Microbee multiPROM interface

VIC-20 program potpourri

Yamaha MT44 home studio

New 25-550 MHz scanner

Perreaux hi-fi system

They're here!...for home, education and personal use.

Robots
How to get top-quality connections for your IBM PC.

Without paying top dollar.

We give you all the right connections. Printers, Plotters, Digitisers.

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QUME SPRINT II plus DAISYWHEEL PRINTER. Designed to suit a host of small business systems and personal computers. "The low cost daisywheel with the right connections."

MANNESMANN TALLY. MT160L. Designed to suit the needs of the growing Personal Computer market. Price/Performance is second to none.

Recently released products for the small business and personal computer marketplace include the MICROGRAPHICS models DMP29 flat bed 8 pen plotter, the DMP40 low cost single pen drum plotter and the DT11 series of digitising tablets.

ANDERSON DIGITAL EQUIPMENT PTY. LTD.

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ETI November 1983 — 3
WE are a No.1 Kit Supplier

SERIES 5000
As designed by ETI

PREAMPLIFIER

POWER AMPLIFIER

Please note that the "Superb Quality" heat sinks for the power amp were designed and developed by Rod Irving Electronics and are 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:
Frequency response:
Input sensitivity:
Hum:
Noise:
2nd harmonic distortion:
3rd harmonic distortion:
Total intermodulation distortion:
Stability:

100W RMS into 8 ohms (+ 55 V supply).
8 Hz to 20 kHz, ± 0.04 dB, 2.8 Hz to 65 kHz, +0 −3 dB.
180° below full output (flat).
-116 dB below full output (flat, 20 kHz bandwidth).
-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 10 W.
<0.003% for all frequencies less than 10 kHz and all powers below clipping.
<0.003% at 100 W. (50 Hz and 7 kHz mixed 4:1).

$269
$239

$299
$279

1 unit $179
2 units $355

EXTRA FEATURES OF OUR KITS

1. Metal Fin Resistor are used where possible.
2. Power, Cool are supplied.
3. All components are top quality.
4. Over 700 kits sold.
5. We have built this unit and know what needs to go into your kit.
6. Power supply comes from a reputable supplier.
7. We are so confident of this kit that we can offer 30 days money back guarantee.
8. English. Switches are supplied by a reputable supplier.
9. All parts available separately for both kits.

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Mail orders: P.O. Box 238 Northcote, Vic. 3070
IT'S TIME TELECOM took its head from the 'sand of technical purity' and looked at the question of type-approved line interfaces which hobbyists could use with their own equipment to experiment with various forms of communications via the public telephone network. I refer specifically to computer modems and 'phone patch' equipment.

For computer-to-computer communications via the public telephone network, a direct-connect modem is by far the preferred equipment. Since 'freesing up' the requirements for type-approval of direct-connect modems last year, this aspect of the computer boom has grown dramatically. But for those who want the satisfaction of the learning process involved in 'rolling their own', or for those who wish to experiment with various techniques, the very requirements of type approval denies them the opportunity. Not daunted though, many have gone ahead in the breach. What we have now is a core of 'pirate' computer communicators using the public telephone network. The cost of getting individual type approval for personally-constructed equipment is just prohibitive.

Now that phone patch for communications services such as radio amateurs, CBers, emergency services and the like is permitted, but only with type-approved equipment wired in place by Telecom (see Communications News, p.131, last issue), I expect a similar situation will arise. There will be a number of people among those groups who will be sufficiently motivated and competent enough to construct equipment, either as a facility, for the purpose of experimentation, or self-education. Here too, the cost of getting individual equipment type-approved, or type-approved at all, is likely to be prohibitive.

What can be done about this situation? Perhaps Telecom will follow the Department of Communications' example vis-a-vis CB radio. That is, ignore it until it becomes so big that the only way to deal with the 'problem' is to legalise it.

I think a better solution would be to have available a type-approved 'black box' line interface that provided the appropriate voltage isolation and signal level limiting generally required and whatever was attached to it was the owners' business and responsibility. Providing perhaps, signal frequencies were kept within a certain spectrum, much as is required of radio amateurs with regard to the transmission modes they're permitted to use.

How about if Telecom? You've been awfully silent since we published the design of a direct-connect computer modem in October last year and a phone patch terminal in May this year.

Roger Harrisson
Editor

**VIDEO ENHANCER**

This simple to build project features three controls for curing video 'image ills' — floor which cuts off the low level noise that causes snow; ceiling — which ensures that high level signals are not enhanced, causing 'ringing'; and enhancement which really 'crisps-up' those soggy signals, providing up to a db of boost. It's designed to be installed either 'stand alone' or in with the ETI-1517 Video Distribution Amplifier. Best of all, it costs around $20.

**MICROBEE PROPORTIONAL JOYSTICK CONTROLLER**

Oh the joy of a 'proper' joystick! Most computer joysticks are of the four-switch type. But, when you want to get into some 'real joystick action, nothing beats a proportional joystick with potentiometers. This straightforward project for the Microbee, in our continuing popular series, simply plugs into the 'Beet's parallel port. Complete with software.

**NEXT MONTH**

**WET/DRY HUMIDITY METER**

Electronic version of the wet bulb/dry bulb thermometer type humidity meter.

**ROBOT INTELLIGENCE**

**LINEAR TRACKING TURNTABLES**

Apparently, turntable sales have experienced quite a 'lift' since the introduction of the digital compact disc. The vinyl disc is not yet dead! Louis Challis reviews linear tracking turntables from top manufacturers.

**SERVICES**

**TECHNICAL INQUIRIES:** We can only answer readers' technical inquiries by telephone after 4.30pm Mondays to Thursdays. The technical inquiry number is (02) 662-4267. Technical inquiries by mail must be accompanied by a stamped, self-addressed envelope. There is no charge. We can only answer queries relating to projects and articles as published. We cannot advise on modifications, other than errata or addenda. We try to answer letters as soon as possible. Difficult questions may take some time to answer.

**GENERAL INQUIRIES:** For all inquiries about back issues, subscriptions ($20.00 for 12 months/12 issues), photocopies of articles, artwork or submitting articles, call (02) 663-9599 or write to: ETI Reader Services, 140 Joynton Avenue (PO Box 227), Waterloo, NSW 2017.

**CONTRIBUTIONS:** Submissions must be accompanied by a stamped, self-addressed envelope. The publisher accepts no responsibility for unsolicited material.
GO ANYWHERE 12-240V POWER

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 -** Cold plated edge connector and PCB huss - Low age rate XTAL sockets for all IC's - High Efficiency Transformer

**K6750 -** (IEA 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.

**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 75% of their normal 240V efficiency. Install permanently into caravans. **COMPLETE BOXED KIT, INCLUDING ALL WINDING WIRE.**

**K6505**

$57.50

**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 celebrate and Fun to use. More seriously this unit could save lives.

**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

**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 after some preset time later. Use for electric blankets, bathroom heaters, patio lights. 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 update.

**K6265**

only $32.50

**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 load 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, pops etc.

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

**K6000**

$39.50
QUALITY VIDEO KITS

Video has been booming for quite a while finally a range of video accessories in kit form.

Two video amplifiers for both VCR and Computer use a brand new video Enhancer and our popular VCR Stereo Synthesizer. All four represent outstanding value for money and all are assembled with Altronics Extra Care.

VIDEO AMPLIFIERS

DISTRIBUTION TYPE
Simple, low cost project will allow you to drive five video monitors from one source, such as a video cassette recorder or a computer. Great for piping video around the house or for clubs meetings when screening lectures etc., or计算机 demonstrations.

THE ALTRONICS KIT includes all components as specified by ETI plus all power supply components.

K5830 Only $45.00

VIDEO ENHANCER

Here’s a simple but effective video Enhancer that is super easy to build at a fraction of the cost of commercial models.

Unit sharpens picture detail and can actually improve the quality of a copy by amplifying the top end of the video signal.

AT LAST A VIDEO ENHANCER KIT

K5825 $35.00

ENJOY THE PLEASURES OF STEREO SOUND
(see EA Sept. 1982)

STEREO SYNTHESIZER FOR VCR’S AND TUNERS

Synthesize realistic stereo from virtually any monophonic source by simply connecting this unit between the source and your stereo amplifier.

Quality phils. K5301 not second source grupag

 Provision for 2 different signal sources

 Selection of either source via front panel switch

 Normal or stereo sound selection

 Complete kit includes all hardwear, cables etc., even soar.

Important † beware of kitset suppliers who sell this kit for less † you get less!

K5810 $55.00

SINGLE OUTPUT

INVERSE AND NORMAL OUTPUT

Brilliant new kit from EA, Super cheap and Super Effective. Inverse & Normal for VCR use this video amplifier is best suited to use with computers. For documentation supplied is extremely well written and provides details for installation into television sets.

NO MORE SWEARY COLOURS, SIGNAL BEATS OR RF INTERFERENCE.

NOTE † NOT SUITABLE FOR USE WITH LIVE CHASSIS TV SETS

K5850 $14.95

FUNCTION GENERATOR

The most essential piece of test gear isconic only to a good multimeter on any hobbyist bench is some kind of audio signal generator. This design utilizes the best 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 ± 1% 3 overlapping ranges ±10 kHz, ±1 MHz. Nominal output — continuously variable from 25 nV to 25 uV.

Distortion — linevarie less than 0.03% at 1kHz Linearity — triangle wave better than 0.1% at 1kHz. Squarewave rise time — 8/12uS maximum output. Amplitude stability — better than 0.1% 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

NEW DELUXE FINISH

We are pleased to announce the release of the Digital Capacitance Kit housed in our Deluxe H380 ABS Enclosure Case. This superb test instrument kit now compliments our top selling Digital Frequency Counter and Function Generator Project kits. This versatile project kit measures capacitance of both polarized and non-polarized capacitors from 1 microfarad to 999 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

POWER SUPPLIES

If you’re thinking of buying a power supply then buy from us, we are the experts on power supply kits and carry a supply to suit most enthusial and professional requirements.

READ ON.

BENCH STANDARD

¢ 3-30v Output ± 1 Amp.
¢ Fully Regulated. Protected fully from Overload and Short Circuits
¢ Based on EA Design.

K3200 $42.50
¢ All the features of above PLUS Current Limit.
¢ ETI Design.

K3205 (PICTURED) $49.50

DUAL TRACKING

¢ 1 to 2v Output ± 2 Amps
¢ 5v ± 0.9 Amps
¢ Fully protected
¢ 10 turn pot enables voltage adj. to within 10mv
¢ EA Design March '82.

K3220 $89.50

HIGH CURRENT

MICROCOMPUTER PS
¢ + 5 Vols at ± 2 Amps
¢ + 12 Vols at ± 2 Amps
¢ 12 volts at 200 millamps.

This universal design has enough grunt to power most disk drives.

K3350 (EA MAY 83) $59.50
¢ 18 volts at ± 10 Amps HAM & CB’ER
Save the expense of a mains Powered Rig.

K3250 $95.00

HIGH CURRENT — DUAL METERING

EA SWITCH MODE DESIGN
¢ 5 50 volts ± 5 Amps
¢ CLEVER DESIGN— a fully isolated supply with a “Switchmode” low voltage circuit.
¢ Easy to build.

K3300 (EA MAY 83) $139.00
¢ 110 TURN VOLTAGE CONTROL OPTIONS.

K3301 $10.00
¢ ± 12V OPTIONS.

K3302 $12.50

ETI SERIES REGULATOR DESIGN
¢ ± 0.40 volts ± 5 Amps
¢ ± 200 watts.
¢ Current limiting ± 5 Amps variable.
¢ Specifications Second to None.
¢ Free from the hum and noise sometimes associated with other techniques.
¢ A PROFESSIONAL SUPPLY.

K3325 (PICTURED) $175.00

All Altronics prices include Sales Tax. Don’t be conned by other advertisers whose seemingly low prices are actually coming from a plus Tax on price. You could well pay up to 32½% more.
SECOND ABC REGIONAL NETWORK

A Federal Government task force is to begin planning a second regional radio network for the ABC. The new network will benefit some four million Australians and boost broadcasting services in rural areas.

Construction of the transmitting facilities is expected to begin in 1984-85.

The Federal Minister for Communications, Mr Michael Duffy, said the new network will provide programmes with a greater amount of local material and would involve the establishment of new ABC studios and the upgrading of others.

MULTICULTURAL TV
UHF ONLY FROM JANUARY

The Multicultural Television Service, currently transmitted in Sydney and Melbourne on both VHF Channel 0 and UHF Channel 28, is to be shown only on UHF 28 from January 1, 1985.

The Minister for Communications, Mr Michael Duffy, said the announcement has been made early to ensure that all viewers of multicultural television can familiarise themselves with ultra high frequency (UHF) reception and equipment by the time VHF Channel 0 is phased out.

"When the decision was taken to establish the Multicultural Television Service few people in Sydney and Melbourne had UHF receivers or antennas. That situation is changing rapidly and today, most receivers produced have both UHF and VHF capability," Mr Duffy said.

"The phasing out of Channel 0 is part of the Government's policy to ensure the orderly development of use of the radio frequency spectrum. The VHF band is becoming crowded as new FM radio stations join the increasing number of television stations using this band. The result can be poor reception as one station interfered with another... the UHF band is less crowded and can accommodate more television services."

Most modern television sets are equipped to receive UHF channels. Older VHF-only sets will require a small UHF/VHF down-converter to allow UHF operation.

MEET GENERAL 'CATTLE DOG' PHILIPS!

The Philips Components 1983 General Catalogue is now available. The catalogue lists products of the Philips Electronic Components and Material Division, including type numbers, catalogue numbers and brief data.

Owing to the extensive range of products it deals with, the catalogue is concise. Complete data is available from the Philips system of data handbooks, now comprised of 46 volumes and divided into four series distinguished by colour: S Series — semiconductors — red; IC Series — integrated circuits — purple; C Series — components and materials — green; T Series — electron tubes — blue.

For further information, contact your local Philips Electronic Components and Materials regional office or write to P.O. Box 50, Lane Cove NSW 2066.

DICK SMITH IN AVONDALE, N.Z.

As a convenience to electronics enthusiasts who live in the western suburbs of Auckland, the retailing centre of Avondale has become the host for the latest Dick Smith Electronics store.

Now Avondale's electronics enthusiasts (and enthusiastic beginners as well) will have at their doorstep everything from components to kits, home computers, telephone products, car sound systems, books on all facets of electronics, etc.

located at 1795 Great North Road, Avondale, the phone number is 886-696. Avondale store manager, Richard Rowe and his specially-trained staff are looking forward to serving you, according to the press release.

ADVANCE IN SOLAR TECHNOLOGY

The highest open circuit voltage (OCV) yet recorded from a silicon solar cell has been achieved by the Solar Photovoltaic Research Group at the University of New South Wales.

In tests measured by international standards and verified in the United States, the new silicon solar cells produced an OCV of 694 mV. Only three years ago, 650 mV was considered the ultimate. With further development, the group expects to soon achieve 700 mV.

The Solar Photovoltaic Research Group is headed by Dr Martin Green.
**SHAPING THE FUTURE WITH NATIONAL**

Visitors to National Panasonics 'Shaping the Future' exhibition at Centrepoint, Sydney in September were greeted by a robot Panawagon, after entering through a space module interior replica.

Inside the exhibit area, 'lunar beings' emerged on the hour to present a display of audio gear from the National Panasonics and Technics range while dancing to a combination of exciting lighting and sound effects.

Also on show was the 'Aussat' direct broadcast satellite receiver system. The satellite is scheduled to be launched in 1985 and will be served by National antennas, converters and receivers, the company asserts.

A 'computerised home of the future' display was also at the exhibition, giving visitors an idea of an average day in the life of an Australian family in the next century.

A giant triple-screen showing an audio-visual documentary, 'The Evolution of Man', brought from Japan especially for the exhibition, also gained attention.

Visitors were encouraged to use and experiment with the products on display including video, audio and television equipment, organs, keyboards, computers, domestic appliances and business equipment.

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**SUNRISE COURSES**

The engineering processes of modern companies are becoming increasingly computerised and technical staff are having to learn to live and work with new technology.

Gerry O'Dowd is attempting to make this transition easier for companies and employees. Mr O'Dowd took up teaching after ten years in the RAAF and is now the industrial liaison representative at Footscray Technical College of TAFE. Since 1981 he has organised special courses for workers in companies which include Ford, Containers and Union Carbide.

"Eventually what we want is for people to come to us with any problem and we will tailor courses to suit them," Mr O'Dowd says. "We will try to fit them into an existing college course, but if we can't, we can organise a special course in a matter of weeks."

Mr O'Dowd's help has already been called upon frequently in the area of programmable controllers. These can save enormous time and effort in industry. For example, if a company begins building a new design of car, they just have to type in instructions on a panel and it will instruct robots. Before, you had to redesign the whole system. "It is a device which is readily understood by electricians, but they must be shown how to deal with it," Mr O'Dowd says.

At Footscray College, supervisors, foremen and other technical staff are taught how to operate Modicon programmable controllers. They are taught about the system's hardware and shown how to program, fault-find and troubleshoot it.

For further information, contact Footscray College of TAFE, P.O. Box 197, Footscray Vic. 3011. (03)688-3400.

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**PERSONAL ELECTRONICS LIFESTYLE EXPO**

Large crowds are expected at Sydney's Centrepoint exhibition complex for the Personal Electronics Lifestyle Expo to be held over four days from Thursday December 1st until Sunday December 4th.

Christmas shoppers looking for gift ideas will have a smorgasbord of electronics products to review and buy from such major suppliers as Apple, Sanyo, Commodore, Matsui, JVC, Westpac, Videocraft, Grundig and Telecom.

Lifestyle Expo will cover the gamut of electronic entertainment, education and communication products for the home, with something for all ages.

On show will be low cost personal computers, the latest entertainment in home video technology and programs, creative music keyboards, new video and computer games, home sound systems, in-car and on-foot entertainment for those into the best in sound, intelligent telephones and home security systems and home robots.

"In the last decade, Australia has proved itself to be the world's most receptive marketplace for innovations in home electronics technology," says Kevin Rebbech, Managing Director of Graphic Directions, the company organising the expo.

"As an indication of things to come, it is estimated that within ten years, up to 40 million American homes will have videotex type information systems for such services as banking, shopping, education, electronic messages, travel reservations, games and personal calendars." Australia appears likely to follow US trends.

Lifestyle Expo will distribute more than 1 000 000 invitations to Sydney householders to participate in this event. Whether you are a personal electronics addict or just looking for Christmas gift ideas, don't miss Personal Electronics Lifestyle Expo. For further information, contact Graphic Directions, 28-46 Foveaux Street, Surry Hills NSW 2010. (02)212-4199.
THE ATOM: IT'S FULL OF COLOURED GLUE, WINE AND STRANGE DUCKS

The idea of a basic particle of matter, the atom, originated with the Greeks and was elaborated on in the 19th Century by John Dalton.

The discovery, in November 1982, of the long-sought-after subatomic particle, the W, was a tremendously exciting event for physicists. It's an important step in the attempt to unify the four basic forces in nature — gravity, electromagnetism and the strong and weak nuclear forces — into one graspable mathematical structure, a so-called grand unification theory. John Dalton is probably doing something useful in his grave, warming up to escape velocity.

Joseph John Thomson shattered the idea of the indivisible atom in 1897 when he identified the electron.

Then Ernest Rutherford bombarded a sheet of thin gold foil with alpha particles early in the 20th Century. He devised a way to trace the motions of these positive particles and proved that in the nucleus of the hydrogen atom were single positive charges which he called protons. Things really started hotting up and with the 'atom smashers' (particle accelerators), subatomic particles of all shapes and sizes were discovered. In 1932, Carl Anderson identified a particle with the same mass as an electron with an equal but opposite charge. This positron was the first bit of antimatter ever found.

In 1947, the pi meson, or pion, was discovered and then the existence of the massless, neutral, and therefore almost undetectable, neutrino was confirmed.

Today, physicists confront a menagerie of more than 200 subnuclear particles known as hadrons, whose names and properties are diligently recorded in the 120-page particle bible called Particle Properties Data Booklet. This is in addition to another class of particle known as leptons.

The daunting prospect is that there could be hundreds of 'fundamental' particles. However, Murray Gell-Mann, physicist at Caltech in the United States, said that this isn't true. He has come up with an amazing idea for a new basic unit of matter called the quark. The quark comes in three kinds of 'flavours' which he has dubbed 'up', 'down' and 'strange'. In varying combinations, they make up every hadron and, though individual quarks have never been seen, there is substantial evidence that they exist.

Experiments have shown that there are small, heavy quarklike things inside the proton — three somethings resting in a mass of 'glue'. Force-carrying particles, now called gluons, are thought to bind the quarks, and therefore all the hadrons, together.

Many physicists have elaborated the quark theory and added three 'colours' and three more flavours — 'top', 'bottom' and 'charm', an exquisite and delicate concoction.

Theorists are restless churning out even more complicated grand unification theories in their effort to answer some bothersome problems. But they are, in turn, creating even more problems. The proliferation of other particles with some rather intimidating names: photinos, sleptons, Goldstinos, technipions, squarks, left-handed Weyl Higgsinos, gluinos, Zinos and even Winos. Exactly where this long and costly quest will lead is imponderable. Despite the formidable obstacles, men like Murray Gell-Mann think the effort is very worthwhile and will result in understanding in a deeper and deeper way the nature of the universe in which we live.

—Jennie Whyte

LASER EXPANSION

Moorabbin-based Laser Systems has been appointed the Victorian distributor for the Laser Electronics range.

The Australian-manufactured range includes lasers for laboratories, schools, factories, hospitals and entertainment, with applications as diverse as cutting, drilling, welding and marine navigation systems.

For further information, contact Laser Systems, 81 Tucker Road, Moorabbin Vic. 3189. (03)557-8385.

VISIONHIRE DEFENDS VIDEOTEX SYSTEM

Despite the critics' dire predictions for Videotex in Australia, Visionhire says it is confident that the computer-based two-way information system, which involves telephone-line access to the data-storage bases, has a bright future.

Visionhire is a member of the newly formed Australian Videotex Industry Association which has set, as one of its goals, the dissemination of accurate information on Videotex, to counteract the confusion arising from misleading reports.

According to David Peers, Visionhire's technical director, "Most of the negative viewpoints have been almost word-for-word recitations of the British experience." (In Britain, the equivalent Prestel system has had a difficult beginning.)

"On the other hand, Videotex found an immensely receptive market in the business com-

munity. From day one it has been aimed not as a system for public use but as a system of providing information retrieval by the business community. "That's not to say, however, that Videotex will always remain within the narrow confines of the business market. There is absolutely no doubt that it will one day become commonplace in our homes."

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The robots aren’t coming — they’re here!

Dennis Lingane

The man who started the electronic games boom and rode the crest of the home computer wave, Nolan Bushnell, the founder of Atari, seems set to repeat his past performance with a venture into personal robots. Dennis Lingane interviewed him at the Chicago Electronics Show in the US a few months back.

Within four years it will be a common sight to see robots of various sizes following their owners down the streets to carry the shopping. At home, the same robot will vacuum the lounge on command or serve savouries and drinks to dinner guests and will even trundle round the swimming pool picking up and delivering frosty beer cans to sunbathing homo-sapiens.

That’s the future according to Nolan Bushnell, recognised as one of the top electronics entrepreneurs in this business. He started Atari in a small garage in Silicon Valley and then sold it a few years back to the giant Warner Corporation for $27 million.

Bushnell moved on to open Pizza Showtime Theatres around the US which combined a pizza parlor with an electronic games arcade for the whole family. Two years ago he launched a new company called Androbot and started to develop ‘house trained’ robots. Some of the top robotics engineers in the US rushed to join him because of his reputation for pioneering new technology and making it work.

In the last few months the first of the Bushnell robots became available on the consumer market. They’re capable of doing limited household chores — but they don’t do windows.

“They could,” says Bushnell, “But I am sick of people asking me if they can, and anyway, why should robots do windows when domestics won’t.”

Your android pet

With their limited abilities, the robots are being bought now as a novelty by computer hobbyists and as household pets by those who like to have something different.

And why not as pets? Bushnell says that robots could easily replace dogs as a household pet.
“Well, most people buy dogs to take them for a walk as an excuse to meet the opposite sex,” says Bushnell. “The robot can be taken for walks instead and is bound to attract more attention than a dog.”

The robot would also be able to bark if need be as part of a passive security system, and even call the police (something dogs can’t do) if somebody broke into the house. Robots don’t need feeding and watering and don’t mess up pavements and gardens, all adding weight to Bushnells’ argument that robots could replace dogs.

Switching to more serious applications, he says that robots will be used in hospitals in increasing numbers to deliver tablets and medicine to patients. Another robot engineer says that robots will be used by police to go up against armed gangsters, and used by firemen to rescue victims from fires.

**Now and the future**

The real future of robots is in the home, says Bushnell, and within four years we will be buying them off the shelf with the same enthusiasm we buy video recorders these days.

Bushnell says that in four months of trading he has already sold several thousand robots to computer hobbyists and people who want to be the first on the block.

His current range of robots include: FRED, a US$250 250mm high robot that can be controlled either from a home computer or an infrared control; Topo, a full-sized robot controlled by a computer, but which can also be voice controlled, and maps out your home; and BOB, an independent ‘intelligent’ robot that comes when it is called and can differ between humans and furniture.

FRED is a beginners robot. He has been developed to help children learn about robots as a cheap add-on to a home computer system. He can hold a pen and has downward facing sensors to make sure he doesn’t roll over the edge of a table or staircase. With his pen he will duplicate patterns you draw on the screen of your computer. He can also be controlled by a joystick through the computer. A voice module with a 45-word vocabulary is available as an add-on.

Next up the scale is Topo. He has most of the FRED features but is around one metre high and can memorise the layout of your home. So if you take him over a route all you need is to give the specific command related to that route and off he goes.

For example, if you have guests on the patio you can load up Topo with drinks and snacks in the kitchen and say “Patio Topo” and he will trundle out to the guests with his load following the route you previously ‘walked’ him over and taught him was ‘patio’.

