled technician. The number of times that particular cleaner is used by GEC can be counted on one hand. Primarily, it has been used where inferior brands of ½" video tape have been used and where the oxide has shed and clogged the video heads.

Conventional cleaning with Isopropyl alcohol and a chamois stick will remove about 99% of most dirt and the abrasive tape is then used to burnish the heads for no more than five seconds.

We repeat, we do not recommend or sell this abrasive cleaner to anybody.

Because of the market segment GEC specialise in, (industry, commerce and education) equipment sold is subject to wear which a normal domestic user would not see in ten years. The reliability of the National product in this environment is second to none. But due to extensive use, of course, heads do get abused and require cleaning at more frequent intervals.

GEC recommend for preventative maintenance, the *Allsop 3* cleaner which is non abrasive and, used in moderation, keeps the head capstan and the pinch roller assembly clean. But this action does not preclude our advice to users that at a regular period the machines are serviced by a competent technician who will manually clean heads, capstan, pinch rollers and blow out the accumulation of dust and oxide fragments which can be found over the surrounding components.

We trust this makes our attitude very clear and we would appreciate if you would publish this philosophy.

A. E. Williams
Divisional Manager
Electronics Division
GEC (Automation and Control)

The National Panasonic video cassette recorder head cleaner VFK-0185 was purchased from GEC.

When the article was going to press I phoned seven VCR distributors to find out what they advised with regard to head cleaning and head cleaners.

The person I spoke to at National Panasonic was either the product manager or the service manager. The statements in the article are quotations from his comments.

Jennie Whyte
Assistant Editor, ETI

Dear Mr Harrison,

Today I received the May copy of ETI and was dismayed to read that from this issue you plan to do away with the pc board artwork that you have always published full size in previous magazines. You plan to replace it with full size negatives available on request for a nominal fee.

I can see your reasons for this: the saving in space and cost in printing in blue on special paper. But could you still reproduce a full size layout either separately or in conjunction with the component placement diagram. I am sure others will agree that this was one of the big pluses of your magazine. For those living out of Australia the increased hassle and cost, although minimal, tends to take away some of the magazine's appeal.

If I may say so, this now brings ETI down to the same level as your competitor!

I would not expect large circuits to be printed but the majority of circuits could still be incorporated in the articles. I have obtained artwork from you for the ETI-660 computer and produced a very good board. I would not expect that to be put in the magazine, and the extra time and hassle *was* worthwhile; but not for a $5-$10 project. By the time I would get the artwork, two to ▶

LETTERS LETTERS LETTERS LETTERS LETTERS

three weeks would have elapsed and the cost would be at least that of a second magazine.

I have found your magazine and its contents eg: Circuit File, projects and feature articles, to be very good in all ways. The schematics and 'wiring up' diagrams are excellent.

I hope you will reconsider your proposal as I'm sure a great many readers would pay a little more per copy (I certainly would) to retain one page reserved for full size artwork.

Finally, I would like to say that I hope your magazine does not become a 'kit-set' manual but retains its grass roots construction principles (unlike some others), which are so fundamental to understanding electronics.

J. R. Hyde
Christchurch, NZ.

You will note from the June issue that all continues as normal.

Many thanks for your kind encouragement and praise of the magazine otherwise.

Roger Harrison
Editor, ETI.

Dear Sir,

At last! What a wonderful surprise.

I bought the June '83 issue of ETI in which you have a column for the VIC-20 with two programs listed. I wrote them up and they both worked. They both *worked*! I just can't get over it.

I'd like to congratulate those responsible. At last I've found an Australian computer publication with printouts that actually work. *Woopee*!

Maybe if you printed that your programs are guaranteed to work, the other 'rubbish' that call themselves computer magazines might take the hint.

Phil Truscott
Tullah, Tas.

Dear Sir,

I was lucky enough to win a Sparkrite Voyager car computer in the contest you organised with Jaycar Pty Ltd.

I wish to thank you for the challenge it offered and I hope others derived as much enjoyment and new knowledge as I did in trying to answer the questions. I congratulate the person who thought up the questions.

I am looking forward to installing and using my prize. It seems to be an excellent unit, from all I have seen and read about it.

May I take this opportunity to compliment you and your staff on the high quality of the content and presentation of ETI magazine. I look forward to each issue and shall, of course, continue to do so.