When his tray has been emptied by the guests somebody on the patio simply says “Kitchen Topo” and he returns to the kitchen for his next load or to return the dirty dishes and glasses.

Topo can also be voice-controlled via a home computer to get him through areas that he doesn’t know. You tell him forward, back, left, right, etc. Topo sells for around US$500, voice synthesis and voice control lifting the price to around US$750.
But the real *piece de resistance* in the Bushnell line-up is BOB, for Brains-on-Board. Priced at US$3000 this is the truly "intelligent" robot that can be expanded as technology improves. It doesn't operate as the slave of a home computer, having instead its own intelligence on-board.

Sensors constantly scan around and beneath him (her?) (?), plotting where furniture, doors and walls are. BOB can eventually memorise the layout of your home and find his own way around. All he needs is to be told that the fridge is in one place, the vacuum cupboard in another etc. Then, on the command "beer BOB" he figures out where he is in the house, where the fridge is, and what walls and furniture lie between him and the fridge. He then trundles off to it, finding the doorways and going around furniture on the way.

Ultrasonic sensors help BOB analyse objects. But even cleverer are his infrared sensors that enable him to distinguish humans from objects. BOB will trundle right up to you, finding his way round the furniture to do so.

He can speak through three ways: with his own on-board vocabulary, via a keyboard from a home computer or by recording your voice and adding it to his own.

BOB also has a "follow me" mode so, given the command, he will follow his mistress or master down to the shops and uncomplainingly carry the shopping in an (optional-extra) Androbot cart attached to his back.

**More to come!**

While BOB is amazing even now, he is only the beginning says Bushnell. A team of 60 engineers, scientists, and computer programmers are working on add-on components for BOB that will make him even more versatile.

He has an electronic belly that, when opened, reveals a number of printed circuit boards. There is currently three megabytes of memory capacity to handle the repertoire of tricks he comes with, but there are a number of vacant slots for extra boards to cater for future development.

For example, BOB currently only has a scoop arm that opens out to catch cans of beer or other objects. As yet, he cannot pick up articles. Add-on arms will be available later that will bend, twist and have hands so he can pick up things. With these he will be able to wash windows, but Bushnell says he won't write the program because he considers it undignified for his lovable robots to have to do something even human servants won't do.

However, BOB will be able to pick up a vacuum cleaner and run round vacuuming the lounge for you, open a door or window, take food from a freezer and place it in the microwave for defrosting, mow the lawn, vacuum the swimming pool, and maybe even wash the car. Bushnell says there isn't much the robots can't do if they are programmed for it.

They can recognise intruders and telephone the police, turn on outside lights when the bell rings, open the door if it recognises a password, and even back itself into a power point to recharge its batteries when they start to run down (BOB has a three-hour battery life at present).

Bushnell's favourite demonstration is to lie by a swimming pool and send BOB off for a cold beer.

**The catch!**

There is one catch to all this. Bushnell says that a home to cater for a robotic lifestyle should be built as if for a wheel chair. Split levels should be connected with ramps rather than steps. If you have a two-storey home you will have to install a special Androbot lift to get him upstairs to deliver your breakfast in bed.

Bushnell has made his robots friendly looking so they will be accepted as household pets and in time may even take on teaching children of pre-school age.

What the Buck Rogers TV producers make Tweaky do on TV with simple remote control trickery, Bushnell has now made a reality. Given time, robots will be as common place as dogs as electronic pets, replacing the canine as a watchdog and doing all the household chores (like feeding the dog), leaving the family free for other activities.

Best of all, a robot won't need feeding or grooming, and will do the household chores without payment.

Futuretronics Australia Pty Ltd, the distributors of the Atari VCS and home computers, has the exclusive Australian rights to distribute the Androbot robots. For further information on these robots contact Futuretronics Australia, 1076 Centre Rd, Oakleigh Vic. 3166. (03)579-2011.
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See ETI, September 1993

SPECIFICATIONS: 3-way speaker system 30 litres capacity, size 65 x 30 x 23cm 8 ohms nominal impedance 45Hz - 19KHz (-10dB) 40 watts nominal power handling

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**BETA HI-FI ARRIVES**

The Beta format companies of Australia, Sanyo, Toshiba, and Sony, have introduced ‘Beta Hi-Fi’ which combines video pictures with a range and quality of sound the companies claim is second only to the latest digital format.

The best index of Beta Hi-Fi's performance is the dynamic range. Most VCRs have a dynamic spread of around 40 dB. If the set is equipped with Dolby noise-reduction it will achieve 46 dB. Audio cassettes, FM broadcasts and LP records range from about 50 dB to 70 dB. The new Beta Hi-Fi VCR delivers an astonishing 80 dB, approaching the performance of compact disc systems.

The system's other specifications include frequency response from 20 Hz to 20 kHz, wow and flutter less than 0.005%, harmonic distortion less than 0.3% at 40 Hz and channel separation of more than 60 dB.

The soundtracks of movies such as 'Star Wars' and 'Apocalypse Now' can be enjoyed to their fullest. The sound can be played back through a television monitor with stereo audio output or a full stereo sound system.

To achieve such high quality sound reproduction combined with an equally high level of video imagery, Beta Hi-Fi departs from previous cassette recording methods.

Conventional systems, both monaural and stereo, use fixed audio heads recording on a longitudinal audio track at the edge of the tape. The Beta Hi-Fi system combines the video and audio tracks, making use of the wider frequency band available.

As the audio track is also recorded (in mono) along the tape edge, as before, the new tapes are compatible with other Beta format machines, and conventional Beta tapes will also play in monaural on the new Beta Hi-Fi.

For further information, contact Sanyo, Sony or Toshiba offices in your state.

**PIONEER’S MULTI-SYSTEM**

Pioneer Electronics has released five stereo systems made up from its "Performance Series" range of turntables, amplifiers, tuners, cassette decks and graphic equaliser.

Hi-Fi enthusiasts can either build their own system, using the Performance Range components, or choose one of the new sound systems utilising the same items.

The $999 bottom-of-the-range A1 system contains such features as: a PL540 belt-drive turntable, an SA540 30 W amplifier, a CT540 cassette deck, a TX540 tuner, a pair of CS549 three-way speakers and a CBA500 furniture cabinet.

The $2599 top-end A9 system includes a PL740 direct-drive turntable, an SA1040 100 W amplifier, a CT1040-W double cassette deck, an SG540 graphic equaliser, a DT540 timer, a JR-L4A lamp, a CS849 four-way speaker system and CBA900 vertical furniture cabinet.

The other systems are the A3 ($1099), the A5 ($1599) and the A7 ($2199).

For further information, contact Pioneer Electronics Australia, 178 Boundary Road, Braeside Vic. 3195. (03)580-9911.

**DANISH, WITH DEEP BASS**

Scan Audio is now stocking the new Jamo PP-2504 loudspeakers with built-in sub-woofers.

Conventional loudspeakers often lack in the very deep bass area. Music lovers who enjoy organ music or other music with lots of deep bass information have therefore found it necessary to connect a separate active sub-woofer to their existing loudspeakers.

For the past 18 months, Jamo has been working on a construction where it is possible to get deep bass information without having a separate sub-woofer.

This new loudspeaker is a four-way construction with two 10" (250 mm) woofers in an anti-parallel connection. The two woofers are mounted towards each other in the bottom of the loudspeaker.

Called the Push-Pull 2504, the loudspeaker is a top-of-the-range model in a new range from Jamo called 'Scan Line'.

The retail price of the top model PP-2504 is around $1495.

**TIME, SOUNDS AND GAMES**

Three components have been incorporated into Sanyo's RP77: stereo listening, digital time-keeping and action games.

The unit's AM/FM stereo radio has two headphone jacks, slide-rule tuning, an LED FM stereo indicator light and a convenient shoulder strap.

A three-position mode switch makes it possible to select digital time display or either of the two game variations on the LCD screen. The game sound effects are heard through the headphones.

The RP77m which retails at $79.95, operates on three AA-size batteries.

For further information, contact Sanyo Australia, 225 Miller Street, North Sydney NSW 2060. (02)436-1122.
THE STATE-OF-THE-ART TAPE

West Germany's BASF corporation — the inventor of magnetic recording tape — has introduced to Australia what it claims is the state-of-the-art videotape, the BASF Chrome Super High Grade.

The new videotape is made with an exclusive pure chromium dioxide formulation for what BASF says is the finest picture quality available.

The chromium dioxide magnetic particle is manufactured synthetically under tremendous heat and pressure to create microscopic monocryals that are almost identical in physical shape, and free from the physical deformities.

Beyer's Wire-less Mic

Beyer Dynamic's new S185 hand-held FM wire-less microphone is designed for professional performers who require high-quality sound without the restrictions of a microphone cable.

Features of the S185 include a built-in switchable limiter, up to three channels and a 65 dB dynamic range with a very low distortion and an excellent signal-to-noise ratio.

The S185 is available in three versions: the SBM185, using an M500 dynamic microphone head; the SEM185, equipped with an electret condenser cartridge; and the SCV185, which, with a CV85 adaptor, can be used in conjunction with Beyer condenser capsules, including shotgun types.

For further information, contact Rank Electronics Ltd, Pymble Street, Pymble NSW 2073. (02) 449-5666.

FEEL THE QUALITY AND THE WIDTH

Concord's latest range of car hi-fi systems, the HPL-500 series, is the most compact yet designed.

Featuring panel lighting, illuminated 'soft-touch' switches and indicators and integral 25 W per channel amplifiers, the four new Concord models are based on a 12 cm-deep chassis — more than 30 mm shallower than most other hi-performance car stereo systems.

LONG-PLAY STEREO VCR

Akai's new front-loading VS-8EA video cassette recorder, due for release in September, is the first in the Akai line-up to offer two-speed long-play and stereo playback.

In the long-play mode, a four-hour cassette will record for up to eight hours.

For music fans, the VS-8EA's stereophonic capabilities are backed up by the Dolby noise-reduction system.

All four models are fitted with a dc servo tape-drive motor which reduces speed fluctuation to \(\pm 0.5\%\), compared with \(\pm 5\%\) in mechanically controlled drive systems.

The two top-of-the-line models, the HPL-535 and HPL-532, also have a unique two-way/four-way amplifier system. Using the integral 50 W amplifier as a base, built-in switching allows four-channel operation at 10 W per channel for four-speaker installations without requiring an additional external amplifier.

For further details, contact Sonic International, 4 Clarendon Street, Artarmon NSW 2064. (02)439-8900.

The VHS-format VS-8EA also utilises the interactive monitor system (IMS) for on-screen instructions. It has 32-station preset tuning, plus on-screen display of the television station's name — each station is given a five-character alphanumeric code which is displayed when the station is selected.

The VS-8EA, which has a cordless remote-control hand-piece, measures 440 x 135 x 360 mm.

For further details, contact Akai Australia, Eden Park, Waterloo Road, North Ryde NSW 2113. (02)887-2311.

AWA FRONT-LOADER

The latest manufacturer to offer a front-loading VCR on the Australian market is AWA. Front-loading allows video recorders to be tucked away in a component rack or shelf, as there is no need for access to the unit's top surface.

Designated Model AV-11, the new recorder retains the five computer-controlled models of earlier AWA units, and a sixth motor has been added to control the front-loading.

The AV-11 also has a new eight-function remote control, connected to the recorder by an umbilical cord.

Dimensions of the AV-11 are 424 x 365 x 130 mm, and it weighs about 9 kg — virtually identical to the lightweight AWA models introduced last year.

ETI November 1983 - 19
ULTRA-FAST CASSETTE RECORDER

A cassette recorder that saves time by making standard tapes understandable at up to twice the normal speed is being offered for the first time by Tandy Electronics.

The Realistic VSC-1000 portable recorder, which is available for around $170, is designed to allow business people to quickly review recorded business meetings, conversations, interviews and focus groups.

The 'speed listening' technology of the variable speech control built into the VSC-1000 cassette recorder plays back recorded tapes with normal sound. It eliminates the usual high-pitched distortion that occurs when a tape is played faster than its original recording speed.

One slide-action control adjusts playback from 80% to two times normal speed. Another slide control adjusts pitch for easy understanding, while a switch allows moving from 'speed listening' to normal speed and back without affecting the settings.

For further details, contact Tandy Electronics, 91 Kurrajong Avenue, Mount druitt NSW 2770. (02) 75-1222.

CARVER'S HIGH-POWER LIGHTWEIGHT AMPLIFIER

Released in Australia in August, the Carver M-1.5 magnetic-field amplifier is believed to be the first amplifier specifically designed to accommodate the dynamic range of digital audio systems and digital record playback.

"Just about the only conventional aspects of the M-1.5 are that it has a chassis, knobs, switches and that you plug it into an ac outlet," says Bob Carver, president of the United States-based Carver Corporation and designer of the M-1.5.

The Carver Corporation's new top-of-the-line model, the M-1.5 is a demand-responsive magnetic field unit that produces 1200 W output power (600 W x 2, both channels driven into 8 ohms).

It features a unique acceleration stress monitoring and protection circuit which constantly evaluates stress, thermal input and other vital factors to render the loudspeakers immune from amplifier-caused damage.

The M-1.5's Australian price is $1895.

Also new from the Carver Corporation, and released in Australia in August, are the Carver M-200t magnetic-field power amplifier — it utilises the technology of the M-1.5 — and the Carver C-2 preamplifier.

The Carver M-200t power amplifier produces 120 W minimum continuous power per channel into 8 ohms, 20 Hz to 20 kHz with less than 0.05 THD. It weighs 3.6 kg and measures 44 x 23 x 6.5 cm.

The Carver C-2 preamplifier, which shares the M-200t's dimensions, features a switchable phono input which allows for use with either moving magnet or moving coil cartridge. A moving coil preamp is built into the unit.

The C-2 offers an infrasonic filter, base and treble controls, tone control by-pass, a tuner input, two tape inputs, provision for two-way dubbing, an auxiliary input, an external processor loop and a mode switch. A rear-panel jack allows a high-level gain choice of 15 or 25 dB.

For more information, contact Convoy International, 400 Botany Road, Alexandria NSW 2015. (02) 998-7300.

MAGNAVOX'S AMERICAN DIRECTION

Magnavox Australia, a wholly Australian-owned company which has been engaged in the manufacture of loudspeakers for more than 50 years, has undergone a substantial restructuring programme, and major changes have been made to its scope of operations.

Contracts have been exchanged with Magnasync-Moviola, California, for the company to acquire a manufacturing facility in the United States with perpetual exclusive rights to manufacture the Magnasync line of studio recorders.

The United States subsidiary, West Coast Audio, will manufacture a wide range of audio and recording equipment, principally related to the television and motion-picture industry, but also having substantial application in the industrial and defence areas.

Magnavox Australia has also announced that Mr N. H. Hicks has assumed the role of majority shareholder and chief executive of the company.

The former managing director, Mr C. L. Hinchen, has retired from active participation in the company.

For further information on Magnavox, contact Magnavox Australia, 6-12 O'Riordan Street, Alexandria NSW 2012. (02) 699-4506.

THE TWEAK METHOD

Tweek, a fluid formulated to prevent oxidation and improve contact of male-female power-circuit connections, has been introduced to Australia by Audio Q Imports.

Marketed in phial form at $20 a phial, Tweek is claimed to improve contact of male-female connections on a molecular level, resulting in an improved signal.

For further details, contact Audio Q Imports, 227 Gough Street, Thornbury Vic. 3071. (03) 481-7828.
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NEW SOUTH WALES: Glenwood Speaker Corporation, (02) 521-5577. Audio Perfection, (02) 629-2985.

ETI November 1983 - 21
The 'portable studio' Yamaha's Multitrack Recording System

Andrew Symaniz
So the boys in the band are ready for a demo tape but haven't got the dollars; or you're an electro-muso, built your own synthesiser but can't afford that 'dream studio'? Wait! Don't OD on sump oil and scotch, salvation may be at hand.

MAYBE you're a member of a hard-working club band, receiving positive audience attention every night and slowly accumulating a denser come-rain-or-shine following of fans, hang-ons and/or music-mag coverage. The next stage in your musical career would be to put down a 'demo' which you would proudly trot around in the hope of scoring better-paying gigs or perhaps that one-in-a-thousand chance of being rocketed to stardom through securing a recording deal.

But, after P.A. hire, band and crew expenses, agency and promo costs; not forgetting equipment maintenance, there's not very much left for spending on the recording. And what are you left with after the hurriedly done demo (because in the studio, time can be measured in dollars per minute) fails to fulfil your wildest optimism? An uninspiring debt that can hamper all future recording attempts.

As a second example, perhaps you are one of the new electro-musicians of the eighties... you own one or more synthesisers, a simple little rhythm machine, perhaps a few interesting acoustical gems such as toy-pianos, one-stringed violins (because it's only ever had one string from the time you bought it at the garage sale five years go), and you have a flair for composition and melodic part writing.

To you, your trusty old cassette player is as important a composition tool as manuscript paper is for classical musicians. But isn't it frustrating when your sequencer lines don't sync up with your recorded patterns? And when you make a single 'boob' or later decide to change the structural format, you have to return to square one! Right?

One of these days you'll put together your ultimate 'dream studio' you say: But as the months go by you realise that unless the money comes from somewhere (and it's very unlikely that you can actually make any at this level) your 'dream studio' will remain just that... a dream.

One very sensible alternative that both the working band and the home electro-enthusiast with limited funds might consider is scrapping together $1300 or so and purchasing the new Yamaha Multitrack Recording System. With careful planning and a bit of time to spare, a creative musician can piece together recordings of surprising complexity. And, either working alone or with other band members, whole songs can be composed, modified and remixed onto another cassette recorder, resulting in a demo tape of remarkable clarity for a fraction of the cost of a studio demo.

The recording system is part of Yamaha's excellent Producer Series range of equipment which includes the CS01 Monophonic Synthesiser, the MR10 Drum Machine and the MS10 Monitor System. However, if you already have the instruments you require, all you'll need is the MM30 Portable Mixer, the MT44 Multitrack Cassette Recorder and the RB30 System Rack and Patch Bay Unit.

Upon opening the cartons and taking a cursory glance at the excellent owner's manuals, I was impressed by the ease with which the system can be patched together and got up and working within a few minutes.

The system rack neatly houses the recorder, mixer, patch bay and provides a handy storage compartment (large enough to accommodate up to 20 cassette tapes, if need be. All connecting cables and inputs and outputs are clearly labelled and use either standard RCA connectors (for patching directly with other hi-fi equipment) or 6.5 mm jacks (when connected to instruments). Everything fits quite snugly together with a few Philips-head screws and the whole system is very light and would not look out of place alongside expensive professional equipment.

The mixer

There are four main inputs to the mixer labelled channels 1-4. These inputs can either be microphone-level inputs, line inputs (for connection to perhaps a synthesiser or effects unit), or tape inputs (used for reading back already recorded signals on tape; for remixing, say, or monitoring pre-recorded sections while recording new ones on different channels).

Each channel has its own input selector so you can connect input sources in any combination. In addition to the four main inputs there is provision for mixing a stereo input signal from an auxiliary source. For example, stereo tape signal from a previous mixdown or perhaps as two extra instrument inputs if the four main input channels are occupied. Alternatively, these two extra inputs can be used as an external effects return from an external stereo signal processor.

The only problem with using the aux-in as a mono effects return is that unwanted preamp noise will be added to the unused stereo channel half, since there is only a single aux-in fader on the mixing console. Also, the aux-input channels have no individual tone controls or panpots.

The channel equaliser section consists of a single shelf-EQ giving ±12 dB boost or cut at 10 kHz. One omission in the design that I feel is worth mentioning is that there is no visual indication of input-channel overload. Admittedly, all any sound engineer worth his/her salt really needs in detecting input distortion is a good pair of ears. But, regardless of keeping production costs to a minimum,
interchangeable provided the external cassette deck being used has a chrome tape selector (EQ: 70 μs) which is standard on the MT44.

On the floor of the cassette tray are three sensors that determine whether the MT44 will operate as a four-track multitrack, or as a regular two channel cassette deck. When a special sensor-stripe (provided with the machine) is placed over the rear cassette window and the tape inserted, the machine automatically switches to multitrack operation.

The tape-travel control panel operations

are all touch-sensitive logic-controlled pads and are a sheer delight to use. Extra functions include a record-mute pad (used for inserting blank spaces on top of recorded tracks: for removing vocalists' giggles when they're not singing during the lead breaks for example) and zero stop/play buttons. What these two buttons do is stop the tape at exactly (and I do mean exactly) zero on the tape counter when in rewind mode. When zero play is depressed the machine automatically replays after stopping. These two features are a godsend for returning to the same point for overdubs or drop-ins. Also, because there are separate controls for record-standby and record, the whole operation of 'dropping-in' on a previously recorded track, recording a new section, and then 'dropping-out' into play mode again is a real breeze — and it's free from clicks on tape at the drop-in points.

The patchbay

The patchbay unit does not actually add to any of the functions that already exist using only the mixer and multitrack. However, its inclusion in the system does make your recording life a whole lot easier since all the rear panel connections are routed and switched through this little number...rather like a telephone exchange station.

Because all the inputs, outputs, and insertions are all conveniently and systematically located on one panel, and all the main interconnections are already patched together on default, you need spend less time fiddling and sorting through a rat's nest of cables, and more time with the real job at hand...creating music.

Along the bottom row are the four micline inputs to the mixer. There are also the aux-inputs, mixer line-out (for connecting to an external stereo tapedeck, say, when mixing down multiple recording sources from the mixer or multitrack), stereo out (controlled by the mixer master-fader and therefore suitable as an output monitor terminal) and the mixer headphone-mix socket.

The replay terminals contain the multitrack line-outs internally wired to the mixer tape-ins. However, signals can be taken out at this point and redirected or passed through external effects units before being reinserted into the same channel, or perhaps a different one altogether already set up for recording.

Also corresponding to each of the four main mixer channels are the record terminals and mixer out selector. The latter is a three-position switch which determines the recording mode of the multitrack. The centre position (tape-out) sends signals passing through the main input channels on the mixer, straight out to the corresponding inputs on the multitrack before mixing.

This direct-out signal is affected by the tone and fader controls but passes out to the recorder before reaching the echo, pan, or graphics controls. This can be a very desirable function since, no matter how you set up the monitor mix using these controls, the signals sent to tape will remain completely unaffected and 'dry' (unless of course you intentionally insert an effects unit somewhere in the chain).

The other two positions for the mixer out selector are for sending mixed signals from either the left stereo-out bus, or the right. It is in this way that several pre-recorded tracks can be 'bounced' down onto one track. The track that is to carry the bounced down mix of the other three will have its
corresponding mixer out selector switch in position to read the side of the stereo-out that the replaying tracks have been panned onto. All that needs to be done now is hit record on the Multi ... a quick fiddle with the mixer channel faders ... and, hey presto ... instant ping-pong!!

The record terminals are similarly internally wired-up to connect the direct-outputs from the main mixing channels with the corresponding multitrack inputs; unless the circuitry is broken by the insertion of effects such as compressors, delay units, graphics etc. Of course, the effects' effects (!) will not be heard through the monitors off the mixing panel, but can be monitored further up the chain from the headphone socket on the multitrack.

**Flexibility**

In the short time I used the Yamaha Multitrack System, I found it to be a remarkably flexible and inspiring musician's aid in a variety of recording environments.

For starters, I took the set-up along to one of the bands I regularly live-engineer for and connected up two of the channels to two auxiliary sends on the front-of-house mixing desk. One channel comprised of a vocal-mix and the other combined the instruments with drums.

The relative levels of each instrument (or voice) were sub-mixed on the main front-of-house system. In addition, I set up two good quality microphones wide apart, and ran them into the other two channels. When I later remixed these tracks I was surprised by the subtle effects that were possible by juggling different combinations of 'desk-sound' with the 'live-ambient-sound'. The remixed tape serves as a good live demo, with space for two more tracks for sound effects or dialogue, or even overdubs.

Next, I took the system with me to a band rehearsal where an old song was being revamped with new instrumentation. I laid down four tracks of drums (luckily I have the use of a pretty comprehensive effects rack so I had a lot of fun putting different echo effects on each track). I then remixed these down onto another cassette deck and used the stereo drum-effects tape as my new multitrack tape while I put down the guitars and bass.

A few generations later I had added three vocalist's, more effects and synthesizer, all mixed down in stereo, two tracks to spare and the original drums still coming through loud and clear! (Actually the drums ended up sounding quite "metallic" because I had somewhat mistakenly over-EQ'd the drums in anticipating a greater sound quality loss from all the generations I knew I would need to do. As it was, the over-EQ'd drums turned out to be an interesting effect in itself).

**Vast potential**

But it was at home, multitracking my own compositions together and playing all the parts myself, that I realised the vast potential of this portable studio as being more than just a recording tool. For me, the Yamaha Multitrack Recording System can become an extension of the composer's mind as parts are laid down, combined and rearranged. Most importantly, half-baked musical ideas can be immediately tested and either modified or rejected, complementing the natural progression of the songwriter's intent. And with a bit of imagination, this very 'user-friendly' piece of equipment can be put to work as an instrument in its own right!

For example, by reversing the tape (and the sensor strip on the cassette window) track 1 becomes track 4, track 2 becomes track 3, etc only they will be playing backwards. By adding echo and ping-ponging to another track, when the tape is reversed again you have the original sounds still there, proceeded by a very eerie sounding pre-echo; quite effective on vocals.

Another idea is to record one vocal track, say, put down another identical vocal part while monitoring the first one, but this time adjust the pitch control slightly left and right. What you get when you play them both back together is one of the best sounding voice/chorus effects you've ever heard!

By experimenting and modulating tracks in different ways many sophisticated spatial effects are possible, including flanging and slow tremelo. With careful and systematic planning (and indeed, *panning*) your musical ideas can explore new dimensions using the Yamaha Multitrack Recording System.

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Louis Challis, ETI.

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ETI November 1983 - 25
Kiwis can fly. The impeccable performance of these outstanding New Zealand amplifiers puts them well above most of their competition. Testing showed that all the figures are exceptionally good with low distortion levels and matched output characteristics.

Louis Challis

The most obvious and unusual feature is the deletion of the conventional tone controls. Perreaux pointedly state that they are not required with a good system where all the items of equipment are selected for their frequency linearity.

Many people will argue this point of view on the basis that turntable, cartridge, radio, tape source and, most particularly, speakers and room acoustics are never linear or flat. Notwithstanding, it could be equally well argued that the conventional tone controls are generally inappropriate and unsuitable for coping with such problems, and that a more esoteric form of frequency correction than that provided by normal tone controls is required to cope with such situations.

The cabinet chassis features neat aluminium side rails, a perforated metal top cover and a vinyl-coated, steel bottom panel. The printed circuit board, clearly visible through the perforated top cover, features an innovative and unusual design layout. The golden-coloured toroidal power transformer and parallel array of twelve electrolytic capacitors are mounted straight on top of the pc board.

To achieve the maximum visual appeal the board features large areas of unetched copper film, carefully finished to provide a matching golden hued appearance. This is very neat and obviously calculated to

Perreaux SM2 preamplifier and PMF 1150B amplifier

AUDIO EQUIPMENT manufactured by 'Perreaux Sound' in New Zealand is relatively new on the Australian market and has been around only slightly longer on the New Zealand market. This firm has had a fantastic growth rate and market acceptance. Its approach to many aspects of design and marketing are novel by our conventional standards and the products worthy enough to penetrate the American market which generally demands good quality, preferably with a good price.

Manufacturers in New Zealand have one advantage over Australian manufacturers; their wages are currently substantially lower. New Zealand's export marketing incentives gives them a significant advantage in the Australian marketplace and helps them compete with the Japanese, American, European and, unfortunately, the remaining Australian manufacturers as well.

SM2 features

The SM2 preamplifier is attractive as well as being innovative in its basic design concepts. It features a very slim profile, rack-mounting module with an anodised satin aluminimum finish and neatly executed black silk-screened lettering on the front fascia. This preamplifier has fewer controls than any I have reviewed before.

On the left-hand side of the front panel is a push-on, push-off power switch, a balance control and a variable volume control with a logarithmic taper. On the right-hand side is an input selector for phonograph, tuner, auxiliary and tape, a source monitor switch and a small light emitting diode. And that is that!

**PERREAUX SM2 PREAMPLIFIER AND PMF 1150B AMPLIFIER**

<table>
<thead>
<tr>
<th>Model</th>
<th>Dimensions:</th>
<th>Weight:</th>
<th>Price:</th>
</tr>
</thead>
<tbody>
<tr>
<td>SM2</td>
<td>465 mm (19&quot;) wide x 45 mm high x 318 mm deep</td>
<td>3.3 kg</td>
<td>Rrp $1216</td>
</tr>
<tr>
<td>PMF 1150B</td>
<td>482 mm (19&quot;) wide x 185 mm high x 400 mm deep</td>
<td>16 kg</td>
<td>Rrp $1245</td>
</tr>
</tbody>
</table>

Manufactured by: Perreaux Sound Limited, P.O. Box 847, Napier, New Zealand.

Distributor: Perreaux Australia, 6 University Place, North Clayton, Vic. 3168. (03)561-5244.
impress the American marketplace where sales of this unit are already making significant inroads.

Four protective fuses are mounted on the printed circuit board instead of on the back panel where you might expect to find them. This has been done on the basis that you should not need access to them and if you do then something is radically wrong which you most probably cannot fix anyway.

The back of the preamplifier has a series of gold plated contacts for conventional phono input as well as inputs that provide a capacitive load or resistive load. The inputs are capable of being adjusted in level and sensitivity by a toggle switch so that the cartridge input impedance and sensitivity can be matched to suit either a moving coil or a moving magnet cartridge. The use of this switch is cautioned except with the volume control at a minimum setting. Other inputs provided for a tuner, auxiliary, tape in and out, a pair of monitor sockets and main output sockets.

**PMF 1150B features**

The PMF 1150B amplifier is even simpler in its frontal appearance than the SM2 preamplifier. It features a brushed satin aluminium front panel but, because of its larger dimensions and much greater weight, also incorporates two handles on either side.

The front panel fascia is surmounted by a black escutcheon; at the left-hand end of this is a LED and at the right-hand end is a rectangular push-on, push-off mains power switch. The side rails of the cabinet chassis, in a similar manner to the SM2, are intended for 19" rack mounting. They extend through to the back to provide protection for the rear mounted, double heatsink array.

The rear panel of the amplifier features a pair of gold-plated coaxial sockets, one of which becomes inoperative in the bridged mode. It also incorporates two pairs of large, universal, colour-coded output terminals. A stereo or bridged input socket allows the amplifier to be used for two channels of stereo or as a single channel amplifier, with almost double the power output, in the mono mode.

Overload protection is provided in the form of a mains power fuse on the small, central rear terminal panel and this is supplemented by two pairs of fuses on the main internal circuit board.

The appearance of the internal circuitry is relatively simple. A large aluminium angle bolt the heat sinks together, with four TO-3 transistors mounted at either end. The circuit designs and type numbers of these transistors have been deliberately polished off, possibly to make it harder for the competition to know whose components are being used in the design.

Unfortunately, this also makes it difficult for the purchaser who is capable of carrying out his own servicing, to know which transistors to use when repairs are required.

I find this approach of hiding component details rather hard to reconcile with what I believe is current good practice. The least that the designers at Perreaux should have done would have been to add their own in-house designations.

When you look at the inside of the chassis it is obvious that it has too much wasted space as the designers have apparently decided to make use of a standard module and existing system hardware, rather than economising on space and weight. If this has resulted in a reduced price, then well and good.

However, I feel that the resulting module creates the appearance of offering power and potential which is inappropriate.

The main power transformer is bolted to the front panel and large areas of space on both sides are empty. The main pc board, with remarkably few components on it, is bolted directly to the output heatsink which forms part of the rear panel. The capacitors and resistors have been chosen for both appearance and functionality.

The unit is sensibly laid out for both heat dissipation and ultimately for servicing. The top panel of the unit features a large cork insulating pad interposed at a location immediately over the power transformer; this effectively stiffens the panel in order to achieve a firm and stable base for other components that may be stacked on top of the amplifier.
SM2 test results

I was a little surprised to find how well both
the preamplifier and the main amplifier
performed. The objective testing confirmed
that they achieve a frequency response
which extends from 2.3 Hz to beyond
120 kHz.

The total harmonic distortion of the
preamplifier, when measured at 1.5 V
output, is extremely low with distortion
figures of 0.0037% at 100 Hz, 0.00026% at
1 kHz and 0.00026% at 6.3 kHz.

I was even more surprised to find that
this particular preamplifier is capable of
achieving peak to peak output voltages
of 75 V. As a result of this I decided to carry
out an IEC High Frequency Total
Difference Distortion evaluation on the
unit. The results of this test are
exceptionally good, so that between 10 V
and 75 V the distortion components are less
than 0.0015%.

This performance is extremely good by
any standards and not what one would
expect from a hi-fi preamplifier. Obviously
this preamplifier is a "wolf in sheep's
clothing", offering a power and potential
for many applications, including high powered
voltage preamplification where absolute
power is not an essential requirement.

The sensitivity of the phono preamplifier
in the high gain mode is typically 285 µV
with an overload point of 180 mV. In the
low gain mode the sensitivity is 2.2 mV with
an overload point of 1.4 V. These
performances are excellent and so were the
signal-to-noise ratio, hum levels and all the
other parameters that we checked. Overall
the objective performance of the SM2
preamplifier was found to be quite
outstanding and a credit to the designers.

PMF 1150B test results

The PMF 1150B power amplifier is also no
slouch when it comes to performance. Its
frequency response extends from 5 Hz to
beyond 120 kHz. The type of transistors or
power FETs that Perreaux use obviously
make this a relatively easy task, although
they carefully remove the details from
interested eyes.

At the rated power of 100 W into eight
ohms, the total harmonic distortion is a
lowly 0.01% at 100 Hz, 0.001% at 1 kHz and 0.0016% at 6.3 kHz.

At the one watt level, the distortion figures
are almost at the point of being
unmeasurable with miniscule figures of
0.00066% at 100 Hz, 0.00024% at 1 kHz and
0.00046% at 6.3 kHz.

With a performance like this you can well
understand why the preamplifier needs to
be as good as the SM2 and why Perreaux
arguably state their case for dispensing with
tone controls.

The signal-to-noise figures of the power
amplifier are also exceptionally good, being
-84 dB linear (unweighted) and
-95 dB(A) relative to the one watt level.

The amplifier requires 140 mV to
produce one watt and 14 V to produce
100 W. If one takes the trouble to compare
the distortion characteristics of the
preamplifier with the drive requirements of
the PMF 1150B amplifier, it is clear that
Perreaux has neatly matched the output
characteristics of the two units, achieving an
unquestionably exceptional performance.

While the amplifier is rated at 100 W into
eight ohms, the actual peak power output
capability, when measured in accordance
with IHF-A-202 requirements, confirms a
225 W peak power capability with both
channels driven to provide an effective
3.5 dB headroom.

At the 100 W level the distortion characteristics of the preamplifier are at
their lowest level, while the distortion characteristics of the power amplifier are
not much higher, certainly well below the
knee of the curve. This achieves an
excellent matching of the two sets of
characteristics which auger well for the user
who requires technical standards to be
one order better than the current norm.

The transient overload recovery performance of the amplifier is also
impeccable. There is no trace of jitter in the
recovery from overload at any frequency,
when reduced to an operating point
immediately below the overload region. All
of the other parameters of this amplifier,
including channel separation, slew rate,
conventional intermodulation distortion
and phase response, are impeccable.
The phase response characteristic, in particular, is exceptionally good, being only +1° at 20 Hz and only −1° at 20 kHz. In the past this sort of performance was only available from amplifiers costing many thousands of dollars.

The provision for bridging is a decided advantage. In this mode it can supply 400 W of output power without the need for a separate bridging transformer, so that you can couple the two inputs without the need of any other external circuitry. This makes it attractive for a wide range of other commercial or semi-commercial uses as well.

**Subjectively**
The PMF 1150B amplifier is unquestionably one of the most advanced that we have measured recently and its selling price will give some of its more august competitors a hard time.

**PMF 1150B POWER AMPLIFIER**

| FREQUENCY RESPONSE: | Tone Controls Defeated
|---------------------|------------------------
| (with or without) | Left: 5 Hz to 100 kHz
| Input to Aux. | Right: 5 Hz to 100 kHz

**SENSITIVITY:**

| (for 1 watt into 8 ohms) | AUX: 0.005 V to 10 kHz
|-------------------------|--------------------------

**INPUT IMPEDANCE:**

| AUX: 0.5 ohms | 67 k ohms
|----------------|-------------------

**OUTPUT IMPEDANCE:**

| 25 milliohms (± 1 kHz)

**HARMONIC DISTORTION:**

| (A) (At rated power of 100 Watts into 8 ohms = 20.3 Volts) |
|-----------------|-----------------|-----------------|-----------------|
| 2nd | 19.6 | 109.0 | 106.4 dB |
| 3rd | 50.3 | 92.7 | 96.9 dB |
| 5th | 115.3 | 122.9 | 109.2 dB |
| 7th | 100.0 | 114.0 | dB |
| THD | 0.001 | 0.000 | 0.0016 % |

| (B) (At 1 watt into 8 ohms) |
|-----------------|-----------------|-----------------|-----------------|
| 2nd | 97.2 | 115.3 dB |
| 3rd | 135.5 | 110.6 dB |
| 5th | 115.1 | - | - dB |
| 7th | 106.1 | - | - dB |
| THD | 0.0066 | 0.0002 % | 0.00046 % |

**PMF 1150B power amplifier transient overload recovery test (IHF-A-2002).** 10 dB overload at rated power into eight ohms, both channels driven. Overload duration: 20 ms, repetition rate: 512 ms.

The subjective performance of both the preamplifier and the power amplifier proved to be absolutely outstanding. The units were tested at home with some of the latest digital recordings, including the Deutsche Grammophon record, number 2532019, by Herbert von Karajan which is a superb rendition of Gustav Holst's 'The Planets'. This recording has some of the most outstanding transients and one of the widest ranges of frequencies that is available in musical content.

Another recording we used that has a more popular appeal is the Decca recording of Verdi's 'La Traviata' featuring Joan Sutherland and Luciano Pavarotti, Decca record number SXDL 7561. This record is an absolute gem and must be one of the finest opera recordings ever to be released in this country.

Listening to these records and others, there was no detectable trace of distortion from the amplifier or the preamplifier during the long subjective evaluation. The inputs were provided by three different linear tracking record players or from the same content evaluated in an A-B test using a CD player.

The lack of colouration in the amplifier (and the preamplifier), supplemented by its more than adequate power-handling capacity, provides it with the attributes required by both amateur and professional.

The well matched performances and absolute lack of colouration of both units make them extremely suitable for monitoring CD players, laboratory amplifiers or recording-studio monitoring amplifiers. In fact, they can be used in any situation where exceptional performance at a reasonable price is a primary requirement.

'Perreaux' may be a relatively new name in Australia, but if they continue to produce equipment as good as this they should have no difficulty making a significant impact in this country, as well as in the American and European markets where quality and performance open most doors, particularly when the price is right.

Absolute copyright in this review and accompanying measurements is owned by Electronics Today International. Under no circumstances may any review or part thereof be reproduced or incorporated in any reprint or used in any advertising or promotion without the express written agreement of the Managing Editor.
We agree! The IBM PC is a superb computer. But look at the price - way over six thousand for a usable computer - then you have to start buying programs!

Now there's a brilliant alternative: the Dick Smith Challenger. For less than half the price of the IBM PC you get much more computer.

Is it really IBM compatible?
We haven't found one IBM PC program that won't work in the Challenger (and we've checked hundreds)! Just pop in an IBM PC diskette - and away it goes! Not only that, but all plug-in IBM PC hardware is also compatible.

OUTSTANDING FEATURES:
- True 16-bit machine (uses full 16-bit 8086 processor, not the partly 8-bit 8088 processor used in the IBM).
- Comes in two versions - either the basic model or the fully expanded 128K, twin disk drive model. Both of which are less than half the price of the IBM PC.
- And the expanded computer gives you both Centronics and RS232C ports PLUS twin double density, double sided slimline disk drives offering an incredible 640K of storage. Memory expandable up to an incredible 256K just by plugging in some extra chips.
- Offers virtually all of the hardware any computer user is likely to want. And if you DO want more, there are 6 expansion slots.

Basic 16 bit Computer
Only $995

The IBM model with equivalent features would cost at least $1700 if they'd sell you one!

YOU SAVE $700 OVER

Dick Smith

Send for your FREE information pack!
a look at the new CHALLENGER
for half the price!

SPECIFICATIONS:
(Expanded Computer)
CPU: 16 bit 8086 running at 4.77MHz
RAM: 128K (int expandable to 256K) plus
16K Video
ROM: 40K (includes BASIC, cassette o/s, diagnostic)
KEYBOARD: Full 84 key tactile, detachable
CHARACTER SET: 256 expanded ASCII, In ROM.
RESOLUTION: 320 x 200 or 640 x 200
COLOUR/GRAPHICS: 16, with scroll & reverse image.

PLUS! All the software you really need – included in the low, low price!

Yes – over a thousand dollars' worth of famous Micropro software included – at no extra charge. Try and get that with your IBM PC! And not useless software, either!

WORDSTAR – the most-used word processing system in the world! CALCSTAR – the electronic spreadsheet to beat them all! MAILMERGE – turn your WORDSTAR into an electronic mailing list!

All the expansion you're likely to need (hardware & software) for only $1995 EXTRA
includes
- Twin slimline double sided, double density disk drives.
- RS-232C serial communications port
- 6 extra expansion slots (4 IBM PC compatible, 2 true 16 bit).
- PLUS the following fantastic software:
  Genuine (licensed) Microsoft MS-DOS & AT-DOS
  Genuine (licensed) Micropro Wordstar, Calcstar & Mailmerge
  And compatibility with all known IBM PC software – and that's a heck of a lot to choose from!

IBM PC configured with similar features to Dick Smith Challenger would cost you well over $7000

CHALLENGER TOTAL SYSTEM ONLY $2990
YOU SAVE $4000

ELECTRONICS
full address details.
$3,995
You can’t buy an S-100 hard disk system for less.

5 MEGABYTES
# $3,995
That’s the full price for the complete “Accelerated” system from Q.T., including a 4 slot S100 IEEE-696 motherboard, 64K ram, floppy and hard disk controllers, a 5 megabyte hard disk, a 200K floppy disk drive, two parallel ports, two serial ports, real time clock (optional calendar/clock with battery backup) and EPROM programmer plus CP/M 2.2, Basic Interpreter, Pascal, Diagnostic software and Communication software which can communicate with PDP-11, VAX, CYBER, other CP/M Systems and various other systems. For another $100 we will give you a box of 10 diskettes full of CP/M UG Software of your choice. Range includes Interpreters, Compilers, Games, Business Software, Utilities, etc.

NOW MULTI-USER
For an additional $650 you get a diskette with MP/M Version 2.1 which is all that is needed (although additional memory is recommended!) to allow you to add another user to your system. Ideal for husband and wife software development teams. No modifications are required on the basic “Accelerated” system to run multi-user. Just use the supplied software option, which makes our system the lowest priced multi-tasking system you can buy.

BUY IT YOUR WAY
SINGLE USER, MULTI USER, OR MULTI-PROCESSING. Buy a single user system now and expand it later. No matter how you buy it you can’t buy more performance for less. UNLIKE “TOY” COMPUTERS OUR SYSTEM CAN BE EXPANDED WITH HIGH-RES COLOUR GRAPHICS, MEGABYTES OF MEMORY, VIDEO DIGITIZERS, A-D/D-A CONVERTERS, IEEE-488, VOICE INPUT/OUTPUT, UP TO 256 PARALLEL OR SERIAL I/O PORTS, MUSIC SYNTHESIZERS, AND IS SUPPLIED AS STANDARD WITH CP/M, GIVING ACCESS TO A MASSIVE SOFTWARE LIBRARY INCLUDING OVER 100 VOLUMES OF PUBLIC DOMAIN SOFTWARE.

DUAL PROCESSOR OPTION
This allows you to expand the basic system with a 16 bit 8088 processor module. Using our exclusive software it is then possible to switch under software control between CP/M 80 and CP/M 86. Coming soon MS/DOS operating system to provide IBM/PC compatibility.

HIGH PERFORMANCE OPTIONS
For another $250 you can double your floppy capacity to 400K or for another $400 you can increase the floppy capacity to 1 megabyte. Add $700 and you can get 256K of RAM instead of 64K. This will allow you to use our unique CACHE buffering software to achieve lightning fast performance from your system. Or add extra memory and our MDRIVE software which uses RAM to simulate a disk drive. The results have to be seen to be believed. Now available as an option for $600 is upgraded to 8MHz Z80H. CP/M PLUS (VERSION 3.0) NOW AVAILABLE for an additional $350.

MULTI-PROCESSING
The “Sysnet 2000” version has no EPROM programmer or multi-user expansion option but can be expanded with slave processor modules. These modules provide a 280A processor (optionally Z80B) two serial ports, two parallel ports, 128K of RAM and real time clock. In this way up to 16 users can share the system’s resources and achieve the kind of throughput previously only possible with mini-mainframer.

HIGH RESOLUTION COLOUR GRAPHICS OPTION
Two versions available — Call for details.

140A Victoria Road
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& Systems
Division

* NOW WITH UNIQUE
EXTENDED 2 YEAR
WARRANTY

All prices shown are exclusive of sales tax or delivery charges. * 2 year warranty applies on all products manufactured by Q.T. Peripherals such as disk drives, printers etc. are subject to manufacturer’s warranty (usually 90 days). * OEM PRICE — QUANTITY 2
ENTER THE ‘MACRO’ PORTABLE

The Dulmont Magnum, a portable ‘macro’ computer was officially launched at the 10th Australian Computer Conference in Melbourne in September.

The Dulmont Magnum features a full 16-bit Intel iapX86 processor, RAM expandable to 256K bytes, MSDOS 2.0 operating system, extensive ROM based software, 8-line by 80 character liquid crystal display, standard peripheral outputs, and a full-size QWERTY keyboard. The computer is battery-powered and weighs less than four kilos.

The Australian designed and manufactured computer is the forerunner of a new generation of portable computers known as macro computers.

Mr Terry Crews, marketing manager for the computer, claims there is no computer on the market that provides the features of the Dulmont Magnum in as small a package at a retail price (including sales tax and software) of less than $2 500.

Mr Crews believes the Dulmont Magnum will establish Australia as the leader in the portable computer market.

Two companies have combined efforts to back the new computer. They are Dulmison, a leading world supplier of fittings for power lines and wholly Australian-owned, and Trumont, the Australian subsidiary of the Belgium conglomerate, Tractonel.

They formed Dulmont Electronic Systems in May this year, when Dulmison realised that the Dulmont Magnum would require substantial backing to meet anticipated world demand for the project.

Dulmont Electronic Systems has established a factory at Hornsby for the production of the Magnum and there are plans to build a large factory complex. Twenty people are currently employed at the Hornsby factory and this is expected to more than double by early 1984.

The Magnum was launched onto the world market at Percompsia '83 in Singapore last month and will be exhibited in Toronto and Los Angeles this month. For further information, contact Dulmont Electronic Systems, (02)477-6444. President Computers is the Australian distributor.

PLATO AND THE HOME COMPUTER

Plato educational courseware, originally developed by the Control Data Corporation for use in schools through terminals connected to a mainframe computer, will soon be available on diskette for the Texas Instruments 99/4A home computer.

There are 64 packages, offering mathematics, reading and grammar programs for students in Years Three to Eight, and 44 packages covering mathematics, writing, science, social studies and reading for Years Nine to Twelve.

The initial Plato package includes an interpreter solid-state cartridge and diskettes containing a survey to help parents or teachers select courseware for individual needs. For those not familiar with the operation of the computer, there is a program designed to teach beginners how to use the TI-99/4A keyboard.

These Plato packages will cost $49.95 each.

To take advantage of the Plato software, the TI-99/4A owners will need a Texas Instruments peripheral expansion system, a memory expansion card, a disk memory drive, and a disk controller card.

Also soon to be available for the TI-99/4A home computer are 15 educational software cartridges, featuring mathematics learning exercises for children in the kindergarten to Year Nine age group.

For further information, contact: TTV Instruments Austrailia, 6-10 Talavera Road, North Ryde NSW 2113. (02) 887-1122.

THE TOP DEALER

Paul Dixon has been appointed to the new position of international dealer manager for System One computer company. Mr Dixon’s appointment marks the emergence of System One into the dealer market with its range of Australian-produced hardware and software that has already been installed in more than 300 user-sites in Australia.

The System One product has also established markets in Hong Kong, Singapore, South Africa, Canada, New Zealand, the United States and Europe.

For further information, contact System One, 14th Floor, 447 Kent Street, Sydney NSW 2000. (02)267-2388.

AED’S NEW MELBOURNE DEALER

Elston Micro has been appointed as Melbourne dealer for the Australian-designed and manufactured AED Universe range of computers.

The AED Universe Supercomputer II features a choice of eight- or 16-bit single- or multi-user operating systems, and has full $100 buss compatibility.

For further details, contact Elston Micro, 53 Waverley Road, East Malvern Vic. 3145. (03)211-5542.
Rabbits are everywhere and with 4 pet viper snakes, you gobble them up. Careful they grow as they eat and might eat their own tails.

Just like a real poker machine complete with spinning wheels and sound effects. It doesn't eat your money and you won't be caught by the booze bus.

Try beating the computer at Chess. There are 6 levels of difficulty and a 'help' feature for the computer to make the next best move for you.
AND MANY MORE! . . .