W.K. Irish
Castle Hill, NSW

The Editor of Erectronics
Tidy Interstitial,

Sapristi Nuckas! Further (and final) to the raging controversy over "yiddle di po" versus "iddle I po", I have sent you a copy from the 'Goon Show Scripts' by Spike Milligan (bow your head with reverence), Woburn Press, London, 1972.

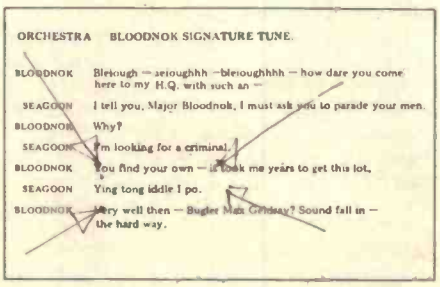
To prevent publication and the most scandalous exposé since Petrov, simply forward a photograph of a $448 note to my good self.

Take heed Sir, you are dealing with . . . ah . . . um . . . anyway, my sister is a Sumo wrestler and my father a professional batter pudding hurler! *

This letter will self-destruct on ignition with a match.

R. Boelen
Ferntree Gully, Vic.

* This does not mean he hurls professional batter puddings.



Dear Bluebottle,

Anyone who read your 'letters' section in ETI March '83 could have been alarmed and woken up when they read C. Tinney's letter condemning the misspelling of the (ahhm!) phrase "Ying tong iddle I po". Your argument was that it was "Ying tong yiddle di po".

I have been instructed by my client Mr. Henery Crum to research this (ahhm!) problem. I found in one of the amazing, talking-type wireless Goon Shows, entitled "The Canal", that Neddie Seagoon does, in fact, state categorically and without any hint of confusion that immortal phrase "Ying tong iddle I po".

Therefore, unless something is done, either by sending certain monies to Mr. Tinney by way of compensation c/o my good self, or better still direct to me, I shall be forced (ahhm!) to issue a military document of a disturbing nature.

Be warned sir, you are dealing with — um-er — anyway, my brother is a wrestler and my aunt is a policeman.

Cordially (ahhm!) yours,
Major Craig Stephenson
SFI and Bar

Rotten swine Etty Yedidor,

This is the BBC Home Service. (clunk rukka rukka ruk) Thank you.

You rotten swine! You nutted me! You captioned me right in the bonce! You misquoted the Ying Tong song. May your knees turn into soggy Weet-Bix and dribble down your shins!

Watch your Dregs correspondent very carefully. I think he's been playing that sinful midnight Ludo again, the evil, debauched pervert.

I looked up my dog-eared copy of the 'Goon Show Scripts' and there it was, staring at me, "Ying tong iddle I po". I nearly poemed on the carpet.

You don't believe me? You little steamer, you, my elbows sweat in sympathy and my nose hairs turn pink! It is there, on the fourth page of "The Canal", you half-crazed practitioner of sensuous Caucasian knee-dancing!

Yours in custard socks
Kevin Moore AGG

Sapristi, exposed! Quick nurse, the screens!

But wait — what does the Ying Tong song really say? Yes, yes. I'm well aware of what the Goon Show Scripts (1972) say, but the circa 1957 Ying Tong song recording says something entirely different! It says . . . it says (thinks — now I've got them) . . . Ying Tong Yiddle Di Po! Play it for yourselves, my little chickens — especially at 33⅓ rpm and with your fingers on the rim.

Nevertheless, I have written 'The Master' himself to mediate this nasty disputation and prevent Soggy Weet-Bix knees and batter pudding battering of my person. We await! ●

Roger Harrison
Editor, ETI.

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FOR SALE: TWO RCF mid horns with 100 W drivers. Perfect condition, suit PA or guitar, $285 pair. T. Baird, 24 Ivan St, Fitzroy Vic 3068. (03)63-6384.

FOR SALE: JAYCAR Series 5000 power and preamp. Still in packing, $500. (099)27-1462.

SELL: PAIR OF PIONEER HPM-150 speakers. Excellent condition, 14 months old, $875 ono. Peter Aldridge, 40 Derwent Crt, Mt Gambier SA 5290. (087)25-5753.

FOR SALE: DYNACO amplifier combination PAT4/ST150, 75 watts RMS. Demos. Dean (08)264-6541.

FOR SALE: AMCRON DC-300A laboratory reference stereo power amplifier, 155 W/ch RMS. THD 0.01%. IMD 0.01%. Mint condition, forced sale. Sacrifice at $750 ono. (02)896-2975.