**EYE OF MIN** 250.089  32K ONLY
The flash of light in the darkness is the Eye of Min.
Gern and you try to capture it... be careful.
$14.95

**CHESS TUTOR** 250.076
Now you can study the classic moves of the
Chess Tutor at your own leisure.
$14.95

**BOGGLER** 250.057
Test your vocabulary by making as many words as you
can from the letters supplied in a limited amount of time.
$14.95

**YAHZZIE** 250.017
Add this well known dice game to your Microbee. Two
versions available on each cassette. A great family game!
$14.95

**SEA DOG** 250.073  32K ONLY.
You are the commander of a sailing ship and your
cannon and crew you must sink the enemy.
$14.95

**FROG HOP** 250.092
Hurry... cross the road before you get squashed.
Then you have to cross the stream but look out for the
proving crocodile.
$14.95

**EDUCATIONAL** RESCUE 250.014
You are stranded on an island. To be rescued you must
select the appropriate synonym to the word on the
screen. Part of Learning can be Fun Vol. 2B
$14.95

**MILLIKAN'S EXPERIMENT** 250.087
Now you can deduce the charge of an electron.
Graphic demonstration and tutorial for Year 11 and 12
physics students.
$14.95

**WORD ADVENTURE** 250.086
Follow the path and answer the synonym, antonym or
homonym to the word provided or correct the spelling
or the serpent will destroy you.
$14.95

**KEPLER'S LAWS** 250.080
A simulation of planetary orbits enabling students
students to analyse Periods, Ellipses and Areas.
$14.95

**WORK-A-BEE** 250.062
This program actually helps you write your own
$19.95

**UTILITY PROGRAMS**

**TYING TUTOR** (Pitmans) 250.078
Typing tutor takes you by the hand and introduces you
typing with the minimum of fuss.
$14.95

**PCG TUTORIAL** 250.037
Opens up the 'mysteries' of Microbee's programmable
color character generator to help you to design your own graphics.
$14.95

**FORTH** 250.302  IN ROM
Now Microbee owners can use the powerful Forth
applications oriented program language. Written by a
couple of dedicated Forth experts, Microbee Forth is
Rom based and comes with an internal dictionary of
200 words. Because the language is interactive,
estensible, structured and recursive, the user can
readily expand the commands by adding new words.
Forth is a very easy language for even a beginner to
master and programs written in Forth run only a little
slower than in Machine Code.
Microbee Forth can run on 16K and 32K systems. A
tutorial is supplied to enable newcomers to master this
exciting new development for the Microbee.
$49.95

**MICROBEE PASCAL NEW** 250.300  IN ROM
A good step into a new language. It incorporates an
editor, a p-code single pass compiler and a p-code
interpreter.
$59.95

**OZ-LOGO** 250.301  IN ROM
A remarkable graphics language enabling your
Microbee to have outstanding graphics capabilities.
$49.95

**SUPER DISASSEMBLER** 250.052
This takes a machine code and translates it into Z-80
standard mnemonics to utilise routines in other
machine code programs.
$19.95

**DE-BUG** 250.070
Enables you to examine internal registers of the Z-80,
single step and make breakpoints through a program.
$9.95

**PROGRAMMING HINTS** 250.014
This program consists of a collection of modules which
you may use to improve your own Basic programs. To
allow you to see the effect of each module, they are all
linked together under a menu driven display which
allows you to Run each module, or List each to see
how they work.
$14.95

**BUSINESS**

**DATABASE** 250.051
The ideal system for keeping lists of all those things
you wish to recall during the year. Ideal demonstration
of data base techniques.
$14.95

**BUSY CALC** 250.050
Fed up with constantly having to erase errors from
your spreadsheet? Is your spreadsheet giving you a
headache? Busy Calc will help solve all your problems
for you. Some of the commands available are: Average;
Sum; Compute; Format; Recalculate and Load and
Save to cassette.
$14.95

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**microbee computer shops**

1 Pattinson Ave,
Warratah 2267.
Phone (02) 487 2711
729 Glenferrie Rd,
Hawthorn 3122.
Phone (03) 818 2244
141 Stirling Highway,
Nedlands, Perth.
Phone 926 88 8250
 Coolman Court, Weston
A.C.T. 2611.
Phone (062) 88 6384

**DEALERS:**

NSW: Jaycar, Inc. Electronic
Agencies 117 York Street,
Sydney 115 Parramatta Road,
Concord. 121 Forest Road,
Hurstville. Cnr Carlingford
and Pennant Hills Road,
Carlingford. Compu-K,
7 Casino Street, Lidcombe.
Comput/Ed, 8 Park Arcade,
Park Avenue, Coffs Harbour
ACT: Computech, Belconnen
Churches Centre, Benjamin
Way, Belconnen.
VIC: Computerland, 37 Albert
Road, South Melbourne.
S.A.: Key Computers, 1061
South Road, Edwardstown.
W.A.: Altronics, 105 Stirling
Street, Perth.
QLD: Software 80,
105 Milton Road, Milton.
Electrographic Office Systems,
25 Grafton Street, Cairns.
Town and Country Computers,
CTL Centre, Anne Street,
Arkenvale, Townsville
TAS: Central Data, 14A
Goodwin Street, Launceston.

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PIIFEE PresentS
An Intelligent TERMINAL

SPHERE COMPUTERS

Keyboard
- Detachable, capacitive, typewriter-style keyboard
- N-key rollover with auto repeat capability
- 4 LED indicators for caps lock, on line, block mode and keyboard lock/protect
- Auto repeat enable/disable
- Repeat rate 20 characters per second
- 5 cursor control keys, 10 editing function keys with 14-key numeric keypad

Communication
- Code: 128 ASCII characters
- Baud rate: 75, 110, 150, 300, 600, 1200, 1800, 2400, 4800, 9600, 19.200
- Parity: Odd, even, mark, space
- EIA RS-232C or 20-mA Current Loop

Display Presentation
- Display format: 24 lines x 80 characters
- Display unit: 12-inch, non-glare Green CRT
- Character type: 7 x 9 dot matrix

Editing Function
- Cursor up, down, left, right, home
- Insert character, delete character, insert line, delete line, erase end of line, page and field, field tab, field back tab, column tab, column back tab, block mode on/off, protect mode on/off, graphic mode on/off, clear unprotected

Emulation
- LEAR SIEGLER ADM-3A, HAZELTINE 1500, ADDS VIEWPOINT
- Character set: 96 ASCII characters, 15 graphic symbols, 32 control character symbols
- 5 screen attributes: Blink, underline, blank, reverse, dual intensity
- Cursor type: Selectable slow, fast blinking or steady cursor, block, underline or invisible cursor

Emulation mode
- Refresh rate: 50/60Hz
- Character set: 96 ASCII characters, 15 graphic symbols, 32 control character symbols
- 5 screen attributes: Blink, underline, blank, reverse, dual intensity
- Cursor type: Selectable slow, fast blinking or steady cursor, block, underline or invisible cursor

External Control
- Power on/off
- Contrast adjustment
- Baud rate
- Parity and data format
- End of message
- Emulation mode
- Refresh rate
- Half duplex or full duplex
- Auto line feed
- Auto new line
- EIA or 20-mA Current Loop
- Reverse video or standard video

Specifications

ENQUIRIES FROM: AVAILABLE FROM OFFICES AND SHOWROOM PARIS RADIO ELECTRONICS, SHOP 1, 165 BUNNERONG ROAD, KINGSFORD, NSW 203. POSTAL ADDRESS: PO BOX 380, DARLINGHURST, NSW 2010. TEL. (02) 344 9111. TELEX AA22579.

MICRO EDP HARDWARE 9A/1 LEURA AVE., CLAREMONT, 6010 WEST AUSTRALIA. (09)384-5511

MAGRATHS ELECTRONICS 55 A'BECKETT ST, MELBOURNE, 3000 VICTORIA. TEL. (03) 347 1122.
NEW RELEASES PREVIEWED AT
PERTH ELECTRONICS SHOW

Your Editor got a very public 'sneak preview' of a number of pending computer releases at the Perth Electronics Show in August, including a beauty from Sharp, the release of which is still pending.

Atari proudly showed their new 600XL and 800XL models which will be priced at $399 and $599 respectively when they hit the stores shortly. The 600XL comes with 16K RAM, expandable to 64K, while the 800XL sports 64K RAM as it comes. Both feature 24K of ROM with Atari BASIC and a Help key for those who get into dire trouble. Bound to be winners in the frantic low-end home computer market judging by the interest shown in Perth.

Commodore, apart from showing off the C64, naturally enough, sneakily snuck their new beuatiful CBM 8096-SK microcomputer on display to raised eyebrows all round. Maybe they'll recapture some of that first fine rapture they got for their earlier business machines with the new 8096-SK.

Tandy, not to be outdone, always had a queue of over-shoulder peer-eers while the new Model 100 portable was being demonstrated. See the news release later in these pages.

Alright, I've kept the best till last - the new Sharp MZ-721 personal. It's about twice the size of its own keyboard (standard QWERTY) which features six function keys and a separate four-key cursor control keypad. On top is a built-in data cassette player and room for the optional colour printer-plottor (which only costs about $200?). It has both RF and direct video output, a brace of I/O ports and expansion interface (disk drives to come). If Sharp get their act together, this little ripper's going to steal the march on a few contenders in the under-$1000 range.

Spectravideo had their SV-318 and SV-328 models on demonstration and attracted the show-standard four deep crowds. The graphics the Spectravideos are capable of puts many top-line video games machines to shame. I guess you've already seen our review of the SV-318 last month.

If it wasn't for the kind cooperation of TAA, who blew me there and back, I wouldn't have known the latest 'gen' on these machines and you wouldn't have heard about the new Sharp. Thanks, fellas.

-- Roger Harrison

McGRAW-HILL TO MARKET
SOFTWARE ART'S GOODS

The McGraw-Hill Book Company and Software Arts Incorporated have signed an agreement for the development and distribution of application packages for personal computers.

Under the terms of the agreement, McGraw-Hill will produce, market and distribute TK Solver Packs, which are application products for use with the TK Solver personal-computer program developed by Software Arts. These new software packages will be based on books published by McGraw-Hill.

The creator of VisiCalc, the first electronic spreadsheet program for personal computers, Software Arts developed this new TK Solver program for solving simple or complicated problems in business, science, engineering and education. According to Software Art, the power of the TK Solver program comes from the ease with which the personal-computer user can set up problems, vary assumptions, find solutions and display results.

For further details, contact the McGraw-Hill Book Company, 1221 Avenue of the Americas, New York, NY 10020, United States.

MOUSE FOR
IBM PC

The Logimouse, a Swiss-made cursor-movement 'mouse', is available in Australia for the IBM PC and PC-compatible computers.

No special software is required: the keyboard and the Logimouse simply plug into an adaptor, and the adaptor is then plugged into the keyboard-port. The Logimouse duplicates the function of the cursor-control keys.

For further information, contact Microhouse, P.O. Box 642, Unley SA 5061. (08) 272-4370.

MOSTYN'S
LATEST
ENTERPRISE

Mostyn Enterprises has been appointed Australian distributor for the Central Data Corporation, the American manufacturer of multibus systems, CPU boards and accessories.

In 1980 Central Data introduced Roloff, an expanding microcomputer system that has revolutionised multi-user operations. Each custom-designed Roloff system incorporates Central Data's own boards and software.

For further information, contact Mostyn Enterprises, 35 Alexander Street, Dundas NSW 2117. (02)871-6297.

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**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 $695.

**OUR PRICE**

- **$415**

**256 DYNAMIC RAM - DRC-II.**
*•* Companion RAM for SBC-800
*•* Ideal for CP/M plus 3D. List Price $665.

**OUR PRICE**

- **$795**

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

**OUR PRICE**

- **$389**

**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.

**OUR PRICE**

- **$593**

**SPC-29.** High performance dual serial & 8 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.

**OUR PRICE**

- **$247**

**COLOUR GRAPHICS SYSTEM.**

**CMC-100/GDC-512.** Combine one palette mixing card with up to eight display cards. Resolution 512 x 490, up to 256 colours simultaneously, user programmable intelligence, software available. Build your own CAD/CAM System. Remarkably low cost for a high performance graphics system. Price plus software.

**OUR PRICE**

- **$825**

**VDC-8024.** The low cost alternative to stand-alone terminal. Flexible 80 x 24 memory mapped video display board with full ASCII, semi graphics, inverse and high intensity video, flicker free screen updating. Battery backed option offers diagnostic of system shut downs. List Price $325.

**OUR PRICE**

- **$278**

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

**OUR PRICE**

- **$130**

**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.

**OUR PRICE**

- **$33**

**THIS MONTH’S SPECIALS**

**DRC-II 64K.**
List Price $600.

**OUR PRICE**

- **$400**

**plus s/tax**

**CCS-16 STATIC RAM CARDS.**

**OUR PRICE**

- **$105**

**plus s/tax**

**SECOND HAND BOARDS.**
All in working order. DRC-II, limited no. only.

**OUR PRICE**

- **$250**

**K-NAR COMPUTER CARDS**

PO Box 412, Dandenong 3175. Phone (03) 795 5856

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.
COMPUTER TECHNOLOGY TO BENEFIT FROM SOCIAL SECURITY PROGRAMME

The Federal Government claims Australia has taken a major step in developing its computer technology as a result of the Department of Social Security's $10 million computer re-equipment project.

In a joint statement, the Minister for Social Security, Senator Don Grimes, and the Minister for Defence Support, Mr Brian Howe, said there would be considerable benefit to Australia from proposals offered by the as-yet-unnamed successful tenderers.

The Department of Defence Support administers the Australian offsets programme, which is designed to stimulate technological advancement and to broaden the capabilities of Australian industry.

Factors in considering tenders for the computer re-equipment programme included the form of technology transfer to Australia, employment creation opportunities, and offsets purchases in Australia.

Apart from the spin-offs for job creation and technology development, the direct value of the offsets would be about $17 million over some four years.

An estimated 140 people would be employed as a direct result of the offset work; this figure did not include the jobs to be provided by sub-contractors. Altogether, the programme would lead to the creation of at least 350 jobs in the computer industry.

SPEECH-OUTPUT MODULE FOR SERIES 80 COMPUTER

A low-priced, plug-in speech-synthesis module, the HP82967A, provides Hewlett-Packard Series 80 personal-computer users with the capability to add up to 1500 words, phrases or sounds to the computer's performance repertoire.

The HP82967A comes with software for reviewing, editing and creating needed speech output. The software is provided on both 9 cm and 13 cm floppy disks and features soft-key menu-driven operation.

The recommended retail tax-free price is $555.

The speech editor program makes it easy to incorporate speech into BASIC programs through the addition of commands such as "Speak" to the Series 80's operating system.

The HP82967A draws its power directly from the Series 80 mainframe. It can take advantage of the HP-86's video monitor speaker for output.

Users of HP-85 and HP-87 computers can use any 8 ohm speaker or headphones for output.

The speech module plugs into any one of the four slots on the back of the Series 80.

For more information, contact Hewlett-Packard Australia, 31-41 Joseph Street, Blackburn Vic. 3130. (03) 890-6351.

A BREATHE OF FRESH AIR . . .

Kayell has released the Dust-Off System II computer cleaning and maintenance kit, featuring the new Dust-Off II Mini-Vac and Dual-Extender accessories and the Dust-Off II canister/valve combination.

Dust-Off II is designed to blow away dirt and lint from CRTs, printers, keyboards, floppy disks, card readers and paper-tape readers. The unit and accessories will also clean keyboards and screens of teletype terminals, word processors and electronic typewriters.

Manufactured in the United States by Falcon Safety Products, Dust-Off II features a lockable valve which provides continuous, triple-filtered blasts and is also capable of brief modulated blasts ranging from a burst to a mild puff.

The Dust-Off System II kit retails for about $75.

For further information, contact the Australian distributor, Kayell, 25 Paul Street, North Ryde NSW 2113. (02)887-1944.

AMUST AUSTRALIA'S BRIEFCASE EXECUTIVE

Amust Computer Australia has launched a determined assault on the personal computer market with the release of its Executive 816 portable briefcase microcomputer.

The Federal Minister of Science and Technology, Barry Jones, unveiled the Executive 816 at a Melbourne function attended by 160 guests from Australia and overseas.

"Amust is a fine example of the successful commercial application of Australia's undoubted technological excellence," the Minister said.

He congratulated the company on its initiative and said he hoped that sales of the Executive 816 would help to reduce Australia's "disastrous" balance of trade in high-technology products.

The Executive 816, though housed in a standard Samsonite briefcase, is claimed to be more powerful and flexible than many desktop microcomputers. It comes complete with about $4000 of business software and will retail for under $3000.

Amust Computer Australia has already received several million dollars of pre-release orders for the Executive 816 from the United States and Canada.

Amust's technical director, Ron Harris, said the briefcase computer has been devised and developed in Australia and would be manufactured here. The supply of critical components has been guaranteed, thanks to the Amust Computer Corporation, of Tokyo, which has a 25 per cent stake in Amust Australia.

ETI November 1983 - 39
C COMPILER FOR 64000 SYSTEM

New C compilers for Hewlett-Packard's HP 64000 logic-development system support the 8086, 8088, 68000, Z8001, Z8002, 6800/6802 and 6809 microprocessors.

As an added programming language, C complements the already available Pascal compilers and the microprocessor-specific assembly languages. This allows the programmer to select the language best suited for each particular application. C bridges the gap between assembly language and Pascal programming by allowing closer interaction with the microprocessor than Pascal, while retaining advantages of high-level language structure, readability and ease of maintenance.

In the HP 64000 development-system environment, the resulting relocatable object-code modules from assembly language or the compilation of C and Pascal languages can be brought together into an executable program using an HP 64000 system linker.

The operating environment provided by the system-hardware-emulation capabilities of the HP 64000 then provides debug and verification of the resulting program.

For more details, contact Hewlett-Packard Australia, 31-41 Joseph Street, Blackburn Vic. 3130, (03) 840-6351.

DISK-DRIVE CLEANER

Having recently entered the computer market, Discwasher — an American supplier of audio and video care products — has released its own brand of disk-drive cleaner in the United States.

The system is designed to clean the interiors of disk drives of all brands in order to maintain the read/write accuracy of the devices. To further optimise effectiveness, a program listing directs the heads to different tracks on the cleaner to prevent previously used (and dirty) areas from being re-used. This listing is written for six of the more popular operating systems.

The nonabrasive cleaner utilises a unique fibre grid-cleaning system to dislodge and collect foreign matter from the sensitive drives. The self-contained cleaning disk requires no fluids and is simply loaded into the device like any ordinary disk.

For further information, contact Discwasher, 1407 North Providence Road, Columbia, MO 65205, United States.

FLEXIBLE MPU-100

Z80 S-100 BUS MICROPROCESSOR

SME is proud to present the flagship of its Unicorn series - the MPU-100.

- Designed for use in commercial, industrial and engineering environments where speed and reliability are paramount, the MPU-100 features an advanced vertical motherboard system that gives it the highest reliability and lowest profile of any machine of its type.
- Economically priced the MPU100 can be configured to perform simple single user tasks or easily expanded by the addition of further function boards to handle up to fifteen terminals and at least 50 Megabytes of hard drive.
- Attractively housed in a rugged steel based aluminium bodied enclosure the MPU-100 is rack mount compatible and is supplied fully assembled and tested.

FEATURES

- Z80, 4Mhz, SBC 800.
- Enhanced FDC floppy controller board.
- DRC-II 64/256K dynamic RAM card.
- CP/M based.
- 10 slot vertical motherboard for reliability and ease of expansion.
- Designed and manufactured in Australia.
THE GO-ANYWHERE TRS-80

Tandy Electronics has introduced a unique 'go anywhere, work anywhere' computer that offers portable computer power complete with built-in software, a full-size typewriter keyboard.

The TRS-80 Model 100 Portable Computer, available for $1099, can function as a highly efficient desk organiser, a personal word-processor, a general-purpose ASCII terminal and as a microcomputer programmable in BASIC.

The Model 100 features instant power-on access to five ready-to-run programmes contained in 32K of ROM. The user selects a program from the main menu by positioning the cursor on the desired program and pressing the Enter key.

The Model 100's built-in programmes are designed to provide a user-friendly operating environment in the system's various modes, which include Text, Schedl, Address, Telcom and BASIC. Material from all files can be displayed on the screen or printed on any Tandy parallel printer.

For further details, contact Tandy Electronics, 91 Kurrajong Avenue, Mount Druitt NSW 2770. (02)675-1222.

NEW!

IMAGINE BEING ABLE TO SEND 32K TO YOUR PRINTER IN SECONDS AND LEAVING THE CPU FREE TO GET ON WITH WHAT IT SHOULD BE DOING.

• PB-32 BUFFER INSTALLS DIRECTLY INTO PRINTER
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• Friction and Tractor Feed

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plus Sales Tax

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Phone: 221-9788. Telex AA47650

MATROX
GXB1000 BOARD

The Measuring Control and Equipment Company is now stocking the Matrox GXB1000 board set. The system, which is compatible with the Intel multi-bus, is designed to provide a low-cost solution to the generation of high-resolution colour graphics displays for CAD/CAM and similar applications.

Display resolutions up to 1600 x 1200 pixels and up to 16 bits per pixel are possible. Other features include 50/60 Hz non-interlaced refresh rates, hardware vector and circle generators (800 msec/pixel), a 256-colour look-up table and a resident graphics interpreter which recognises about 256 high-level graphics commands.

For further information, contact the Measuring Control and Equipment Company, 2a Chester Street, Epping NSW 2121. (02)86-4060.
microbee

THE MICROBEE E-X-P-A-N-D-S AS YOUR NEEDS GROW

MICROBEE

... the Australian designed and built computer system that grows with your needs, to give you a whole world of computing opportunities. As you add a range of options, your Microbee grows and is supported by an ever increasing range of software and accessories. Microbee is recommended by the Education Departments of N.S.W., Western Australia and Queensland and is used by schools, technical colleges and universities throughout Australia and New Zealand.

Schools around Australia and New Zealand have found the 16K PLUS to be the ideal starting system.

16K PLUS

It features Microworld, Basic in ROM, 16K of user RAM for program storage, backed by CMOS battery to retain programs when the machine is switched off. It also has a 16 line/64 character upper and lower case display with low and high resolution graphics, cassette interface, RS232, programmable I/O port and a host of other features, others charge as extras.

Your system becomes even more expandable with the addition of software in ROM such as Wordbee, Logo, Edasm, Pascal and even Forth. Add a RGB colour option and your programs take on an exciting new visual dimension.

$469

32K IC

The Microbee 32K IC features 32K of CMOS RAM plus integrated software such as Wordbee, Communications, Machine Code Monitor and Self Test. It can be easily connected to a modem to ‘talk’ to other computers over telephone lines and is even capable of becoming a terminal for other systems. The battery-backed CMOS RAM enables you to write word processing files or run basic programs anywhere, then return to school/office to print them out. The remarkable capabilities of the Microbee 32K IC have won so much approval that it has become our best seller for serious home use.

$599
NOW! WITH WORLD CLASS SOFTWARE MICROBEE CP/M64 DISK SYSTEM

64K DISK SYSTEM

A new and exciting release! This system is probably the best value CP/M computer available on the Australian market. The package deal includes Microbee 64K keyboard unit, the new Microbee 400K disk drive system 'bundled' software including CP/M 2.2, Microsoft and Microworld Basic (disk and tape versions) Wordbee, Edasm, Busycalc and a host of utility programs to format. Also copy disks, compare files, communicative ability with other computers and demonstration programs that enable you to master this powerful computer with ease.

Your Microbee 16K or 32K can be adapted to a full disc system. (Ask your nearest Microbee shop for a quotation). Or for versatility, add a second disk drive to your 64K disk system and look for the hard disk drive early in 1984. All Microbee options can be added to expand your system to suit your needs. Your carefully selected library of programs is worth much more than the $500 price tag. The $995 keyboard and single drive must be today's best value on the Australian market.

<table>
<thead>
<tr>
<th>64K/SINGLE 400K DRIVE/SOFTWARE</th>
<th>$1495</th>
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</thead>
<tbody>
<tr>
<td>64K/DUAL 400K DRIVE/SOFTWARE</td>
<td>$1795</td>
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</tbody>
</table>

If you already own a 16K/32K Microbee contact your local Microbee shop for an exciting upgraded quotation that will save $$$ on your new disk system.

ACCESSORIES

MICROBEE DOT MATRIX PRINTER:
Ideal for graphics or letter writing. Can be connected by cable to the parallel port or with a serial option to the R232 port.
- Parallel Printer: $449
- Parallel cable: $49.50
- Serial printer: $549
- Serial cable: $49.50
- Ribbons: $12.50

MICROBEE JOYSTICK:
Brings your system to life and adds realism and excitement to your programs. $39.50

ROM BOARD:
Extends the internal memory so your Microbee can use a wide range of software packages without changing the ROM. $79.50

MICROBEE CARRY CASE:
Strong good looking protective case. $9.95

MICROBEE 'GREEN MONITOR':
Features 18MHz bandwidth for a clear display plus built-in power supply. $199

BOOKS

MICROBEE TECHNICAL MANUAL 250.001
Contains full technical description of the Microbee operation service instructions, circuit diagrams and component list. Registration form is included for automatic up-date service for 12 months. $65

MICROSOFT BASIC MANUAL 250.005
For full use of your Microbee Disk System with MBASIC. This manual is all you'll need to master MSOFT BASIC on your Microbee. $24.95

INTRODUCTION TO MICROBEE 250.009
— Your first 100 programs. Walk into the world of Microbee computing with ease. This manual takes you from go to becoming a competent programmer in Microworld Basic. Prepared by two Australian school teachers, this practical course is an ideal companion for your Microbee. $14.95

DEALERS:

NSW: Jaycar, 117 York Street, Sydney. 115 Parramatta Road, Concord. 121 Forest Road, Hurstville. Cnr Carlingford and Pennant Hills Road, Carlingford. Champ, 7 Casino Street, Lismore. Comput/Ed, 8 Park Arcade, Park Avenue, Coffs Harbour. ACT: Computech, Belconnen. Churches Centre, Benjamin Way, Belconnen.

VIC: Computerland, 37 Albert Road, South Melbourne. S.A.: Key Computers, 1061 South Road, Edwardstown. 77 Grenfell Street, Adelaide. W.A.: Altronics, 105 Stirling Street, Perth.


APPLIED TECHNOLOGY RETAIL PTY LTD
DIck’s Dot-Matrix Printer

Manufactured in Japan by the BMC company, Dick Smith Electronics’ new multi-function dot-matrix printer, the BX-80, is designed to operate via normal software control and can operate with virtually any computer a standard Centronics parallel-printer interface.

The BX-80 produces high-quality printing in a variety of column widths, in both normal and italic fonts, and supports dot-image graphics.

It accepts adjustable sprocket-fed (fanfold) and friction-fed (single sheet) stationery. The printing speed is 80 characters per second. The BX-80 retails for about $649.

For further information, contact Dick Smith Electronics, P.O. Box 321, North Ryde NSW 2113. (02) 888-3200.

Melco’s Printer Buffer

The PB-32 printer buffer from Melco is capable of storing up to 32K of data at high speed and passing it on to the Epson MP-80/82/100 printer at lower speed. This can be very useful to increase computer availability where printing cannot be done interactively.

The buffer is sufficiently large to accommodate between 15 to 30 typewritten pages (depending on how much of each line is actually printed). This means that most small print jobs can run completely independent from the machine after the data has been transferred at high speed.

The PB-32 is easily installed, as it fits into the printer on the standard mounting posts. Installation instructions are supplied with each unit.

For more information, contact Alfatron, 1761 Ferntree Gully Road, Ferntree Gully Vic. 3156. (03) 758-9551.

Sendata 300 Modem

A new direct connect 300 bps modem that is no taller than a 50c piece and fits snugly under the base of a telephone, has been released by Australian communications manufacturer, Electro-Med. Called the Sendata 300 the modem is simple to operate and does not require operator training. It attaches to the existing telephone wall socket plug and becomes fully operational with the flick of a switch by the operator.

- No installation costs.
- Simple operation.
- Fits under telephone base.
- Attaches to existing telephone plug.

Sendata

OEM and Dealer Enquiries Welcome
Electro-Med
Electro-Medical Engineering P/L
69 Sutherland Road, Armadale, Victoria 3143, Australia
Telephone: (03) 509 5844.
Telex: AA34008
## COMMODORE ADD-ONS

**Commodore** has introduced a full range of accessories for its VIC-20 and 64 personal computers.

The 1520 printer/plotter is a four-colour printer with high-resolution illustrations. Retailed at $360, it uses four separate ballpoint ink pens to achieve multi-coloured graphs, charts and other types of illustrations which are enhanced by the use of colour.

The VIC 1525 graphic printer is an 80-column dot-matrix printer with graphics capability. Able to handle sprocketed paper in widths from 10 to 25 cm, the 1525 prints upper- and lowercase letters, numbers, special characters, PET graphics and dot-addressable graphics at 30 characters per second. The 1525 retails at $479.

The 1526 quality printer has an 8 x 8 dot-matrix character font. The print rate depends upon the character size, but is quoted in the manual as 45 lines per minute when printing 80 columns. Ribbon life is 1.2 million characters, and the printer handles up to three copies, including the original. The retail price is $629.

The 1701 colour monitor is a high-resolution quality monitor which will retail for around $400. Housed in a beige cabinet, the 35 cm screen has seven different controls to allow fine adjustment. There are separate luminance and chroma inputs.

## MITSUBISHI’S MICRO/ROBOT

The Mitsubishi RM 501 industrial micro-robot, now available in Australia, is a revolute-type robot with six degrees of freedom, a range of grippers and a control unit capable of bi-directional interface with a variety of external equipment.

The basic unit, which consists of the robot body (arm and gripper) and control box, costs about $9 986, excluding tax. The control box provides five basic functions, including translation of robot commands to robot movement learning mode and serial/parallel interface for host use. Servo motors are used in the body for accuracy, repeatability and ease of installation.

For further information, contact Intelligent Systems Research, 2/969 Bourke Road, Camberwell Vic. 3124. (03)82-8287 or Masatek Pty Ltd, Suite 1, 1a Leonard Street, Hornsby NSW 2077. (02)477-6120.

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### 6500 PRICES SLASHED

**Upgraded to 2MHz with these Low Prices**

<table>
<thead>
<tr>
<th>Part No</th>
<th>Description</th>
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<tr>
<td>6502A</td>
<td>CPU, 40 Pin, Clock, 64K</td>
<td>$5.83</td>
</tr>
<tr>
<td>6511AQ</td>
<td>Single Chip Micro, CPU, RAM, etc</td>
<td>$26.44</td>
</tr>
<tr>
<td>6541A</td>
<td>Port, Controller, RAM, I/O Host Slave I/F</td>
<td>$19.25</td>
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<tr>
<td>28-03</td>
<td>2801 Pin Compatible, 24 Pin Piggyback</td>
<td>$78.82</td>
</tr>
<tr>
<td>6522A</td>
<td>VIA 40 Pin two bit I/O Ports</td>
<td>$5.13</td>
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<td>5632A</td>
<td>COMBO 40 Pin</td>
<td>$6.86</td>
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<tr>
<td>6545-1</td>
<td>or 6545-1PE CRT Controller</td>
<td>$11.41</td>
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<tr>
<td>6511A</td>
<td>AGA 28 Pin</td>
<td>$7.24</td>
</tr>
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<td>6552</td>
<td>Single Chip Printer-Controller</td>
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<td>1791-02</td>
<td>EPC 80 Pin</td>
<td>$3.80</td>
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<td>1793-02</td>
<td>FDC 40 Pin</td>
<td>$31.80</td>
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<td>2661-1</td>
<td>Sync/Asyn Coms 1/F 28 Pin</td>
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<td>2128</td>
<td>2K x 8 RAM 120 nsec LP mode</td>
<td>$5.62</td>
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<td>4164</td>
<td>4K x 1 Dynamic RAM</td>
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<td>2532</td>
<td>4K x 8 Industry Standard EPROM</td>
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<tr>
<td>4164</td>
<td>Socket for 6511AQ and 6541AQ</td>
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### LITTLE BIG BOARD

**Kit 1: LBB Printed Circuit Board**

- LBB User's Manual
- Setup Sheet
- MP7A Monitor prom and Shopping List...$149.00

**Kit 2: LBB Printed Circuit Board**

- LBB User's Manual
- Setup Sheet
- MP7A Monitor prom
- LBOOT6 Boot Eprom and Component Set......$499.00

**Mitsubishi Drives:**

- 5¼” x 1.6 Mb...$255.00
- 8’’ x 2.8 Mb...$587.00

**STD 5 Slot Enclosure with Power Supply...$385.00**

**Sales Tax included — P & P Extra**

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### ELECTRONIC HOBBYIST!

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- Ringwood
- Lilydale
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**We can supply your components at city prices**

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**ETI November 1983**

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**Computing Today NEWS**
TANDY MEANS BUSINESS
WITH NEW TRS-80 MODELS

Tandy Electronics’ new TRS-80 Model 12 offers advanced professional features, easy expandability, language programming capabilities and increased data-storage capacity.

Tandy says the Model 12 presents a low-cost solution to those applications requiring large information files or a large number of transactions, including inventory control, medical records, accounting or large worksheet applications.

The Model 12 is available in either a one-disk drive version (26-4004) for $549.99, or a two-disk drive version (26-4005) for $6999.

It has a Z80A eight-bit processor, direct memory access and vectored interrupts for faster throughput. The system offers 80K of memory and one or two built-in 1.25-megabyte disk drives. The system’s new TRSDOS 4.2 disk-operating system — an enhanced version of TRSDOS 2.0 — supports double-density, single- or double-sided 20 cm floppy diskettes.

The Model 12 features a high-resolution 20 cm green phosphor monitor with 80 or 40 characters per line by 24 lines. The system displays upper and lower case characters with descenders plus 32 business graphics characters. The detachable low-profile keyboard offers 82 keys, including a numeric entry keypad and eight new special function keys (F1 through F8) to provide quick access to programme-designated functions.

Tandy Electronics has also introduced the TRS-80 Model 4, a completely self-contained personal desktop computer, available in 64K one-disk or two-disk systems and a 16K cassette-based system.

Tandy says the Model 4 offers significant advantages for business professionals and managers, educators, small business owners and personal computer users.

It can run existing TRS-80 Model III software with no conversions required. The disk systems can also run the new TRSDOS, LDOS and CP/M Plus-based programs. This compatibility allows upgrading to a Model 4 without obsoletting present software, and makes new scores of programs immediately available for business, educational and personal applications.

The Model 4 two-disk drive version with 368K total disk capacity, 64K memory, and parallel printer interfaces is $3299. A single-disk Model 4 with 184K formatted disk capacity is $2799. The 16K Model 4 cassette-based system, upgradeable to disk system capabilities and sound, is $1799.

In a white-finish cabinet, the TRS-80 Model 4 includes a high-resolution 30 cm black-and-white monitor and a 70-key typewriter-style keyboard. The keyboard includes a standard 12-key numeric pad, upper and lower case, and three programmable function keys, caps and control keys.

For further information, contact Tandy Electronics, 91 Kurrajong Avenue, Mount Druitt NSW 2770. (02) 675-1222.

CARE SET
CASSETTE CLEANER

Daeworsh has released a cassette drive head and mechanism cleaner designed to keep computer cassette players functioning at optimum level to ensure unhampered data flow.

The American company says Care Set will clean the cassette drive head in 15 seconds. It is non-abrasive and uses no alcohol or fluids, and is designed to clear contamination from the pinch-rollers and capstans.

For further information, contact Arena Distributors, 642 Albany Hwy, Victoria Park WA 6100. (09)361-5422.

F38E70 SINGLE-CHIP MICRO

The Fairchild single-chip microcomputer series has been enlarged with the release of the F38E70, a complete eight-bit microcomputer on a single MOS integrated circuit.

The F38E70 is functionally identical to the F3870, except it has 2K of EPROM in place of 2K of ROM. It can execute the F8 instruction set of more than 70 commands.

The F38E70 features 2048 bytes of EPROM, 64 bytes of scratchpad RAM, a programmable binary timer, 32 bits of I/O and a single 5 V power-supply requirement.

For more details, contact Fairchild Australia, 366 Whitehorse Road, Nunawading Vic. 3131. (03)877-5444.

The Mice emulator is controlled via an RS232C compatible interface, and all software necessary to operate it is contained in EPROMs within the module.

It can be operated using only a display terminal or in conjunction with a computer system. Different processors can be emulated by simply changing the personality card and associated EPROMs.

The Mice accepts high-level ASCII commands through the RS232 serial interface. In addition to the resident assembler and two-pass disassembler, the command set also includes forward/backward trace, cycle step, instruction step, direct I/O port access, memory examine/display, memory test and transfer, upload/download in Intel or Tektronix format, halt/breakpoint set, enable/disable memory, bus requests and interrupts, and target reset.

For further information, contact Macrodynamics, 66 Barry Street, Bayswater Vic. 3153. (03)762-6800.
While it's highly unlikely our WordPlus system ever would have to clean up a sentence such as the one above, it could without any trouble whatsoever.

Essentially, WordPlus is a computer programme that catches errors in spelling and other dictionary based tasks.

However, you are the one in control, you can over-ride its advice at your discretion.

Software Source also has another programme called Punctuation and Style. This system catches errors in punctuation and grammar and picks up phrases that are being misused and suggests alternatives. As you can imagine, both these systems can help your writing style considerably.

Correct grammar can cut down greatly the costly misunderstandings in business communication, so these programmes from Software Source may well be the best means a business has nowadays of cutting down the competition.

See Software Source for Basic/z, C-86, Directory Sort, Modem 86, Spellbinder, Super Calc, VSpool & VEdit.
Microprofessor MPF-1P reviewed

Lance Wilson

This complete microcomputer system gives step-by-step hands-on instructions into all aspects of the Z-80 microprocessor. Optional extras give it a wide range of practical applications.

**The MPF-1P Microprofessor.** This is based on the Z-80 CPU, operates at 1.79 MHz and has on-board 4K RAM and 8K ROM. Other features are a 49-key keyboard, built-in speaker, interface for program storage/reading to and from cassette, 20-digit, 14-segment alphanumerical green tube display, 40 input/output lines, battery backup for the RAM contents, buss-expandable Z80 architecture and three user manuals.

MANY READERS of ETI will be acquainted, either first hand or through reviews, with the Microprofessor MPF-1B trainer. This is an educational microprocessor development system which can be used by the computer buff as a self-teaching aid for micros.

Multitech have done it again and come up with a higher level model (at a higher level price), incorporating a much expanded monitor as well as a viable 8K interpreter option.

Designated the MPF-1P (for PLUS) it features a 16-segment display of twenty characters which will scroll to forty. This display is similar to the incandescent displays of some of the new portable computers and the Texas Instruments’ ‘Speak and Spell’.

The unit comes in the same presentation as the standard MPF-1, a compact look-likes package with the processor board in residence. There is mounting space for another full-size or two half-size accessory boards laid out in a very concise and accessible unit. The only ergonomic disadvantage is the tangle of wires and power supplies required to power a three-board system.

There is a full range of accessory boards including printer, EPROM programmer, interface and memory board, speech and sound generation boards. A TV interface board is mentioned in a glossy brochure. However, no further details were available on this interesting option which promises to make the Microprofessor one of the most useful development systems available.

The standard of manufacture is of the highest order. The quality of the circuit boards is A1 and they are particularly well laid out, especially where cutting and jumpering is necessary to accommodate different types of memory chips.

**MPF-1P monitors**

When the unit is switched on the display comes up with ‘MPF-1P’. To enter the monitor, key-in a CONTROL plus the appropriate letter from the keyboard. This drops the system into the selected section of the monitor; for example, into the two-pass assembler or text editor.

The expanded monitor provides a broad range of facilities which make it a more advanced design compared to the older MPF-1B. However, this added facility makes it more complicated. It results in an advanced piece of hardware which is less of a starter system and more of a software
the lack of circuit diagrams, as are available in the MPF-1B User’s manual, is a significant limitation for the hardware buff. It seems to be an oversight that these circuit diagrams are missing. From an educational point of view they are necessary, and a lot of the MPF-1P applications involve the construction of interfaces to mate with the real world. The User’s manual is very well detailed but it would be easier to understand if it had a different format. Now it is necessary to jump from the back to the front in order to find out how to enter a program via the two-pass assembler. Thus it requires several passes through the book for things to gel in the reader’s mind.

On page 100 an example is given which should have been in the first ten pages. This example helps to hang some of the material together; loading an assembly language program requires the use of the text editor to enter it and the assembler to process and lodge the machine code in memory.

The Experimental manual is much the same as that for the MPF-1B. The section on the Counter/Timer Chip (CTC) has been transferred to the interface manual which comes with the Input/Output and Memory board (IOM) option.

The Experimental manual is a good introduction to machine language programming, ranging from binary arithmetic experiments through to how to program a clock.

The documentation occasionally lapses into a sort of Chinese-English language which does not make it easy to understand. There seems to be a need in Taiwan (and Japan) for people whose native language is English to write the manuals. Many larger Japanese companies, however, have seen the light and their equipment manuals are well written in English.

In spite of these shortcomings, the information is adequate and quite well indexed.

**Options**

The IOM board is an interface option for the MPF-1P and provides the Parallel I/O chip (PIO), the Counter/Timer Chip (CTC) and the Communication Interface Chip (USART 8251). Thus experiments in both parallel and serial interfacing are possible.

This option will not be detailed here since the handbook for the review machine was a draft issue only. It does have an extra 6K RAM and 4K ROM to expand the memory space (see memory map).

The printer accessory for MPF-1P is a 20-column matrix thermal printer with resident monitor EPROM and disassembler. The only significant difference from the MPF-1B’s printer is the monitor software. There is, similarly, a vacant EPROM socket for the user. It will list both BASIC and assembly language programs; the latter are input via the assembler, or disassembled from machine code. A limited graphical capability using the TAB function is possible, as well as the listing of data and results.

**Conclusion**

The MPF-1P is a most impressive piece of educational hardware, substantially fulfilling its obvious roles as both an assembly language trainer/controller and easily interfaced BASIC-language computer.

As a first-off piece of hardware for the neophyte it has certain limitations which its predecessor did not have. However, these are balanced by its strengths such as a good BASIC interpreter and a more versatile range of peripherals.

Many organisations have already entered microprocessor training via the MPF-1B. The MPF-1P provides a logical step forward for the advanced trainees, complementing the MPF-1B.
Here is an unbeatable opportunity to purchase a top quality printer from a well known and respected manufacturer, Texas Instruments, at a saving of over 30% on their normal list price.

**OPTIONS**
- Serial EIA cable for 810 printer: $50 exc. tax, $60 inc. tax.
- Serial cable for 850 printer: $55 exc. tax, $66 inc. tax.
- 4K buffer for 850 printer: $100 exc. tax, $120 inc. tax.
- All items carry normal warranty.

**TI 810 PRINTER**

The Texas Instruments Omni 800 Model 810 printer is a receive-only, forms-programmable, impact printer. It features a microprocessor system which controls all character recognition, printing, and paper movement. Basic operating, data processing and self-test routines for the microprocessor system are stored in ROM. Random-access memory stores vertical format control routines which may be locally programmed by the operator or remotely programmed through the communications line.

A single seven-dot-column printhead produces the 9 x 7 dot matrix for character generation. Printing is bidirectional at the rate of 150 characters per second. A full 132-character line is printed in less than one second.

The standard print format is 10 characters per inch (cpi) horizontally and six or eight lines per inch (lpi) vertically. The printer produces one original and up to five copies using sprocket-fed paper in widths from 76.2 to 381 mm (3" to 15")

A detailed, comprehensive, A4 format 76-page manual is included.

There's nothing flash about the Texas Instruments 810 printer — it's an ideal printer. It prints quickly and cleanly, and it's as close to unbreakable as we've seen. We run three of them in this office — one has been on line for more than a year without missing a beat. It literally never gets switched off, and runs up to 24 hours a day, all the time.

When we want to move cables in the ceiling, we stand on the printer to get to them! Most printers these days would collapse as soon as you even thought of doing such a thing.

The TI 810 is recognised throughout the industry as a reliable, fast workhorse. It's claimed to run at 150 characters a second, and it comes closer to its rating than anything else we've tested. On a solid-text printing test that shows 80 cpm machines are actually running at around 34 cpm, the 810 comes up just under 130. That's fast.

Its dot-matrix typeface is obviously draft quality, without full descenders, but it is clear and readable. If speed and real bulletproof reliability are what you need, this is the machine.

Normal retail price is around $2200 before tax, and it is good value even at this price.

**SPECIALS**
- **TI 810 PRINTER**
  - $1410 exc. tax
  - $1692 inc. tax
- **Normal list price on this printer is $1890 exc. tax; save $480!**
**TI 850 PRINTER**

The Model 850 Printer is a reliable, versatile dot-matrix impact printer featuring 150 cps bi-directional operation and 9 x 9 or 15 x 9 dot-matrix characters with true descenders. Mosaic graphics are possible with a squared-off pattern six dots wide by 12 dots high. It is also capable of raster graphics. It comes with a parallel interface as standard, but a serial option is obtainable. There is a 256-character buffer inside and a 400-character buffer option is offered, too. The 850 can handle single sheets of paper or fanfold paper up to 254 mm (10") wide and roll paper up to 127 mm (5") in diameter. A comprehensive, copiously-illustrated, 108-page manual is supplied with the printer.

**SAMPLE PRINTOUTS**

This is an example of ENHANCED print made by the Model 850 Printer.

This is an example EMPHASIZED print made by the Model 850 Printer.

This is an example of STANDARD print made by the Model 850 Printer.

**SPECIFICATIONS**

**TI 850 PRINTER**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>50-132 Vac, 47-63 Hz, single-phase or 187-264 Vac, 47-63 Hz, single-phase</td>
</tr>
<tr>
<td>Power</td>
<td>100 W maximum</td>
</tr>
<tr>
<td>Size</td>
<td>412 mm (16&quot;) wide, 220 mm (8.7&quot;) deep, 127 mm (5&quot;) high</td>
</tr>
<tr>
<td>Weight</td>
<td>6.5 kg (14 lb) including options and accessories</td>
</tr>
<tr>
<td>Characters</td>
<td>Full US ASCII and 7 international</td>
</tr>
<tr>
<td>Line levels</td>
<td>O or +5 Vdc</td>
</tr>
<tr>
<td>Speed</td>
<td>1000 cps maximum</td>
</tr>
<tr>
<td>Line control</td>
<td>Stroke acknowledgment</td>
</tr>
</tbody>
</table>

**EIA RS-232-C standard subset**

- 12 or +12 Vdc
- ASCII and similar international codes
- 256 characters, expandable to 4000 characters
- Printer busy
- Wire-matrix impact printer
- 15 x 9 dot matrix (standard print)
- 10 cp and 16½ cp (standard)

**Power Requirements**

- Voltage: 50-132 Vac, 47-63 Hz, single-phase or 187-264 Vac, 47-63 Hz, single-phase
- Power: 100 W maximum

**Physical Dimensions**

- Size: 412 mm (16") wide, 220 mm (8.7") deep, 127 mm (5") high
- Weight: 6.5 kg (14 lb) including options and accessories
- Characters: Full US ASCII and 7 international
- Line levels: 0 or +5 Vdc
- Speed: 1000 cps maximum
- Line control: Stroke acknowledgment

**Method**

- Wire-matrix impact printer
- 15 x 9 dot matrix (standard print)
- 10 cp and 16½ cp (standard)

**Paper Drive**

- Sheet, roll or fanfold (single or multipart)
- Multipart
- Fanfold paper up to 127 mm (5") wide
- Single pan up to 254 mm (10") wide
- 254 mm (10") maximum width
- 127 mm (5") maximum diameter
- Single pan 0.254 mm (0.01") thickness
- Multiplip, 0.34 mm (0.014") minimum for original plus two copies (no copies permitted except on tax copy)

**HOW TO ORDER YOUR TI PRINTER**

Fill out the coupon here and enclose a cheque, bank cheque or money order for the amount required made out to PACESETER SYSTEMS PTY LTD.

If you are not paying sales tax, please quote you sales tax number on the coupon, where indicated, or for schools, colleges or other educational institutions, enclose a sales tax declaration on your letterhead.

**SEND COMPLETED COUPON TO:**

c/o ETI Magazine
P.O. Box 227, Waterloo NSW 2017

Sales tax no. .... (if applicable)
I enclose $ ............ total.
Cheque or Money Order no. 
Signature (unsigned orders cannot be accepted)

**Please send me:**

- T.I. Model 850 Printer(s) @ $ .............. tax free/tax paid*
- T.I. Model 810 Printer(s) @ $ .............. tax free/tax paid*
- Serial EIA cable(s) for 810 printer @ $ .............. tax free/tax paid*
- Serial cable(s) for 850 printer @ $ .............. tax free/tax paid*
- 4K buffer(s) for 850 printer @ $ .............. tax free/tax paid*
- plus freight: 850 printer — $10, 810 printer $20

*strike out whichever is inapplicable.

Name ..............
Address ..............
Postcode ..............

**OFFER CLOSES 31 DECEMBER 1983**
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 560 A DMA chip.

64K DYNAMIC RAM + 4K STATIC CRT RAM + 24K EEPROM OR STATIC RAM
“Big Board II” has 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 2K8 SRAMs for the memory-mapped CRT display and space for six 2732 As, 2K8 static RAMs, or pin-compatible EEPROMs. 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 450ns2732 EEPROM containing the monitor.

MULTI-DENSITY CONTROLLER FOR SSDS FLOPPY DISKS
The new Ferguson single-board computer has a multi-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 54 pins for 5.25” drives, the other with 50 pins 8” drives.

VASTLY IMPROVED CRT DISPLAY
The new Ferguson SBC uses a 6845 CRT controller and 8002 Video Attribute 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 60 characters 8002A chip supplied for 16 to 30 color monitors.

STD BUS CONNECTOR
The Ferguson computer brings its bus signals to a convenient place on the PC board where users can solder an USTD bus card or plug directly into it, and it can be well connected by bus cable to industry-standard card cages.

DMA
The new Ferguson computer has a Z80A DMA chip that allows byte-wise data transfers at 500K bytes per second and bit serial transfers via the Z80A S10 at 880K bytes per second with serial processor overhead, though the monitor for the new computer uses the DMA chip mality for transferring data to and from disk. The chip can readily be used for other things since its “write-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 CB IOS 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
The new Ferguson single-board computer has one parallel port for an ASCII keyboard and four others for user-defined 10. When the computer is powered-up or reset, the monitor looks for a carriage return at the keyboard 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 S100, while the other is for systems and application use.

EPROM PROGRAMMING CIRCUITRY AND SOFTWARE
The new Ferguson SBC has circuitry and drivers for programming 2716s, 2732A’s, or pin-compatible (E)EPROMs. Software S5s extra.

CPM
CP/M with Russell Smith’s CB IOS for the new Ferguson computer is available for $220. The CB IOS is available separately for $65.

Pricing and Availability:
Available ex-stock
In single quantities, full kits cost $895 inc. tax, and $4.87’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” & 5½” systems will be available.

Board with main chips now available (includes PCB, Manual, PALS, Monitor ROM, SAM, ROM chips). You have to add rest of components at 5% + tax.

Errors and omissions excepted.
"Phone Tap" Bargains!

Is your phone tapped? No? Well if you don't rate, then tap ours! If you ring or write and say "Phone Tap!" in November, you can get the special prices shown below.

**GO ON BUG US!**

**Piezo Horns**

Jaycar has broken the price barrier for Piezo Horn Speakers!!

We now DIRECT IMPORT a range of cheap horns at prices that will stagger you! Similar units are sold everywhere at P.A., Disco and Hi-Fi applications.

**BD677 Popular Philips Darlington Transistor**

We have the most popular transistors at low dealer prices.

We also have a "TWIN SCREENED AUDIO CABLE" sold per metre for just $2.00 per roll.

**TWIN SCREENED AUDIO CABLE**

Two screened round audio cable, 2.5 mm² twin conductors. Available in 10 metre lengths. This cable normally sells for $5.00 per metre or $42.00 per roll.

Cat. WB-1504 $2.00 per roll

**BD677 DARLINGTON TRANSISTOR**

The BD677 is an NPN, TO 136, 60 volt 4 amp Darlington transistor. Its gain is 1,000! For less than 25c each, you can buy a bulk buy of this snappy little transistor to save you money.

Cat. ZX7022 (8 amp 650V SCR) $1.95

**Sennheiser Muffs**

Genuine factory made spare foam earpads for the famous HD-414. We have plenty of stock.

Cat. AA2011 $5.95 per pair

**PIONEER 4" WIDERANGE**

ONLY $9.95 ea

**Phone Tap**

Call the Jaycar phone for our current phone tap. Normally this unit would sell for around $25, but at this price, you would get a phone tap that is built to last for many years!

Cat. GM99 $17.95

**FANTASTIC MULTIMETER**

Over 100x the sensitivity of the standard cheap variety. Makes the Fluoro starter kit very cheap! (PCB's for the kit) Cat. HP8747 from $20.00 per roll.

**1N914 DIODES -- INCREDIBLE SAVINGS**

The 1N914 (or 1N4148) if you like, is probably the most popular diode in the history of electronics. We probably use over 100,000 a year ourselves! Jaycar has made a bulk purchase of these diodes and we can pass on great savings!

We must sell these in minimum lots of 500.

Cat. Z91500: 1.9N914/1N4148 $1.95

ONLY 3% cents each, 1,000 ONLY 2 cents each, 10,000 ONLY 7 cents each and these prices include tax.

FROM 2 cents each!!!

**CALL BOOK**

1983/4 Australian Amateur Call Book Cat. BE-1000 $7.95

Wow! $17.95

**SAVE OVER 50%...**
Robot Turtle
Grab One NOW

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 ahead of the flat two dimensional world of the VDU. When connected to the I/O ports of your computer and incorporated into the control of each wheel, it has blinking eyes, will beep with a choice of two tones and when ordered by the computer, spins down a pen to chart its progress and provide hard copy of the results of the program. When set free to run around the turtleneck it will explore its environment. When the turtle shell bumps into an unmovable obstacle touch sensors send back data to the computer for it to calculate evasive or regularity action.