FOR SALE: SERIES 5000 preamplifier $300. L. Preller, 27 Cavill Close, Holt ACT 2615. 54-4552 after 6 pm.

COMMUNICATIONS

FOR SALE: TRIO 9R95DS receiver, as new, $125. IC202 2M SSB transceiver, oscar coverage, original packing and condition, $150. Jim (050)24-2104 bh.

FOR SALE: KENWOOD TR-72006 two metre FM, car transceiver. Ten watt output, $100. (07)369-6197.

FOR SALE: KENWOOD TS-520s transceiver $475. DG-5 digital readout $180. Remote NFO-520s $130. TV-502 two meter transverter $150. (02)84-6510.

WANTED: FOR MARCONI TF867 standard signal generator. Require operator and maintenance handbook or notes for purchase or loan. R. Gurr. (08)276-4547.

FOR SALE: YAESU FRG7 communication receiver, as new, $250. (096)47-9027 evenings.

MISCELLANEOUS

WANTED: VERTICAL plug-in type 17D/1 for BWD 1722D, state price. Will exchange for 17A plus cash. Hickman, PO Box 74, Hamilton NSW 2303. (049)48-5553.

WANTED: CIRCUIT DIAGRAMS for TS-01 display terminal locally manufactured by Electronic Control Systems circa 1972. Kris 682-0324 or (045)79-6365.

WANTED: PRACTICAL ELECTRONICS magazine October 1982 and January 1983. M. Vinicombe, 12 Brereton St, Garran ACT 2605. (062)81-5375.

SELL: TELETYPE model 15. One with keyboard, one without, $50 and $30 resp. Gary Hegedus (03)435-2257.

MANUALS WANTED: CBS710, B&K1503/1602, Taylor 45D, Haltronics 201B, Khan SP58-1A, AWA Voltohmyst, AWA 1A57321, MAGNATECH 34B, PULTEC EQP-1A/MEQ5. GMT 303. R. Hibberd, P.O. Box 318, Willoughby NSW 2068. (02)406-5787.

FOR SALE: ASR33 teletype (printer) plus paper tape reader/punch and transformer. Plugs into LNW board. Very good condition. A. Lindsay (09)299-7159.

FOR SALE: ITOH8300SP printer, centronics, 125 cps, as new $575. Tally line printer, serial, 120 cps, 15" platen, $650. 19" racking boxes with extendable mounts, 430x430x150 mm, $25. (062)54-9508.

FOR SALE: MODEL 15 teleprinter with full workshop manual ideal for printer, $100 ono. R. Buck, 90 Dight St, Richmond NSW. (045)78-3107.

BARGAIN PACK: MIXED components includes 1N914s, resistors, DIL sockets, desolder braid, electros, battery snaps plus other items at $10, including postage. T. Firman, P.O. Box 498, Cheltenham Vic. 3192.

COMPUTERS

FOR SALE: S100 PCG fine graphics board, manual, cables and joystick, $90. MW640 board, $75. Clare C70 keyboard edge connector, cable, unused, $160. Gordon (07)30-1949

SELL: S100 computer. DGZ80 CPU, MW640 VDU, 16K RAM, 12K BASIC, 10-slot motherboard, cage, PS, fan, cassette, TV, programs, manual. $850 ono. Mick (062)41-5140.

FOR SALE: ZX81 with 16K, $64 of software on tape, many more on paper, including book of 30 programs. $290. Peter (02)533-4959 ah.

FOR SALE: COMPUTER ENCLOSURE. Attractive steel case can house monitor, PSU, processor card, disk drives. Includes mains lead, fuses, mains filter, power switch, muffin fan, tinted perspex front, $60. Monitor to suit, $50. PSU to suit: +5 V at 8 A, +12 V at 3 A, −12 V at 1 A, $70. (03)339-5604 bh or (03)379-4438 ah.

FOR SALE: TELETEC keyboard with numeric keypad, needs encoder IC, $40. (03)339-5604 bh or (03)379-4438 ah,

FOR SALE: APPLE II unlimited vocabulary voice synthesiser with speaker and instructions. Plugs into peripheral slot. Software available, $160. (060)24-4540.

FOR SALE: PC COMPUTER. Apple 128K, 80 x 40 character display, two floppy disk drives, brand new, purchased three weeks ago, still in boxes. Word processor pack, Zaroax, $300. Total price is $3450. Carlos Gutierrez, 1/86 Woids Ave, Hurstville NSW 2220. (02)547-1642.