The complete "HEBOT II" kit including all hardware, dome, wheels etc. Cat. XR1020

$399 inc tax

Universal Interface Card Kit Cat. XR1022

save $100

ONLY $299

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. 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(W)x85(S)x25(D)cm looks similar to a pocket calculator and runs off a standard 9V cell. Provision is made for a mains adapt for 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)

Low cost IC inserters

Up until now these have cost a fortune!! Features:
- CMOS SAFE conductive plastic
- Exclusive bent pin alignment guides in handle, 8 to 40 pins
- Ground strap can be connected.
- One hand operation.

INJECTORS

Cat. No  Model  Description
TH1810  CIT820 8 – 20 pin $6.95
TH1812  CIT22 22 pin $6.50
TH1814  CIT2428 24 – 28 pin $6.95
TH1816  CIT8360 36 – 40 pin $6.95

EXTRACTORS

TH1818  ET480

Deceptively simple looking device. One piece metal construction, 8-40 pins

GREAT VALUE!

$14.95

We have made a scoop purchase of computer grade Box Fans. They measure a standard (50 x 50 x 40mm). But there's a catch! They are only available in 115V. Great if you are making equipment for export to the USA or if you find yourself in a hurry!

Cat. YA 2508

ONCE SOLD FOR $24.50

WHAT'S UP DOC?

Are the "rabbit ear" antennas on the back of your portable TV broken? You know those ones that are telescopic and have ball-swivel joints. We have genuine "HMV" factory spares that will fit other TV's. Apparently they are almost industry-standard components. Each unit comes with a short length of lug-terminated 300 ohm ribbon.

We have a small stock lot available at only $7.95 each.

Cat. AA2005

$7.95

Peekless crossovers

Two Way Crossover

5W - 5W - 5W R.M.S. Handling
FREQ. 7600Hz
Cat. CE 2012 9.50 ex

$9.50

Value

$14.95

Three Way Crossover

40W R.M.S. Handling
FREQ. 750Hz to 5000Hz
Cat. CE 2022 $22.50 ex

$22.50

Number 1 for kits

POST AND PACKING CHARGES
55 - 59.99  $1.50
60 – 69.99  $2.50
70 – 99.99  $3.50
100 – 199.99  $4.50
200 – 299.99  $5.50
300 – 399.99  $6.50
400 – 499.99  $7.50
500 – 999.99  $8.50
1000 – 1999.99  $9.50
2000 – +  $10.50
Free INSURANCE for Road & Registered Post over $50.
All sales or faulty items returned (not +6 months under guarantee) cost postage and handling.

Shop Hours: CARLINGFORD, CONCORD & HURSTVILLE
Mon - Fri 9am - 5:30pm; Sat 9am - 12pm; Thurs night 8.30pm
MON - 8.30pm; TUES 9am - 8.30pm; WED 8.30pm; THURS 8.30pm
Mail Orders and Correspondence: Box X 25 Haymarket, Sydney 2000.
The "image computer", a new tool for business, science or engineering

The computer tool currently revolutionising our working lives in almost every sphere is the word processor. Wang have taken it a quantum leap forward with the release of their PIC — professional image computer. This scoop report is exclusive to ETI.

Collyn Rivers

Figure 1. A real estate agency exploits PIC's ability to integrate text and images — and then to access both via an integrated data base.


Computer technology advances so rapidly that developments which would have been breath-taking five years ago now rate a few paragraphs in a trade newspaper. It is, then, a measure of Wang's new image scanning technology that technical journalists from all over the world flew to Wang's head office in Boston, USA specifically for the release.

What Wang has created is the ability to capture visual data, edit it, merge it with word processing, store it on disk, retrieve it with computerised management information facilities, and transmit it electronically anywhere in the world.

The technology combines many of the functions of the highest grade facsimile machines, micro-fiche storage, data-base systems, word processing, and electronic mail. The system processes drawings, photographs, handwritten material, and text, much as a word processor does with words.

The system also provides for stored images or data to be retrieved via data-base commands. Descriptions may be added to the images, and the images subsequently retrieved by commands based on the image descriptions.

All material is optically scanned, digitized, edited if required, printed out, and recorded. The material may also be transmitted to other PIC terminals anywhere in the world.

Applications are vast. Transmitting copies of signed documents between offices, storing and retrieving permanent records of contracts, assembling pre-publication material including diagrams and pix, integrating inventories with exploded assembly drawings, planning documents, transmitting copies of advertising layouts for review or approval, instantaneous transmission of Japanese and Chinese text, etc etc.

The basis of the system is the image processor itself. This is a compact desk-top unit which optically scans pages up to 275 x 350 mm. Light reflected from the scanned material is focussed onto a charge-coupled...
device which digitizes the information. Resolution is 1728 pixels horizontally, and 2200 lines vertically (equivalent to Group III facsimile standards) — a total over four million digitized bits of information per page.

The scanning process can be initiated from the scanner itself, or from the keyboard of the Wang Professional Computer used with the image processing system. Once scanned, a process taking four seconds, the digitized image of the page is displayed on an image monitor and also stored in memory.

**System components**

The essential components are a Wang Professional Computer, an Image Processor, an Image Monitor and basic Image Processing software.

The Image Monitor has a 12″ diameter high resolution white-on-black screen (800 x 600 pixels). It displays a half-page of image information at full original size (275 x 350 mm), or a full page at half size; can scroll between half images, and can also enlarge any portion of the image to twice original size.

**Storage**

Images are stored on a conventional 10 MB Winchester disk drive supplied as part of the Wang PIC. An average image page requires between 90 kilobytes and 120 kilobytes of memory. Thus the 10 MB drive can store approximately 100 images.

**Printers**

Wang’s Thermal printer creates high resolution character and image output on draft paper at 200 dots/inch. Large-scale users may alternatively consider the Wang Laser Imaging printer which prints up to 12 pages a minute at 300 dots/inch.

**Software**

Image Processing and Image Composition software is essential. There are also several optional packages.

Image Processing software enables the user to manipulate page and document content to almost any extent conceivable. Any part of the image may be reviewed.

Images can be enlarged or reduced, rotated through 90°, lightened or darkened, or even reversed into ‘negative’ form.

Image Composition software enables images to be prepared and used in applications like word processing. It is an electronic way of combining pictures with text — the cutting and pasting operation familiar to children (and paste-up artists!).

The various software functions include the ability to specify the pages from which material is to be abstracted and then re-positioned, the ability to outline the precise area of the image to be transferred, and the ability to move and rearrange all images and text on the new composite page.

**Optional software**

Integrated Word Processing adds standard word-processing features to the Image Composition software. Thus text can be entered and formatted around images, using standard Wang word processing operations.

Integrated Notebook allows users to create their own individual ‘notebooks’ of text and image information. For instance an engineer could establish a notebook containing all details of current projects including images of design concepts, relevant physical data, commercial information, and all related correspondence.

Integrated Database provides search and retrieval facilities for text and images. Records and fields are established, as with any other data base system, with the added facility that the data may be defined (and retrieved) as numbers, characters, texts, dates, telephone numbers, or images.

Figure 1 shows a typical record — designed for a real estate co-operative. Here the images could also contain floor plans, maps with directions, site layouts etc. Further optional software includes form generators and programming utilities enabling users to create specialised programs using (PC Interpretive Basic and Cobol).

**How much?**

The PIC system is based on Wang’s existing Professional Computer. This can be upgraded to PIC capability by adding an Image Monitor and Controller (US$2000), Image Scanner and Controller (US$4500), Image Core Software (US$1500) and U.S. $15 for a thermal printer.

At the time of writing — mid-October — no firm Australian prices were available. The system will be available from February 1984.

“PIC is the single most powerful and fully integrated office automation tool available today,” says John Cunningham, president and chief operating officer of Wang, “its applications are limited only by the imagination.”

Your reporter flew from Sydney to Wang’s headquarters near Boston specifically to see this unit. The return distance was over 20 000 kms. Not a single kilometre was felt to be wasted.

The Wang PIC system is a genuine breakthrough in computer technology. ☞
Multiply your Microbee’s ROM capacity with this interface board

Roger Harrison

This project design by F. M. Capmeil, presented with the cooperation of Avtek Electronics, permits extending the ROM capacity of the Microbee to 44K, or to 308K total by daisy-chaining up to six slave boards to produce a sort-of high speed ‘read-only virtual disk’ (a ROD?). It takes 2532s or 2764s (can be mixed) and, in addition, provides 11 open-collector outputs and eight buffered inputs.

In addition, eight buffered input lines are provided along with 11 open-collector transistor output lines. Using this board with special purpose-written software in ROM, you can turn your Microbee into a burglar alarm, a process controller or such like.

A cassette of ‘driving’ software is provided with kits. This contains two ‘monitor’ programs, one in BASIC, the other in machine code. Using the monitor you can utilise the input and output lines and, as data for these needs to be in decimal form in programs, but it is in binary form when inputting or outputting, a decimal-to-binary conversion program is included for your convenience.

Copyright on the PCB board is held by Avtek Electronics who are marketing the kit. Hence, we have not reproduced the artwork. In any case, the board is double-sided with through-plated holes, not something most hobbyists are capable of making for themselves! To ease construction, the board is solder-masked and the component side has a silk-screened overlay showing component locations. For those who can provide components out of their own stock, Avtek will sell you a board and monitor cassette alone.

Construction

Assembling the board is quite straightforward. Sockets can be used on the fifteen DIL ICs if you wish. Commence construction by soldering all the IC sockets in place, noting orientation. Follow with the resistors, capacitors and diodes, ensuring you get the tantalum capacitors and diodes the right way round. Then solder the 11 transistors in place. The three-terminal regulator (IC16) can be assembled next. It needs a small heatsink. A Thermalloy #6073 or similar should be adequate. Insert the regulator’s three legs into the board holes and then bolt it and the heatsink to the board before soldering the legs in place. Smear a little thermal compound on the rear of the regulator’s flange before assembling it. To improve heat conduction to the heatsink.

Insert the ICs now, or solder them in place if you’re not using sockets. Beware you get the ICs correctly orientated.
PARTS LIST — ETI-673

Resistors all 1/4W, 5%
- R0, 12-19 100R
- R11 5k
- R20 1k

Capacitors
- C1 1u/25 V tant.
- C2-5, 13 10µ/16 V tant.
- C6-12 10n ceramic

Semiconductors
- D1, D2 1N4001, 1N4002
- IC1 74LS08
- IC2, IC6 74LS42
- IC3 74LS74
- IC4 74LS30
- IC5 74LS138
- IC7, 8, 12 74LS32
- IC9, 14, 15 74LS174
- IC10 74LS04
- IC11 74LS02
- IC13 74LS244
- IC16 7805
- D1-11 BC548
- ZD0 15 V, 1 W zener
- ZD11-20 27 V, 400 mW zener

Miscellaneous
- P1 50-way I.D. plug
- SK1 24-pin IC socket
- SK2 14-pin IC socket

ETI-673 pc board; 50-way I.D. board header; approx. 50 mm of 50-way ribbon cable; IC sockets — 4 x 28-pin, 6 x 24-pin, 1 x 20-pin, 6 x 16-pin, 8 x 14-pin; heatsink — Thermalloy #6073 or similar, 14-pin DIP I.D. plug or header; 24-pin DIP I.D. plug or header, ribbon cable to suit, etc.

Estimated price: $99-$110

ETI November 1983 — 60
A wire link has to be installed on the rear of the board, from pin 2 of the expansion socket (SK2) to pin 19 of EPROM socket I. The 50-way header-cable-socket assembly is mounted last of all. Insulation-displacement (ID), connectors were used on this prototype. The 50-way cable is grey and has one lead marked with a red stripe. This is the pin 1 line, as shown on the component overlay. Only a short length of cable should be used as the lines are unbuffered. No more than 80 mm is necessary.

Give the board a thorough check and, if all’s well, you’re ready to roll.

A total of ten EPROM sockets have been provided. Sockets 1, 2 and 3 can accept either type 2532 or 2764 EPROMs, while socket 4 only takes a 2764. Sockets 5 through 10 take only 2532s. Pin numbering on the 28-pin types (for 2764s) is shown in brackets. Sockets 1, 2 and 3 are paired with sockets 5, 6 and 7 respectively, but only sockets 1, 2 and 3 will accept A2532s. Pin 254 (5, 6 and 7 then being unnecessary when 2764s are in place).

On-board link fields permit selection between ROM types. These fields are labelled S51, S52, S53 and S54. Use of the link fields is explained in the text.

The ‘output enable’ line (OE) of the selected ROM, or ROM set, is driven low to accept, selected by the address and data bus decoding scheme that is part of the output selection circuitry. Sockets 1 through 7 are located at 8000 to DFFF in the ‘Bee’s’ memory map, known as the EDASM (editor-assembler) location. Sockets 8, 9 and 10 are located at E000 to EFFF, the NET (network) location.

The project uses two of the 280 I/O ports for both EPROM selection and the Input/output control. These ports are 254 (FE hex) and 255 (FF hex).

The output port 255 has eight outputs labelled F0 to F7. Three of these outputs F0, F1 and F2, are used to select the EPROMS in the EDASM location (sockets 1 through 7).

The output port 254 has eight outputs labelled E0 to E7. Two of these outputs, E0 and E1 are used to select the EPROMs in the NET location.

The remaining outputs are used to drive 11 transistors. They are F3 to F7 and E2 to E7. The collectors of the transistors are brought to the Input/output socket, SK1.

The A1 to A7 2B0 address bus lines from the ‘Bee are gated with an inverted copy of the I/O Request (IORQ) line. When on-board ROM is to be selected, the AO-A7 address lines will be high and IORQ low. The AO line determines which 280 port is selected, being low when port 254 is selected, high when 255 is selected. The RD line will be low.

A data value on the data bus is latched by IC9 from the lower three lines, D0-D2, and outputs E0, E1 and E2 are decoded by IC2. Similarly, IC3 latches the value on the data bus and decodes outputs F0 and F1.

The ROM selection signals are gated with the appropriate output from ICS which decodes the upper four address lines, A12-A15. Software in the selected EPROM will only be read with both the MERQ and RD lines are low and a valid address is present.

The selection of the various EPROM sockets is effected by the output lines as indicated in Table 1.

<table>
<thead>
<tr>
<th>F2</th>
<th>F1</th>
<th>F0</th>
<th>E1</th>
<th>E0</th>
</tr>
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<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
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</table>

Table 1. EPROM selection code

It should be evident that every time a port is written to, the output has to take into account which EPROM is meant to be selected. This may seem a little complicated but it allows complete software control on the board. The EPROM selection can be changed within execution of a program, allowing complex jumps between programs residing in different EPROMS located at the same address. This effectively extends the available memory in ROM from 12K to 44K per board, with 12K available at a time.

The output responds to the basic command:

```
OUT port no data
```

Example: OUT 255.47 (both values are in decimal notation).

In the command: OUT 255,2 — 2 represents the data. This data will be translated into an eight-digit number in binary, in this case: 00000010. Each of the digits will be put onto one of the output lines, as follows.

| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |

A “1” means that a voltage is applied to the transistor driver and it will turn on. A zero means that no voltage will be applied to the transistor and it will not conduct.

If you want to turn on a single output line it is necessary to know the decimal equivalent of the complete 8-bit binary number formed by the eight outputs, before that particular line can be driven high. The cassette monitor software includes a binary-to-decimal conversion routine for your convenience.

There are two ways to write to the output:

(1) The decimal value corresponding to the output required is known. In this case just output to the desired port. (2) Only one data line needs to be changed from last output, in which case it is necessary to hold the binary values in a 4 by 10 array, change the bit corresponding to the line to alter, convert to decimal, and output. In this way one could write alternately to several output ports after setting or resetting the desired lines.

The input is connected to both port 255 and 254. Reading from port 255 is the same as reading from port 254. The Input port has eight inputs labelled D0 to D7 (not to be confused with the 580 data bus). If the board uses a different address pair the input will also respond to both.

The Input responds to the BASIC command:

```
variable = IN (port no.)
```

Example: A = IN (255), where the port address is in decimal.

IC3 buffers the input lines which are protected against excess voltage or reverse polarity by the 100 ohm series resistors and 5V6 zeners across each input. The user output ports, F2-F7 and E3-E7, comprise a series of open-collector BC548s, Q1 to Q11. Each transistor is protected against supply over-voltage and reverse polarity by the zeners across each output. The E-series outputs are driven by IC15, the E-series by IC14. These two ICs latch the data value from the 2B0 address bus, their outputs driving the bases of the output transistors.

Power-on ‘clear’ is effected by IC10c. When first powered-up, C4 will be discharged and the Input of IC10c will be driven high. After C4 charges, the Input of IC10c will go low, clearing all the outputs of IC14 and 15. The output of IC10c also clears latches IC6 and IC9 and the EPROM selection circuitry.

Supply input can be between nine and 12 V dc. IC16 is a three-terminal regulator that provides the +5 V supply for the board. Capacitor C1 maintains the stability of IC16 and C2 provides output bypassing. Diodes D1 and D2 provide mutual supply rail blocking while ZD0 protects against over-voltage and reverse polarity input on the external supply inputs.

The expansion socket SK2 brings out the Z80 data bus plus Bee expansion connector signals RD, address line A12 and ports B and 9, along with +5 V and ground.

Note that there is a Z80 WAIT signal input on the I/O socket, SK1 (pin 9). Protection is afforded by R0 and ZD20.
Project 673

Before using the board you'll need to decide what EPROM types you'll be using and set up the linking on SS1, PS1, PS2 and PS3 accordingly. As it comes, the board is set up for 2532s with tracks linking the connection pads in the field areas on the top side of the board. The appropriate tracks must be cut and links installed as shown here.

PROM type selection. The first three sockets can accept either 2532s or 2764s. Four link fields permit individual selection. As it comes, the board is set up for 2532s. Link field SS1 permits you to designate the EPROM type — a for skt 1, b for skt 2, c for skt 3. For 2764s, cut the existing track a'd install a link to the right, as shown. The A11, CE and OE pins for each socket also have to be jumpered when 2764s are selected. Pin selection fields PS1, PS2 and PS3 effect this. They're located near each socket. Again, cut the existing track and jumper to the right, as shown, on the pin selection field for the appropriate socket.

Power supply

The project can be powered from the Microbee or from an external power supply. Microbees have been supplied with different power pack models at different times since first released. Some are able to drive both the 'Bee and the MultiPROM board, some can't. The sign of a power supply with insufficient 'grunt' in this application is: RESET doesn't operate!

The board can be powered externally from a small 9 Vd.c power pack capable of supplying 200 mA or more (current depends on the number of ROMs inserted). The Dick Smith M-9560 9 Vdc/600 mA plugpack or similar would be fine.

Input/output

The project uses two of the Z80 I/O ports for both the EPROM selection and the input/output control. The ports used are:
- port 255 (hex FF)
- port 254 (hex FE)

The ports used can be changed by inverting one of the address lines via a spare inverter provided on-board. This function allows the connection of several boards all at a different address. The pairs of addresses available are:

- 255/254
- 253/252
- 251/250
- 247/246
- 239/238
- 223/222
- 193/192
- 127/126

Software selection

The EPROMs are selected by an OUT statement from BASIC. The address of the EDASM location is 255. To select the first EPROM of the EDASM location set, enter:

OUT 254, 1
then hit the return key. Then enter EDASM followed by the return key.

As another example, if you wish to select the third EPROM in the NET location set, enter:

OUT 255, 3
then hit the return key and enter NET 'followed by the return key, again.

A cold start will not change your EPROM selection but a power OFF will. If your 'Bee has a battery backup, the data will not be lost but before anything, you must reset the proper EPROM.

Example: OUT 254, 1 (Wordbee), type EDASM. You are in Wordbee. Then enter text. Turn power OFF. Turn power on, the screen should display:

OPTION NOT FITTED

This is because the 'Bee does not see any EPROM until they are selected. So, enter OUT 254, 1 (Wordbee), type EDASM. You should be back in Wordbee. If you're 'Bee appears to hang, then reset. It is a good idea to always leave the monitor when turning the power off as this leaves a return address in memory and will prevent a possible hangup.

Using the input & output lines

To use the input and output lines on-board, you will have to interface them to some sort of hardware. Take the inputs first. There are two forms the input can take: reading the 'status' of a switch, which can be open or closed; or the input can be driven from the output of a logic gate. To read the status of a switch, use this circuit.

However, this is only useful where the switch is less than a few metres away. Where the switch or gate is at the end of a long line, use an optocoupler at the MultiPROM input, like so:

If the input is a pulse or varying dc level signal, then it is necessary to use a signal conditioner. This circuit should do the job:

To drive an input direct from a logic gate output, no special interface is required. In all cases, use twin-pair cables; one to the input, the other to 0 V.

Now for the outputs. The output lines are 'open' BC548 collectors. That is, an output device, such as a relay, is connected between a power supply and the collector. When the output is programmed ON, the transistor conducts, operating the output device.

It is a simple matter to drive a relay or dc motor. Like so:

The maximum supply voltage the BC548s will stand is 30 V. So any supply should be kept below 90% of this value (i.e. below 27 V). A 27 V zener is used to protect each output transistor. Note that any external supply used to power the device being switched should have its 0 V line returned to the MultiPROM's 0 V line.

We don't have the space here to go into programming details, so that will have to be left to a following article. In any case, kits are supplied with a manual which includes programming and other software details.
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ANOTHER POWERFUL FEATURE OF THE BOARD IS THE INPUT/OUTPUT SYSTEM, 11 OUTPUTS, OPEN COLLECTOR TRANSISTOR OUTPUTS. EACH CAN BE TURNED ON OR OFF WITH AN INPUT SIGNAL. A SECURE INTERFACE TO ANY COMBINATION OF MODEMS, STANDARDS, TELEPHONE EQUIPMENT, MICROBEE...THE SYSTEM IS DESIGNED TO ALLOW FOR TOTAL SOFTWARE CONTROL. BY USE OF A 'USER MODE' SIGNAL, THE OPERATOR CAN SELECT ANY OF THE ABOVE. THE ADVANCED SUPERVISOR SOFTWARE réseauS SEVERAL FEATURES TO THE USER.
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ETI-644 Modem
-follow-up No. 2
Roger Harrison

For those of you still struggling to get your recalcitrant '644 modem up and running, the following pearls of wisdom and experience from Trevor Marshall (the designer) and Richard White (a successful constructor) should set you on a successful course.

THE FOLLOWING contribution from Trevor comes via Bill Bolton who runs his own RCPM system in Sydney and who visited Trevor in California last July, returning with these ‘words from the master’.

Operating experience with ETI modem on Bell 103.

Since April 1982 the ETI modem (prototype) which I have adapted to the Bell 103 system frequencies, has been performing well at 300 and 600 baud across the USA.

In January 1983 I added an APPLE-CAT 212 add-on card to give my RCPM Bell 212 1200 baud full duplex capability, but left the ETI to handle the 300 and 600 baud FSK operation. The values that I currently have in my circuitry differ slightly in some cases from those published in ETI, mostly due to optimisation under operating conditions.

Several months ago Bill Bolton showed me messages from some of you who seemed perplexed by the complexity of the design. To the best of my knowledge there are no serious design flaws, and those who have suggested changes to the filter component values obviously missed the whole point of the diode/variable-filter design.

Unfortunately, I can’t help much in CCITT filter optimisation but the settings I used for Bell 103 originate are F in answer mode (F = low pass, C = high pass) and 73 in originate. I use 0110 for the digital (data smoothing) filter. All these settings offer equally good performance for both 300 and 600 baud and I don’t reprogram them.

Bruce Orr rightly pointed out that operation of 75 baud is marginal. The design was executed to give optimum performance with 300/600 baud, and the 1200/75 mode was given very much less attention. I hoped that once the modem was made available to the hobbyist, its performance would be maximised by the combined efforts of many, not just my own.

In my defence, however, the 45288 (IC4) was originally specified to be a Motorola part. In addition I specified C5 and C9 to be 5% polystyrene capacitors. I tested many of these for balance and found few problems. As I left for the USA long before the article was published, communication was difficult. I was unable to exercise as complete a control over the project quality as I had hoped.

The errata Matt Whelan gave refer to faults on the PCB, which I had diagnosed well before the article was published but which never quite got fixed. I never designed or drew a circuit in which C31 went to the junction of D14 and D4. This was a PCB error which should have been fixed (by ETI). You should all know by now that R48 goes to ground, not -6 V.

All in all, however, it appears ETI did a good job with the project (and they even paid me for my efforts!).

One of the first things I found desirable to change was the arrangement for the line hybrid balancer. I changed R93 to 10 ohms. This promptly blew up RL2, so I put a heavier-duty relay in there. It is not involved with the keying speeds and does not need to be a reed relay. I changed IC18 to TLO81. I made RV2 a pot on the front panel, and found a value for C45 and C46 that gave me maximum attenuation of the transmitted carrier from the incoming signal. These changes combined to make the largest improvement I ever effected in the design.

I changed R90 to 2k7 to give the system more gain, as the phone lines here in California are the worst I have ever come across (they make Sydney look quite good by comparison).

In closing, I often wonder why I have no callers from Australia. There are several who call my 'Thousand Oaks' RBBS system from Britain every week. Surely some of you who work for OTC (I didn’t really say that — ) could arrange to keep Bill more up to date with what’s happening over here. Transfers at Bell 212 1200 Baud FSK are really very fast. The ETI modem works on Bell 103. 300 baud FSK. On originate you
receive on 2025/2225 and transmit on 1070/1270. Program your lowpass filters as high as possible (1111) and the highpass to about 1650 Hz.

The system currently is on-line 24 hours (least activity is from 2 am to 4 am PST and 4.30 pm to 6.30 pm PST). There are 30 megabytes (some 3500 files) up at last count, with 8086 and 68K and Z8K software just starting to make a showing.

Keep up the good work.
— Trevor Marshall

Note that all known errata were published on page 132 of the April '83 issue of ETI.

Hot on the heels of Trevor's missive, which Bill published in his CP/M column in the October Your Computer, came a phone call from a passing associate, Richard White, who had successfully debugged a '644. Other constructors may learn from the following offering.

Further to our phone conversation of 5/10/83, I will list several of the problem areas I have found in the ETI-644 modem kit:

1. The 4528 IC is a problem area. The particular problem I had was that the monostable's pulse was too long for it to reset prior to the next pulse on the higher frequency selections. This caused erratic operation. Cure was to decrease both C5 and C9 to 1n.
2. DC offset at the output of IC20 (2 V) needed adjustment to allow the full operating range in this area. This fault may have been related only to my set of chips.
3. TRANSMIT LINE LEVEL. The text mentioned that line level can be set at -6, -12 or -18 dbm. The circuit diagram and parts list, however, give the resistor for -6 dbm. In practice, this level of transmit signal tends to swamp the receive signal unless this is of a high level (even with the transmit signal nulled optimally). Empirical testing has shown that levels of -18 dbm and lower will operate successfully, even where the modem was formerly unreliable. I am currently using a 270 ohm resistor for R41. This has been successful in all conditions encountered so far.
4. Nulling the line is quite touchy (1/4-turn on a ten-turn pot). This must be done with the optimal cap in C45-46 and takes quite a bit of fiddling to get right. It must be done with the line open, your modem in the transmit mode and preferably with nothing else on the line (dial tone or answer tone etc). The nulling is very empirical, starting with a 10n cap and substituting other values to determine best performance. All this is stated in the ETI text, but it is very brief and somewhat vague.
5. Reset pulses from IC1a (4001) were a little touchy. I made R6 and R7 10k to solve this (may be related to my chip set).
6. R48 goes to ground, not ve.

R48 to ground. Here is this portion of the circuit corrected.

Other suggestions:
(i) Don't build it unless you understand the theory of this circuit — completely.
(ii) Don't change the filter component values — you're missing the point of the design (see (i)).
(iii) Have a dual-trace CRO in your pocket. Debugging is hopeless without both this and the knowledge to understand the fault.
(iv) Tread carefully and carry a big circuit diagram.

— Richard White

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ETI November 1983 - 65
ETI-673 MICROBEE
MULTIPROM INTERFACE
This project allows extension of the Microbee's ROM capacity. It plugs into the Bee's 50-way expansion bus and can either be fitted inside or externally, giving 16 open-collector outputs and eight buffered inputs. Turns your microbee into a really versatile machine.

ETI-154A/B SOLID-STATE RELAYS
Two solid-state switches for remote control of mains-operated devices or appliances. These allow safe interfacing between a computer or other control equipment and mains equipment.

ETI-272 AUDIO POWER LEVEL INDICATOR
This is a simple project that employs three LEDs. To suit installation in the series 4000 or series 5000 amplifiers. This project is more useful than a simple clipping indicator (your ear is better at that!) and cheaper and easier to install than a bar graph level display.

ETI-672 MICROBEE TELETYPET TYPE INTERFACE
The "Clayton's" of printers is the old surplus teletype—such as the Model 15 etc. For around a tenth the price of a dot-matrix printer, you can have hard copy from your microbee using this simple interface.

ETI-153 TEMP. PROBE
$18.50
ETI Oct 83
This project uses a 10-LED bargraph display module to show audio level from -23dB to +6dB. It's simple to build and set up.

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

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$20.00
ETI Dec '83
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ETI-654 APPLE II ANALOGUE/DIGITAL INTERFACE
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ETI March '83
This project will give you Apple a set of 8-bit digital inputs and outputs plus one analogue input and one analogue output. Applications include: driving a robot, recording science experiment results, etc. (digital only shown).

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ETI Feb '83
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ETI-162 30 V/1 A FULLY PROTECTED POWER SUPPLY
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ETI Oct 83
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ETI Oct 83
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ETI-335 PUSHBUTTON-PROGRAMMABLE WIPER CONTROLLER
$28.50
ETI March '83
No more fiddling with knobs and not getting the delay between wipes that you want—this wiper controller is simply 'programmed' with two pushbuttons to provide the wrong delay you need.

ETI-461 GENERAL PURPOSE BALANCED INPUT PREAMP
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This project can be used as a balanced mic amp, with low impedance input, a low or high impedance input differential amplifier or a balanced input instrumentation amplifier.

ETI-733 RADIO/TELETYPET CONVERTER FOR THE MICROBEE
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ETI April '83
Have your computer print the latest news from the internet shortwave news service. Just hook up this project between your shortwave receiver's audio output and the Microcontroller's parallel port. A simple bit of software does the decoding. Can be hooked up to other computers too.
The Little Big Board

Part 2, options & operating notes

This article covers a number of options you can implement with the project plus additional notes on the system that might assist you.

Roger Harrison

FOR THOSE constructors who wish to start off with a 'stand alone' system, the STD buss interfacing may be left off, saving a few dollars, if you think it's worth it. All you have to do is leave out buss buffers U1, U2, U3 and U6, along with U4 and U30. If you later wish to implement the STD buss, just obtain the ICs and install them.

If the project is to be installed in a card cage, you'll need to allow a minimum of 15 mm clearance on the component side of the board. As STD buss sockets in a card cage are placed at 12.5 mm (1/2") intervals, insert the Little Big Board into slot 1 as this will give you plenty of clearance.

Alternatively, you could insert the board in any slot, provided you left the adjacent lower-numbered slot vacant (STD boards are inserted in a card cage system with the components to the left, facing the next lower-numbered slot).

Clock battery
There are two sizes available for the 3 V lithium back-up battery for the MSM5832 real-time clock. Both are made by Matsushita, one being 12 mm in diameter, the other 23 mm. October's cover photo shows the big one, the lead picture in the article shows the smaller of the two. By gently bending the leads back beneath the battery body, you can just get the pins in the board and solder them from the other side.

Disk doings
Part 1 did not clearly explain about 5 1/4" disk drives. The Little Big Board will drive 3 1/2" drives, but only those that are 8" look-alikes' having a 50-way connector, like the Mitsubishi M4854. No, you can't plug in the old MPI 5 1/4" drives you bought for your old System 80, now languishing at the boat mooring, without considerable mucking around. Like dropping the System Clock to 2 MHz, fiddling with the PLL constants in the Disk Controller and making some peculiar connector arrangement. Then there's the software. My advice is to cash them in and get a pair of new high density slimline drives. Jumpering details for the Mitsubishi M4854 are given in the User's Manual.

Low-cost terminal

A low-cost terminal
Now here we have some good news for you! By special arrangement between ETI and Applied Technology a special 'stand alone' low-cost terminal is being produced by Applied Technology, consisting of a 'stripped down' Microbee and called the "B-ETI" (Betty, if you like) derived from Bee — ETI. Well, if Apple can have their "Lisa", why can't we have our "Betty"? Costing only $275 on special introductory offer (see p 71). the B-ETI operates at 300 and 1200 baud transmission speeds, and in either half or full duplex mode, all software selectable.

It emulates the popular ADM-3A terminal format and most of the 'Televideo 912' format, making it simple to install in CPM systems as either of these formats can be chosen.

Interfacing the B-ETI

Interfacing is via the serial port at the rear and transmission employs eight data bits with one stop bit and no parity. This presents no problems to the Little Big Board. The B-ETI has an almost bare core board containing a 2K data buffer and a 2532 EPROM which provides all the control software, giving you six commands to select the mode of operation from the keyboard.
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- Functions of Monitor Eprom.
- Block diagram of L.B.B. operations.

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**ETI November 1983 - 69**
Commands are as follows:

**RESET** (held down for over three seconds)
- Resets B-ETI to accept next command.

**ESC**
- The escape key ‘rubs out’ a particular command to enable another to be entered.

**Type T (CR)**
- This will set the B-ETI into a terminal programmed for 300 baud FULL DUPLEX transmission.

**Type TH (CR)**
- This will set the B-ETI to output at 300 baud programmed for HALF DUPLEX transmission.

**Type U (CR)**
- This will set the B-ETI to output at 1200 baud FULL DUPLEX transmission.

**TYPE UH (CR)**
- This will set the B-ETI to output at 1200 baud HALF DUPLEX operation.

The B-ETI requires 12 Vdc at around 700 mA. The video output can be plugged directly into one of the low-cost monitors currently available for less than $200. Thus you can have a complete serial terminal for under $500! Many of these low-cost monitors have a 12 Vdc output socket which can power the B-ETI directly.

The screen format is the standard 80 characters wide by 24 lines, with upper and lower case characters supported. Each character key, and the space bar, auto-repeats if held down longer than about one second. I have tried a converted monochrome TV set as a monitor, and the characters are still quite readable, though not as crisp as when a proper wideband monitor is used.

At 1200 baud transmission speed, a complete screen refresh is noticeably slow, but then hobbyists don’t work to deadlines where every second counts and it’s an acceptable trade-off for the price. (Maybe some cunning and resourceful hobbyist will figure out a mod. to make a B-ETI’s skirts fly?)

What’s more, the B-ETI has more applications than as a straight serial terminal for the Little Big Board. Like, as part of a radioteletype system in an amateur radio station.

In case you’re wondering — yes, we’re planning some projects around the B-ETI. Stay on-line, folks.

---

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**ETI**

November 1983
EXCLUSIVE ETI READER OFFER

THE “B-ETI” LOW-COST SERIAL TERMINAL

By special arrangement between ETI magazine and Applied Technology, makers of the famous Microbee personal computer, we introduce the B-ETI serial terminal.

Essentially, the B-ETI makes a low-cost “glass teletype.” It consists of a ‘stripped-down’ Microbee. It operates at 300 & 1200 baud transmission speeds in either half duplex or full duplex modes. The B-ETI emulates the popular ADM-3A terminal format and most of the ‘Televideo 912’ format. This makes it simple to install in CP/M systems as either of these formats can be chosen. Transmission uses eight data bits with one stop bit and no parity. Interfacing is via the serial port on the rear.

The B-ETI has dozens of applications with computer, and computer-related, project and equipment. It is ideal as a low-cost terminal for the ETI-690 Little Big Board computer published in the October ’83 issue of ETI for example, or as part of a radioteletype system in an amateur radio station.

The screen format is 80 characters wide by 24 lines. Upper and lower case characters are available and each character key auto-repeats if held down longer than one second.

The video output can be plugged directly into one of the low-cost monitors currently available. Many of these have a 12 Vdc output socket which can power the B-ETI directly. Alternatively, it can be powered from any suitable 12 V dc source capable of supplying 700 mA. A power pack is not included. As the low-cost monitors available are generally priced around $200 or less, you can have a complete serial terminal for less than $500!

This is an introductory offer.

The B-ETI serial terminal has not yet been offered for sale through retail stores. When it is, it is expected to sell in the $330-$340 range so you save around 20-25% by taking advantage of this offer.

This offer is made by Applied Technology Pty Ltd (Incorporated in NSW) in cooperation with ETI magazine and ETI is acting as a clearing house for orders. All orders will be despatched by road freight for $10, insurance included, anywhere in Australia. While deliveries will be generally ex-stock, please allow up to four weeks for delivery to cover order processing and any delays that may occur.

INTRODUCTORY PRICE

90 DAY WARRANTY

The B-ETI is manufactured especially for ETI readers by Applied Technology and a full 90-day warranty is available as well as normal backup service.

APPLICATIONS

- low-cost computer terminal.
- Use with ETI-690 Little Big Board.
- use with modem as remote computer terminal.
- use with radioteletype (RTTY) converter/modulator in amateur radio station.

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- powered from 12Vdc supply.
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- 80 characters x 24 lines screen format.
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31 DECEMBER 1983

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This machine original. After Knock off the software. great blocks change Programmable Generator. displays using Anyone who hasn't bothered with this game, should. at lesson. educational action. Too hard double games, of games, going games should teach you Microbee you? You Tas Tom Moffat, MICROBEE SOFTWARE bit most clever, and most addictive. These programs produced interesting screen displays using hi-res and lo-res graphics, and occasionally the Programmable Character Generator. But they didn't get up and move, like arcade games. Today's crop sure do. The 'new wave' of Microbee games use completely non-traditional programming methods. Without going into it too deeply, the new software is almost always in machine code. Much of the visual impact relies on manipulation of the Programmable Character Generator, or PCG. You can write the PCG version of the letter 'A', for instance. In many places on the screen. If you then change the PCG version of 'A' to something else, every occurrence of 'A' already on the screen will change as well. If you do this at machine code speeds, the action on the screen really flies. There are a few other tricks, like fiddling the programming of the VDU controller chip and using the Z-80's automated Instructions to quickly move great blocks of data round. The people who write these programs must eat, sleep, and talk in binary. But they sure get the results.

Now for an overview of some of the 'new' Microbee software. It's all been 'kid-tested' and some of the descriptions of objects on the screen will be their words, not mine.

Microspace Invaders

Knock off the 'micro' part and you'll know what this game is all about. It's every bit as good as the original. After a long session playing this game I immediately tried a commercial arcade version, and found it somewhat sluggish. Maybe the machine was a bit sick, someone had stuck a sign on it saying "This machine is a rip-off".

The screen display on the Microbee is shown in Figure 1. You have four cannon, like the one directly above the score '20'. You can move it back and forth with the < and > keys, and fire with the space bar. Meanwhile the wave of Invaders moves back and forth, slowly descending, as you launch rockets at them. The fourth one in the bottom row in the picture has just popped a rocket and it's exploding.

The invaders attack by dropping 'squiggly bombs', two of which show in the picture. The bombs eat away at your 'forts' and will blow up your cannon. From time to time a large UFO bleeds its way across the top of the screen. Hitting this big one gives between 100 and 400 extra points. Any hit generates a sound effect that suggests that the computer has gas. Loss of a cannon is heralded by a few bars of a funeral march.

Winning strategy — hide under a fort, shooting your rockets up its side. This way only half your cannon is exposed to the squiggly bombs. You can shoot the bombs as well as the invaders, but if disaster is close duck completely behind the fort and then come out shooting. Any 'big ones' should be attacked, if at all possible.

Asteroids Plus

Another Microbee Implementation of a popular arcade game. This one doesn't look like much in freeze-frame (see Figure 2), its attraction comes from its movement and sound.

You have a starship, the black object in the centre of the screen. You can spin it around, and fire a continuous stream of missiles (the dots). Your targets are geometric shapes such as cubes and diamonds that spin their way across the screen. When you hit one they explode in a most satisfying way, but they re-form into other shapes.

The picture shows one blowing apart just before it re-forms. If an object hits your starship it explodes into a shower of debris that nearly fills the screen.

Demolished objects sometimes form other objects with a particularly nasty disposition; space fish for instance. These will actively hunt you down, and they sometimes turn into guided missiles against which there is no defence.

If threatened by collision you can energize a shield can keep rolling. When the object has passed you drop the shield and shoot. But guided missiles just lean up against the shield, waiting to blow you to Kingdom Come when it falls.

The only way to avoid a guided missile is to accelerate your ship out of the way. Even then the missile will chase you, and a moving ship is almost impossible to control.

You control the object is the 'fizzy-whizzy', a spiral-shaped thing that swoops onto the screen, intent on collision. Its presence is signalled by a sizzling noise from the speaker. Sometimes a big 'A' will appear, then launch a 'football bomb' as it passes. You must first shoot the fizzy-whizzy and the football bomb, as well as the other objects, before they get you.

As you can imagine, this game is loaded with action. But, unfortunately, as more stuff appears on the screen, the game slows. There's just too much material to move around quickly. Still, it's a ripper of a game.

Winning strategy beginners will first discover the "garden sprinkler" technique, in which you rotate continuously while spraying shots. You'll randomly knock out a lot of objects this way.

For really good scores, be sure you go to the top first, and have everything you need at the ready. Your mission is simply to outlast the game. Play conservatively. Use your shield as an object approaches you, and then shoot it in the back as it retreats.

Destroy one object completely, before starting on another one. This keeps space fish and guided missiles in a square, blowing up a fizzy-whizzy until the last moment. It may launch a football bomb, and you'll then get the score for both the football bomb and the fizzy-whizzy (If you don't blow it up, that is)

Good play on your part, particularly among fizzy-whizzles and football bombs, sometimes results in extra spaceships being awarded. So you can build up the scores until you physically run out of steam.

Robot Man

A Microbee version of PacMan, and just as good. See Figures 3 and 4. There isn't quite as much variety as in some of the space games, but you need lightning reflexes to do any good in Robot Man.

You control the little round fellow who goes through the maze, chomping the dots. The two baddies in the centre cage soon emerge, intent on chomping your little round fellow. But if you chomp a square, the baddies turn to apples (why apples, I wonder) and for a few moves you chop them. If all the dots are gone, and you've still got men who are un-chomped, you get a new maze full of dots and squares. But you also get three baddies instead of two.

You'll notice this game provides a shade of grey on the screen, as well as black and white. And rumour has it that Robot Man will give a colour display on a colour Microbe. It will be interesting to find out how it does it.

Winning strategy long hours of practise.
Undaunted, I called in a neighbor who has a lot of chess experience, especially against computers. He told me of the general characteristics of the game, how computers were 'materialistic' and didn't consider the full implications of moves. He hinted that the Microbee would be a pushover, but decided to play at its Level 1 (out of 6), just to put it out of its misery quickly.

About an hour later he began to mumble about it playing 'not a bad game'. An hour after that, with sweat on his brow, he finally trapped the Microbee into a checkmate. It resigned by laying its king on its side, in the accepted fashion. Had the Microbee won somehow, I don't think the fellow would be speaking to me any more.

Winning strategy asks Boris Spassky.

Eliza

No picture, as there's nothing to see. No graphics. But this program I am a real mind-bender anyway. It's one of the first simulations of artificial intelligence, although it doesn't seem all that artificial.

Eliza is simply a question and answer session. Eliza is a psychotherapist. You are mentally disturbed. (If you're not, you may be after running this program.) The program is mostly a collection of questions which are selected to follow on from key words in your previous answers. The subject is heavy... your childhood, sex, life, death, the universe. The questions can look general, but they may be designed to probe your deepest secrets.

It's all meant to be good fun, but the story is still going around about the scientist in America who had Eliza running in a mainframe system. When he turned his secretary loose on it she started telling it things she would never admit to her closest friend. The Microbee version of Eliza, being smaller, isn't quite as 'heavy' as the big version. But it will still provide some startling moments.

Winning strategy: You can't win, you know the computer is out to get you.

About the pictures

The pictures in this article were produced on a C-Itoh 8510 printer in the graphics mode. They are an exact reproduction of the screen, although the blacks and whites are reversed. The 'screen dump' routine was inserted in the programs usually in place of some sound effect, so as to catch the screen in mid-explosion. If anyone wants a copy of the 'screen dump' program for the C-Itoh 8510 printer, send $8 to the author for a post-paid cassette.

OPERATE OUTPUT AT 110 BAUD

Gary Hegedus, Greensborough, Vlc.

It's fairly easy to get your hands on a cheap teletype machine which is good news for home computerists who want to produce hard copy without going to a lot of expense.

However, many of these machines run at 110 baud which is not a standard speed on older (pre Microbee ICs) Microbees.

OPERATE OUTPUT AT 110 BAUD

```
0100 REM PROGRAM TO OPERATE OUTPUT AT 110 BAUD
0110 REM TYPE OUT#40! AFTER RUNNING PROGRAM
0120 REM PROGRAM BY GARY HEGEDUS = GEOFF TAURINS
0130 FOR Y=416 TO 486
0140 READ D
0150 POKE X,Y
0160 NEXT X
0170 END
0180 OUT(4,71)
0190 DATA 197, 245, 219, 2, 283, 275, 40, 256, 240, 183, 285, 199, 1, 6
0200 DATA 15, 295, 198, 1, 16, 258, 53, 285, 198, 1, 285, 198, 1, 193
0210 DATA 201, 245, 197, 219, 2, 283, 173, 48, 2, 283, 239, 211, 2, 239
0220 DATA 197, 213, 197, 193, 197, 193, 16, 245, 193, 241, 281, 33, 160
0230 DATA 1, 34, 195, 8, 33, 160, 1, 34, 188, 8, 195, 33, 128, 8
```

CALENDAR MODIFICATION

Jim Lawrence, Ravensthorpe, WA

This modification is to Noel Bailey's program 'Calendar' which appeared in ETI September 1983 on page 68.

I believe that leap years are years divisible by four, or by 400 if the beginning of a century (i.e.: ending in 00). The program works well for normal leap years but refused to recognize 2000 as a leap year.

CALENDAR MODIFICATION

```
00670 PRINT TAB(11); "NOVEMBER"; TAB(45); "DECEMBER"; RETURN
00680 IF Y-Y400'400=0 THEN 720
00690 IF Y-Y4'4=0 THEN 710
00700 L=0: GO TO 730
00710 IF Y-Y100'100=0 THEN 700 ELSE 720
00720 L=1: REM L=1 FOR LEAP YEARS ELSE L=0
00730 FOR M=2 TO 12
```

My modification to the program solves the problem, even if it is not particularly elegant.

Lines 650 — 710 have been renumbered so that they are now 670-730. I also changed the start of the printout instruction from line 160 to line 205 to avoid printing the input.
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มหาชน
Peter Kainzay has won the VIC-20 expansion board this month. In this bloodthirsty game you must kill or be killed; a fight for survival. Not for the fainthearted.

Peter Kainzay, Bendigo, Vic.

The object of the game is to avoid and kill numbers of droids, and do the same thing to the other player as well, to become the highest scorer or survivor.

If you find during the game that the screen turns to garbage (this happens rarely), delete the REMs and rerun.
ALARM CLOCK

This simply lets you use the VIC's internal clock as an alarm clock. It is a 24-hour alarm clock with two alarms and facilities to be able to control up to 128 devices using the clock and the user I/O port.

ALARM CLOCK

Mark Smith, Laverton Vic.

MAZE CHASE

You must think and act quickly to score any points in this game.

MAZE CHASE

Mark Smith, Laverton Vic.
AIR BATTLE

Gordon Maxim, East Devonport, Tasmania

This game uses programmable characters, colour and sound effects. The aim is to shoot down as many aeroplanes and helicopters as you can in a two minute period. This is done by placing the sights over your target and pressing the fire button on the joystick (or pressing the space bar). You keep the sights over the target until the missile, which first appears at the base of the screen, reaches the target.

Both sights and missile must be on the target at the same time to score. The game is controlled by either joystick or keyboard.

The actual listing contains as much program as can be used with the unexpanded VIC, and after running it there are only ten bytes free.

Spaces have been left out of the listing to speed things up and to allow more room for the program. There are several characters inside quotes in the listing which some VIC owners may not have seen before. In line 13 a reversed backslash which means a "shifted carriage return", to enter it leave a space where it should be when entering the line, then move the cursor to that space, type CTRL/RVS ON, then a "shifted M".

In line 20 are two characters which are obtained by typing F7 and F1 respectively, after entering a quote. Some of the lines have more than the allowable 88 characters and must be entered by using abbreviations mentioned in Appendix D of the manual.
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November 1983 ETI  

84
POLARIS II
Tim Parish, Myrtle Bank SA

This is a revamped version of Polaris which appeared in ETI April '83. The game is now in colour, has sound effects and is considerably more challenging than the old Polaris because the submarine moves at half the original speed. The scoring is now five points per plane hit, otherwise a three digit score would be impossible. Also the depth marker does not move so high, to allow for the slower submarine speed.

The colour routines (ETI April '82) have been moved so that they end at 08ff instead of 07ff. Also, the Chip-8 colour routine, which starts at 0868 here, has been modified since V0, V1 and V2 have the right values before it is called up.

To load the program, first load the colour routines so that they end at 08ff, then type in the program as listed, which will over-write some of the colour routines code.

Finally, change the byte at 08d2 to 08 and the byte at 08d5 to d5. Then you're ready to dodge the torpedoes and depth charges.

POLARIS II

LUNAR BLITZ
Peter Easdown, Kew NSW

You are the last fighter pilot in your squadron and your mission is to fly as far as possible across the lunar surface to bomb the enemy's bomb stores. You must do this as often as possible, but watch out, the enemy's mad butterfly seeks to destroy you.

In this game you direct a fighter-class attack craft across the screen, dodging the lunar landscape which rolls across the bottom of the screen and the mad butterfly which continues to move across the screen above the lunar surface.

Your craft is heavily armed with forward-firing lasers and is highly explosive.

The aim of the game is to last as long as possible and to shoot the butterfly and to bomb the bomb stores.

When you first run this program it will display a heading, then the letters 'A' and 'F' in brackets. By pressing 'F' you will return to the monitor; pressing 'A' will start a new game.

Down at the bottom of the screen you will see the butterfly and the numeral '5'; if you shoot the butterfly you will get 5 points. (Bombs don't work on the butterfly.)

Also at the bottom of the screen is a portion of the lunar surface with the number '10'. If you drop a bomb directly into this hole you will get '10' points. Warning, you only have 10 bombs, once you run out, you must land in the crater that you started in to replenish your supplies.

Your death can be brought about in three possible ways. You crash into the lunar surface; you crash into the butterfly; you are shot by the ground defence systems.

Upon your death your score will be shown.

To play Lunar Blitz use these keys:

- 4 — brake; 5 — bomb drop; 6 — laser fire; 7 — move up; 9 — move down

LUNAR BLITZ

POLARIS

BOMBS AWAY

Robert Curtis, Auckland NZ

I am 14 years old and a student at Macleans College in Auckland. Last year I built myself an ETI-660 and have had a great deal of fun in programming it.

When you run this program you will see a craft at the top of the screen, a rocket at the bottom of the screen, and a row of meteors halfway down in a horizontal line.

The aim of the game is to move the top craft down the screen, dodging the meteors and hitting the bottom rocket.

Key 5 starts your craft moving

Key 4 moves your craft diagonally left

Key 6 moves your craft diagonally right

You score five points for each successful hit. You are allowed to hit two meteors before the game ends, but the first time you miss the rocket will be the last time!!
ALTERNATIVE BLOCK PUZZLE

This is an alternative version of the 14-15, or moving block puzzle, published in ETI November 1982 in the Chip 8 poipourri on page 92.

The puzzle was originally designed by Sam Lloyd early last century and he offered a $100 reward to anyone who could solve the problem in the form that you presented.