FOR SALE: 23 cm Philips monitor LDH 2121. Brand new in original package. Giveaway price $125 ono. 21 Aistrope Ave, Modbury SA 5092. (08)264-8207 ah.

FOR SALE: DEFENDER, very fast game for Dream 6800, 1K. Send $6 and your address to K. Bennett, 6 Barilla Crt, Burwood East Vic. 3151, for your listing.

MICROBEE HARDWARE: Multiprom and I/O controller takes four set EPROM at EDASM, three sets at net, with development software and manual. Francois (02)328-1246.

FOR SALE: SINCLAIR ZX81 16K RAM, Sinclair printer, software, manuals and all leads for connection, $450. (03)580-1047.

FOR SALE: VOTRAX type-'n-talk, text-to-speech synthesiser, unlimited vocabulary, built-in amplifier. Complete with manual, power supply, cable and driver program. Cost $500, sell for $300. (02)44-1126.

FOR SALE: ZX81 plus 16K RAM pack, cassette player and over 40 programs on cassette. Worth $550, sell $299 ono. New condition. (075)37-1685.

FOR SALE: FOUR APPLE IEEE 488 Interface cards, unused. $300 each ono. Jon Breedveld, c/-Primary School, Forrest Vic 3236. (052)36-6244.

FOR SALE: BIG BOARD, double density for 2.5 MHz. Software selectable, five 8", SS/DS, SD/DD, $135. Software, hardware, documentation. Details $2. P. Gargand, PO Box 10, Aranda ACT 2614.

FOR SALE: ETI-660 in case with modulator and transformer, 3K RAM and colour, works perfectly, sell with software tape for $70. (07)351-1868.

RADIO AMATEURS like to 'chase DX'. That is, they get a thrill out of making contact with stations a long way away. Now, that means different things according to the frequency band being used. On, say, the 14 MHz band (shortwave), DX means across the Pacific and/or across the world. On the 144 MHz VHF amateur band, DX might mean 300 km (across the state) or 2000 km (across the Tasman). Owing to its relative rarity, DX contacts on the VHF bands are highly prized by the VHF amateur fraternity.

The ultimate DX on the VHF or UHF amateur bands is "Moonbounce". Moonbouncers use lots of power and large, highly directive antennas to literally 'bounce' signals off the surface of the Moon to distant places. The signals travel half a million miles in the process (they use miles on the other side of the earth).

As you could imagine, the signals heard *via* Moonbounce are very weak and very sensitive receivers are employed. Because the Moon literally "wobbles" in its orbit, and because the Moon's surface is not a smooth reflector, quite a deal of fading is experienced. Also, as the Earth and the Moon are moving relative to one another, there's some doppler shift to cope with. All in all, it's a wonder any contacts are made. But they are.

In the annals of the Moonbouncers' literature, one reads from time to time of strange signals being heard. These usually occasion intense investigation in an effort to locate the source. As Moonbounce stations are few and far between, and because contacts are generally arranged — or special 'activity days' are arranged — all the Moonbouncers know each other and who might be on the air at any particular time. Every Moonbouncer tape-records every test and every contact — it's the best proof of contact, by such an evanescent means, yet devised.

An innocuous little parcel arrived from America not long ago. In it was a tape from a certain well-equipped Moonbounce station located in California, callsign W*6*ET. I've left out some critical letters to avoid possible embarrassment to the parties concerned.

This tape-recorded the events of a certain Moonbounce activity day some months back. The operator, Chuck, has sent copies of the tape far and wide, in an effort to sort out a 'strange' signal that occurs between the various stations recorded *via* Moonbounce on that day.

Chuck had his 30 ft dish 'locked' on the Moon with his homebrew computer-controlled tracking system, the receiver front-end — mounted right at the dish's focal point for best performance — was in fine form, and he could receive his own signal like he'd never heard it before. It was shaping up to be a good session. So, hearing a few stations working each other, and guessing there might be others listening around, he found a clear frequency and put out the general call.

*"CQ DX, CQ DX, CQ DX Moonbounce. This is W*6*ET calling. W*6*ET whisky ** six ** echo tango, W*6*ET."*

The tape records his call and when he switched to receive, the last 2¼ seconds (the time its takes for the radio wave round-trip to the Moon and back) of the reflected call. A short period of noise is heard, then a faint 'warbly' heterodyne (single sideband transmission being used) fades up out of the noise and back down again. The noise characteristics change as Chuck adjusts his receiver's dynamic tracking filter. Then, a clearly recognisable, but slightly 'quavery' voice is heard.

". . . tango . . . six . . . echo . . . ho . . . tee . . ."

The signal's a little weak and 'watery' and Chuck makes further adjustments to the receiver bandwidth and post-detection filtering to improve the signal-to-noise ratio. He also throws in the dynamic amplitude stabiliser to reduce the fading effects. The signal pops out of the noise this time like magic.

". . . ee . . . tee . . . phone . . . home"!

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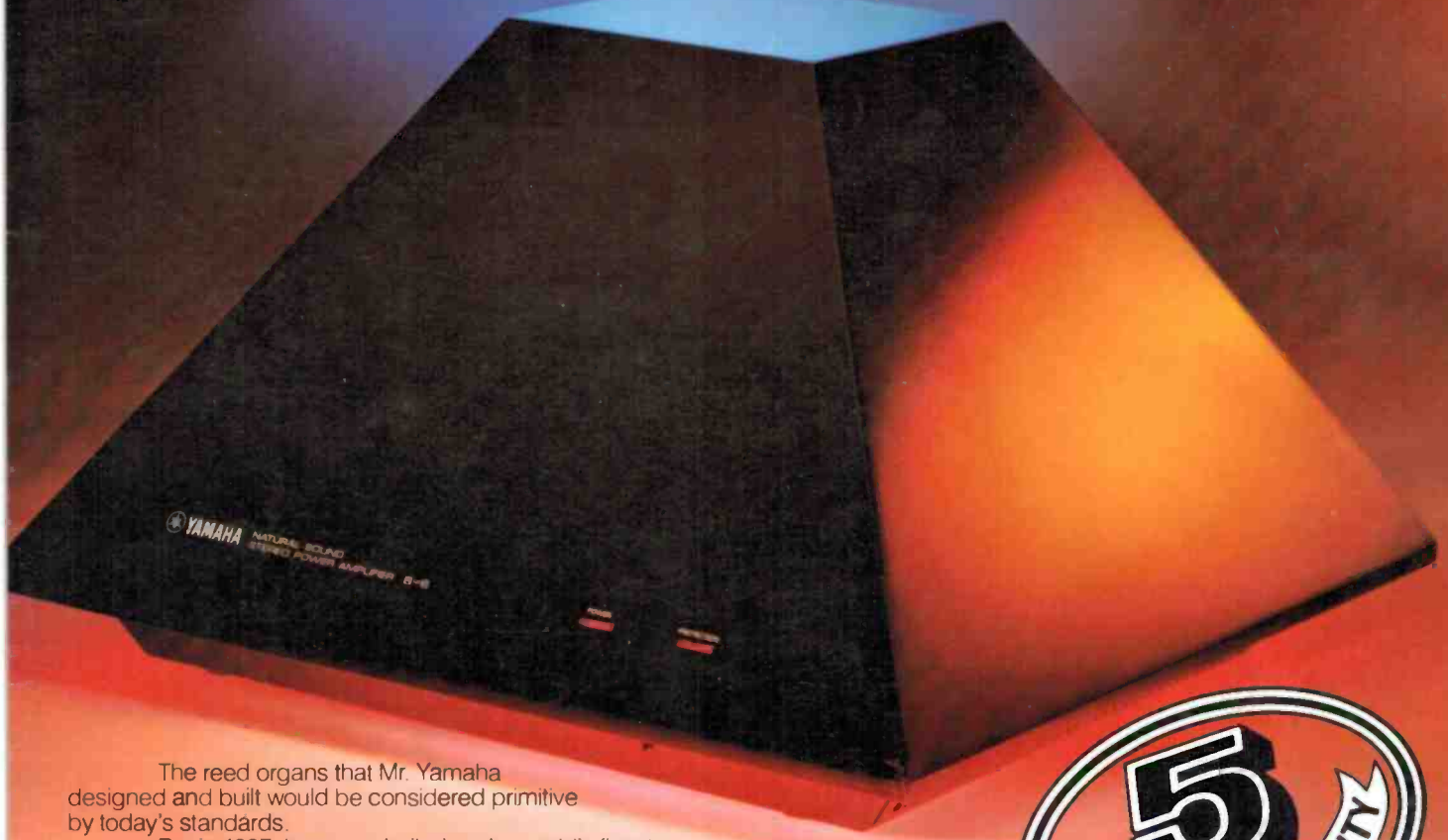

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