To make it solvable you must originally set the blocks up in the correct order, with the blank at the end, and the following program does this. Hopefully this will go some way towards relieving the frustrations of other Chip 8 hackers.

I have also adapted the program for our school computers (we use the Polycorp machines) and it has been very well received.

ALTERNATIVE BLOCK PUZZLE

0600 6A12 6B01 6110 6200 6001 A6B4 D127 F029
0610 3010 DAB5 7106 7A08 3130 1624 6110 7208
0620 6A12 7808 A700 F01E 3010 1636 8300 6010
0630 F055 8030 1638 F055 7001 3011 160A 6A2A
0640 6B19 6C10 62FF C006 7002 2658 72FF 3200
0650 1646 F00A 2658 1652 84A0 8580 8800 3600

IAGO FOR TWO UPDATED

This is a modification of the Iago for Two program which was designed by Frank Rees and published in ETI in February 83.

This version draws the board in the middle of the screen, has sound effects and numbered co-ordinates which it makes all that much more interesting to play.

Key 0 concede a move/change position.

PAMAK PROBLEMS?

This program ran the first time we tried it, but it would not reset and run again.

Bill Kreykes, who designed this program, rechecked a photocopy of the listing he sent us and claims that there were no errors.

He also gave a photocopy of the same listing to two 860 owners to check the program and they found the game to be faultless. The only suggestion is that you again check the data entered, although you have probably already done this a few times.

The program does not run the problem could be with the MCSR at 0934. This segment of the program can be used instead of the MCSR. Change the data at 0902 to 2800.

0820 3A02 1B04 000E

The MCSR gets the high of register 3 and register 6 (0F and 04) to effect the transfer of the screen from 0988 to 0488 onwards.

You must make sure that the data from 0988 onwards is as shown because if the Pakman's home is not as it was after the program could default after the screen comes up and a Pakman is placed in the home.

At this stage the Pakman was placed over a foreign object, VF would be equal to 01 and the program would keep on calling subroutines until the scratch pad RAM was fully taxed. This would cause a lot of problems with the data changes throughout the program.

NOTES AND ERRATA

'660 Software, July '83, page 53. An artistic cut was made to the last line of the Memory Display Utilty program. The last line of O680 should be 7A00 AF4A F055 000E. Then it will work.

'660 Software, August '83, page 68. In the Gobble program there were a few blurred spots. Check that you typed in the correct information at these addresses.
8EE 2E46; B64 A97D; D54 000E; D36 000E; E50 1E20.
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<th>Frequency</th>
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<td>Y 1030</td>
<td>16.0000 mHz</td>
<td>$5.00</td>
<td>$4.50</td>
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<td>83 x 54 x 28</td>
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<td>47</td>
<td>$1.20</td>
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In anybody's language that's big. Buoyed up by the industry trend to slimline drives, MPI are delivering both push-button and twist-lock half-height 5¼" drives as well as staunchly supporting their full sized units.

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Specializing in 5¼" standard and half-height drives to the ST416 interface, Miniscribe have carved out a reputation for reliable 5, 10 and 20 Mbyte drives at reasonable prices. Daneva Australia now backs the Miniscribe line with their years of mass storage experience.

Miniscribe recently announced that they have successfully negotiated a deal making them a preferred supplier on the IBM PC Programme.

WHISPERING GALLERY.

PSST! 3.3 Mbytes on a half-height 5¼" floppy? Look out for this one early in '84. Incidentally we've heard that the same drive will read standard 48 and 96 TPI media.

A double-sided 3" micro floppy is in the works. Following an agreement between the big three proposers of the 3" standard a US manufacturer is well on the way to launching their own version. We should see product in Australia soon.
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ZX COLUMN

COMPUTER PICTURES

Matthew Rees, Boort, Vic.

You may have seen computer or type written pictures which are made by a build-up of small plotted points on various characters. Well this program enables you, by using the graphics, to do this with your ZX81. (See Figure 1)

Figure 2 shows how a very basic figure is set up to be plotted. You will notice the spaces and points are numbered across from left to right. The 'Z' at the end of each line is used to signify just that, the end of each line.

The program works by taking one character at a time from the AS (good example of using the slicing of strings in the ZX81 for data) and after conversion, uses this to plot points and spaces. Not use of compact screen data, not every point on the screen has to be separately accounted for.

Looking at the AS you will see that not only numbers, but also letters are used. What I have done is assigned the numerical values of 0 to 9 and A to Z. This was achieved by using the code of the character less 28. (See Appendix A, page 181-182 for ZX81 basic programming.)

This range of numbers could be expanded if required, e.g. first plot of a line is now 35 or less, by including, say, from ( )- code 11 to ( )- code 27. You could extend this range from zero to 52.

X = horizontal position on axis.
Y = Vertical position on axis.
T = string pointer (advanced).

ZX81 USER'S HANDBOOK — REVIEWED

P. Moxom


The Sinclair ZX81 has been at the centre of much software and hardware development since its release in the UK. One of its by-products has been the sale of ZX81-related books.

One friend (T) commented on the ZX81. 'Those smaller, plastic-cased computers are great for lifting tacks off drawing boards - you can use the tip of the pop-art case.' Being the owner of a ZX81, the comment did not go down too well.

The ZX User's Handbook is designed for those '81 users who want questions answered about their pride and joy. The book is not meant to be read from cover to cover as some of the information is almost direct from the ZX81 manual supplied with the '81. But as a reference guide it is quite good.

The book starts off by assuming no knowledge of keyboard entry on an '81. It explains fully how to obtain any '81 command quickly and without hassle. The book then goes on to explain the use of binary, decimal and hexadecimal number systems and also how they are used within a computer.

Sometimes the book loses you in mathematical paraphernalia. The writers seem to have been caught up in the thrill of writing a book on technical details for the ZX, and in so doing have lost themselves in the process.

The most difficult part of the book is to follow the explanation of the computer logic circuits and electronic gates. The book assumes that you have done a course in electronics and just need to brush-up on the information.

The book is full of interesting small programs that will fit into the standard 1K machine. The explanation of graphics is good and the programs in that section are entertaining, to say the least.

There are programs such as binary-to-hex conversions and back again. Most programs have a section at the end giving hints on how to make the program run faster.

The best part of the book is its indepth explanation of machine code programming.

Another good thing about the book is its comprehensive glossary of terms which covers six and a half pages. A good index which follows the glossary has a list of all functions available from the keyboard.

The book is expensive at $15 but is a must for all serious experimenters and '81 fanatics.

SPEED COMPARISON PROGRAM FOR ZX 80 (OLD ROM)

J. L. Elkehorn, Chigwell Tas

This interesting little program graphically demonstrates the efficiency of machine code routines. It allows the user to fill the screen with a random character, either in slow BASIC mode or fast machine code mode.

A BASIC listing is supplied, along with an assembly listing of the machine code routine, so that the user can analyse the approach used. The program occupies about 2K, including the screen display.

BOGART

Matthew Rees, Boort, Vic.

This program draws a picture of Humphrey Bogart.
SPEED COMPARISON PROGRAM FOR ZX80 (OLD ROM)

BASIC Listing

1 REM BASIC VS. MACHINE CODE
2 REM SPEED CONVERSION
3 REM FULL SCREEN VERSION
10 DIM A (255)
15 LET M = 18500
20 LET C = M
60 FOR L = 1 TO 20
70 PRINT ....
80 PRINT
90 NEXT L
95 GO SUB 3000
100 LET MS = "FDE5DD2AOA40017F0360
D7E0FF7E620040BD318F53A1E40E656FD
D7F0B0D2578FD020E5FF1C9"
130 LET H = CODE (MS)
140 LET L = CODE (MS)
150 LET B = 16 * (H - 28) + L - 28
170 POKE C, B
180 IF B = 201 THEN GO TO 1000
190 LET C = C + 1
195 LET MS = TLS (MS)
200 GO TO 130
1000 LET X = USR (M)
1030 INPUT I*
1040 IF I = "S" THEN STOP
1050 IF I = "B" THEN GO TO 2000
1070 GOTO 1060
2000 CLS
2005 LET BS = CHR$ (RAND (64))
2010 FOR I = 1 TO 20
2020 FOR L = 1 TO 32
2030 PRINT BS;
2040 NEXT L
2050 PRINT
2060 NEXT I
2070 PRINT
2080 GO SUB 3000
2090 GO TO 1020
3000 REM PROPRG
3010 PRINT "ENTER B FOR BASIC GENERATION"
3020 PRINT "L/F FOR MACHINE CODE GENERATION"
3030 RETURN

Assembly Listing

RANLD FDE5 PUSH IY  \ Save it
D02A 0A40 LD IX. (nn)
01 7F03 LD BC, nn

LOOKY D07E 00 LD A, (IX + O)
FE 76 CP, J18  \ Look for newline
20 04 JR NZ  \ To put
D023 INC IX  \ Bump it
10 F5 JR, LOOKY  \ Go again

PUT 3A 1E40 LD A, (nn)  \ Get character
E5 EF AND A, 191  \ Mask for valid
D077 00 LD (IX + O), A  \ To screen
08 DEC BC  \ Countdown
D023 INC IX  \ Next screen position
78 LD A, R
FE 00 CP, 0  \ Finished?
20 05 JR NZ, LOOKY  \ Do more
FDE1 POP 1Y  \ Restore it
C9 RET  \ Back to BASIC

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NEW LOW-COST DMMs
FROM FLUKE FEATURE BARGRAPH

John Fluke Manufacturing has introduced a new family of handheld multimeters, the Fluke 70 series, manufactured in the USA. These small, 3½-digit instruments offer rugged design, quality construction and, for the first time in handheld multimeters, both digital and analogue displays.

A 32-segment analogue bar graph gives trend indications at a glance for peaking and nulling measurements or a quick continuity check.

Designed to appeal to a broader consumer group than Fluke traditionally addresses, the new series simplifies operation to a single eight-position switch for functional selection.

The meters can make instant range selections automatically with a high-speed autoranging circuit. Each unit is backed by a three-year warranty.

The series includes three models, all featuring basic measurement functions (ac and dc voltage and current, as well as resistance) with dc accuracy ranging from 0.7% for the basic Fluke 73 to 0.3% for the Fluke 77.

The Fluke 75 has autoranged millamps, a choice of manual or autorange operation and a continuity beeper.

The deluxe, full-feature Fluke 77 has a touch-hold function which frees the user to concentrate on the test points without watching the display. It automatically beeps when it detects a stable reading, then holds the reading until the user selects new test points or the meter determines a new stable reading.

The meters help conserve battery life with a unique 'sleep' mode to automatically power down the meter after one hour of non-use should it be left on accidentally.

The Fluke 70 series is priced from $110 plus tax. For further information, contact Elemeasco Instruments, 15 McDonald Street, Milsons Point NSW 2137. (02) 736-2888.

LONG-LIFE ELECTRONIC PRESSURE SWITCH

Copal Electronics’ new PS Series pressure switch incorporates a semi-conductor pressure transducer and electronic hybrid circuitry.

Unlike conventional mechanical types using a bellow, bourbon tube of piston as a pressure-sensing element, the PS pressure switch has no mechanical moving parts, which helps to ensure high reliability and long life — up to 100 million pressure cycles.

There are two PS models, the PS3, intended for use in relatively low pressure ranges in pneumatic robotics and automatic machines, and the PS5, mainly for liquids and for a pressure range of 46-1035 kPa.

For further details, contact Mayer Krieger and Company, 246-248 Angas Street, Adelaide SA 5000. (08) 223-6766.

ETI November 1983 — 97
EPROM-BASED ENERGY RECORDERS

The Measuring and Control Equipment Company has released two new solid-state wind and solar energy recorders.

The Mace DFR78-WND wind recorder and the Mace DFR78-SOL solar recorder use EPROM as the data-recording medium. Both are designed to operate in remote areas under harsh conditions and are capable of operating for several months without attention.

DFR78-WND records from an anemometer and wind vane to log information on wind run and direction or wind velocity.

DFR78-SOL operates from a Kipp and Zonen pyranometer solarimeter to record global solar radiation. The solarimeter output is directly connected to the recorder, which has a very low drift dc instrumentation amplifier that feeds a precision voltage-to-frequency converter.

The frequency output is counted in a register to obtain integrated incident radiation reading which is logged by the recorder at predetermined time intervals.

For further information, contact the Measuring and Control Equipment Company, 2A Chester Street, Epping NSW 2121. (02)86-4860.
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Daneva has introduced the Sharp LM-48001G liquid crystal display unit with an 80-character 16-line display capability.

The LM-48001G features 237 x 70.5 mm wide viewing area and 480 x 126 full dots, making it possible to display 16 lines of 80 characters each. It can also display graphics, pattern, dimensions and other output information. The wide viewing angle and high contrast display is due to the use of a newly developed LCD suitable for high duty drive (1/64 duty) and wide cell area design based on high-precision alignment film and cell gap control technology. The unit boasts low power consumption and is suitable for a wide variety of applications including portable personal computers, office automation equipment, automotive instruments, telephone and radio communication terminals and medical equipment.

For further information, contact Daneva Australia Pty Ltd, 66 Bay Road, Sandringham Vic. 3191. (03)598-5622.

NEW PC-MOUNT TRANNIES

Selectronics, manufacturer of a wide range of transformers and wound components, has released details of new 6 VA, 15 VA and 20 VA printed circuit board mounted transformers.

Designed and manufactured in Australia, the PCB mounted units conform to AS126 and are competitively priced for short runs (e.g.: 100 off) as well as large volume runs.

For further information, contact Selectronic Components Pty Ltd, 25 Holloway Drive, Baywater Vic. 3153. (03)762-4822.

NEW PUSHBUTTONS

MEC, a Danish manufacturer of rotary and pushbutton switches, has recently launched the multipurpose Unimec pushbutton range.

There are two versions — a momentary and an alternate key action — each containing all the necessary contacts to provide five contact functions. The functions are: c/o contacts, two make contacts, two break contacts, two make-and-break contacts and reverse polarity.

AEGIS LINE FILTER

Aegis Pty Ltd has released a printed-circuit board mounted 240 V mains line conditioner called the Calleda CZ5053. The unit operates at up to three amps, 50/60 Hz and offers a fast and efficient way of isolating sensitive equipment from mains derived radio frequency interference and troublesome spikes and transients.

The unit is designed for easy assembly into electronic equipment at the construction stage. It measures 88 mm x 41 mm, is 30 mm in overall height and weighs 90g.

For further information, contact Aegis Pty Ltd, 141 Christmas Street, Fairfield Vic. 3078. (03)481-1422.

LOW-POWER 3½ DIGIT DVM IC

The Teledyne TSC7126, an improved version of the Intersil 7106 single-chip 3½ digit DVM integrated circuit, has been introduced to Australia by Promark Electronics.

The 7126 boasts the exceptionally low power drain of 50 μA typical from a single 9 V battery and directly drives an LCD display. This auto-zero, auto-polarity converter features 1 pA input current and on-chip clock and voltage reference. In addition, the differential input allows measurement of load cells, strain gauges and other bridge-type transducers.

The 7126 can be used as a plug-in replacement for the 7106, changing only the values of the seven passive components.

For further information, contact Promark Electronics, Suite 102, 6-8 Clarke Street, Crow's Nest NSW 2065. (02)439-6477.

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PROGRAMMED SOCKET AIDS PC LAYOUTS

The new Aprotics programmed socket allows integrated circuits with different pins to be used with existing pc layouts. The new socket eliminates the inconvenience encountered when it is necessary to match a functionally correct second source IC device which has a pinout design that does not match circuit board layout. The unit is 4.5 mm high and is made with reliable double-sided selective gold contacts, with closed entry for simplified IC insertion.

For further information, contact Rifa, 202 Bell Street, Preston Vic. 3082. (03)480-1211.

PULS EIGHT TRANSFORMER

An Australian-designed and manufactured low-profile, high-power transformer range has been introduced by Puls Eight Electronics.

For OEM or Retrofit audio and general applications, the PST 550 range features a low, 80 mm profile. 550 W rating, high energy-volume ratio and low stray-flux radiation. The range is vacuum-impregnated, and has high temperature bakeout and insulation.

For more details, contact Puls Eight Electronics, 85 Prince's Highway, Beaconsfield Vic. 3807. (03)707-1632.

RIGHT-ANGLE LAMPS FOR EASY MOUNTING OF LEDS

Now available from Hewlett-Packard is a series of industry-standard, right-angle LED indicators. They are T-1 3/4, LED lamps assembled in black plastic housings that orientate the LED at a right angle to the printed-circuit board. Called the HLMP-5000 series, the right-angle lamps are designed to be used as back-panel diagnostic indicators and printed-circuit board logic-status indicators.

There is a colour choice of high-efficiency red (HER), standard red, yellow and high-performance green, with or without a current-limiting resistor at competitive prices. The compact, black-plastic design allows flush seating on the pc board and may be end-stacked on 6.35 mm centres.

For more details, contact Hewlett-Packard Australia, 31-41 Joseph Street, Blackburn Vic. 3130. (03) 890-6351.

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104 - November 1983 ETI
Surface acoustic wave (SAW) devices have been used for the last decade in professional and military equipment and are now beginning to be found in consumer electronic products. In these articles the basic physics of SAW devices are explained and some important current applications of the technology are examined.

Part 1

IN 1887 Lord Rayleigh, the great pioneer of modern acoustics, showed that a unique mode of wave propagation can exist at the surface of an elastic solid. This Rayleigh or surface, mode wave has four important characteristics:

1. The wave has a longitudinal component (solid displacement parallel to the direction of propagation) and a transverse component (displacement perpendicular to the propagation direction) each 90° out of phase. This gives rise to a backward elliptical motion of solid elements at the surface (Figure 1a). The amplitude of both wave components falls rapidly within the solid, confining the wave to within one or two wavelengths of the surface. The wave generates an oscillation of the surface as shown in Figure 1b.

2. The wave velocity of propagation is of the order of 1500-4000 metres per second for most materials and is thus about 100,000 times as slow as electromagnetic wave velocities. The SAW wavelength is reduced by this factor, allowing a physically small length of solid to contain a great number of wavelengths.

3. The propagating wave suffers little attenuation (less than 1 dB/cm for commonly used materials at wave frequencies of hundreds of megahertz).

4. The wave mode is essentially non-dispersive i.e.: waves of different frequencies propagate with the same velocity.

The usefulness of SAW technology in electronics arises because it is possible to convert radio frequency electrical signals (over the range extending from a few megahertz to about one gigahertz) to surface acoustic waves and then back to electrical signals in a fairly efficient transduction process.

P. J. Hall
Physics Department, University of Tasmania

Figure 1(a). Motion of solid elements in an isotropic solid due to the propagation of a surface wave. Similar disturbances occur along axes of high symmetry in the anisotropic crystalline solids used for SAW device substrates.

Figure 1(b). Oscillations in a vertical plane through a solid. Note the surface oscillations.
A mechanism for achieving this is shown in Figure 2. Using standard microelectronic fabrication techniques a metal interdigital transducer (IDT) is deposited on a piezo-electric crystalline substrate, usually quartz or lithium niobate. Although complex in detail the basic IDT operation is fairly easy to understand.

The electrical input signal is applied in such a way as to ensure that, at any instant, the charge on neighboring IDT 'fingers' alternates in sign. The resultant electric field between the fingers leads to a mechanical stress in the piezo-electric solid and surface acoustic waves are launched in both directions. For maximum efficiency the physical spacing of the IDT fingers ought to be one half of an acoustic wavelength at the input frequency.

Wideband transducers can be designed by optimising the electrical and acoustic loads on the IDT. The propagating waves create electric fields in the solid which cause a voltage to be induced in the output transducer when the waves pass underneath.

The device illustrated in Figure 2 is an electrical delay line, the delay being simply the separation of the IDTs divided by the SAW velocity. Typical delays range from microseconds to hundreds of microseconds.

In many devices the unwanted energy propagated by the bi-directional IDT is either absorbed by an acoustic termination or scattered away from the functional surface. This leads to a minimum device insertion loss of 6 dB and also means that the portion of the signal reflected back from the receiving transducer, then back from the transmitter to finally arrive at the receiver IDT again, is suppressed by only 12 dB relative to the wanted output.

This triple transit signal is the main device spurious response and can be further suppressed by deliberately mismatching the impedance of the IDTs, leading to an increased insertion loss. Fortunately the trade is reasonable: increasing the insertion loss from 6 dB to 12 dB improves the triple transit suppression from 12 dB to 33 dB.

Polyphase IDTs are now available which launch a unidirectional surface wave and lead to devices with much lower insertion loss and better triple transit suppression. Nevertheless, the relatively high insertion loss of most currently available SAW devices is due to IDT mismatch.

To appreciate the signal processing potential of SAW devices it is necessary to look on the IDT as a sampled delay line. Surface waves travel from one pair of electrodes to the next at a finite velocity so the input signal is repetitively delayed and added to itself. The constructive or destructive signal addition creates the amplitude and phase response of the SAW device.

The amplitude of a particular delay line tap can be set by choosing the length of the IDT fingers at that point. The phase, or time delay, of the tap can be varied by changing the relative position of the fingers. In a given SAW device either the transmitter or receiver IDT, or a combination of both, may be used as the signal processing element.

It turns out that such a delay line is exactly what is required to form the basis of a transversal filter. In such a device a given frequency response is obtained by synthesising the time domain impulse response of the desired filter. The impulse response is the output from the filter when the input is a very short pulse and is, in fact, the Fourier transform of the desired frequency domain characteristic.

Figure 4 shows the impulse and frequency response of an ideal band-pass device, the type of filter to be discussed later. The impulse response synthesized by a transversal filter is necessarily finite in length and sampled rather than continuous, but by following the usual principles applying to the design of sampled systems, the desired impulse response can be well approximated.

To use a SAW device as a filter it is only necessary to 'draw' (using metallization) the sampled impulse response on the substrate. The second IDT can be a broad-band type designed to pass all frequency components of interest (Figure 5).

One major constraint applies to all SAW filters. Since the polarity of the charge must reverse on alternate IDT electrodes in order to establish surface wave propagation, the sign of alternate samples of the impulse response reverses.
A major advantage of SAW filters is that they are not 'minimum phase' devices, therefore the amplitude and phase responses can be specified independently. Hence, a fairly sharp frequency response can be combined with a linear phase response, often important in video and data distribution networks.

Before examining some specific applications of SAW filters it is worth summarizing some of the advantages of the technology. These advantages can be listed as:

1. Versatile response with essentially no adjustment or tuning.
2. Straightforward fabrication using standard techniques.
3. Excellent repeatability from device to device due to the photo-lithographic processes used in making the IDTs.
5. Passive.
6. Wide frequency range of operation (10 MHz to 1 GHz).
8. Graceful degradation (small faults cause small performance changes).
9. Radiation resistant.

**SAW bandpass filters**

The primary specifications for a bandpass filter are the centre frequency, \( f_0 \), and the bandwidth, \( \Delta f \). These and other secondary specifications are explained in Figure 6. It is convenient to express the bandwidth in a normalized form, the percentage fractional bandwidth of the filter being simply \( (\Delta f / f_0)\times 100 \).

Table 1 details the achievable performance with typical modern SAW filters but does not include data for the new devices with polyphase IDTs.

The most commonly used substrate material is lithium niobate, but in filters with a small fractional bandwidth (less than 5%) quartz may be used to ensure greater temperature stability. The centre frequency range is restricted at the low frequency end by large device die sizes and a poor spurious response performance by the filter. At the high frequency limit, photo-lithographic processes used to manufacture the IDTs are severely taxed.

The filter bandwidth limitations are set essentially by the number of fingers in the IDT. For very narrow bandwidths (less than 60 kHz) the number of fingers needed is very large, causing an intolerable number of reflections and spurious responses.

In situations where such narrow bandwidths are needed, a second type of SAW filter is used. These 'resonator' filters are the SAW analog of microwave cavities and can achieve fractional bandwidths of 0.01% or so.

At the other extreme, fractional bandwidths of more than 40% are difficult to synthesize with SAW transversal filters because of the very small number of IDT fingers employed to approximate the wanted response.

The insertion loss figures quoted in Table 1 are typical but the adoption of polyphase IDT techniques can reduce the insertion loss to as low as 1.5 dB. As a general rule, increasing the fractional bandwidth of a SAW filter increases the insertion loss since the resistive loading of the IDT must be increased.

Amplitude and phase ripple in a well-designed filter are due mainly to spurious device responses. These responses also govern the ultimate rejection capability of the filter. The 50-70 dB rejection quoted is achieved routinely in modern filters.

Figure 7a shows a typical SAW bandpass filter, in this case a 38.9 MHz TV IF filter. The same device is available in a choice of the two packages shown and both encapsulations sell for a few dollars.
The frequency response of the filter is shown in Figure 7b and is close to the ideal response for the TV application.

Most SAW devices are not produced in the same numbers as TV filters but nevertheless the price is attractive in many situations, especially when the total cost of alternative filters is considered.

In addition to the advantages of high performance, no alignment filtering, SAW devices offer exceptional device reproducibility. Figure 8 demonstrates the exceedingly small variation in response expected in production SAW filters. This advantage is present in all SAW devices and is often of great benefit in coherent (phase sensitive) communication and signal processing systems.

Time coded filters

When examining SAW bandpass filters it is convenient to retain a conventional frequency domain specification of the filters even though the response is actually synthesised in the time domain. It is also stressed that SAW filters may have independent specifications for the phase and amplitude responses.

Bandpass filters are normally designed with a linear phase characteristic or, equivalently, with a constant group delay (i.e. all inband frequencies entering the filter emerge at the same time). A device that exhibits a flat group delay is said to be 'non-dispersive'. In fact, there are applications where dispersion (the emergence of different frequencies at different times) is required and where SAW dispersive filters are now used extensively. These devices are best characterized by their time domain rather than their frequency domain responses.

Chirp radar

One of the most common professional uses of SAW technology is in pulse compression or chirp radar systems. An impulse, which in theory contains an infinite number of frequency components, is applied to a SAW device known as a dispersive delay line or DDL (Figure 9). The DDL output is a dispersed version of the input and is a frequency modulated pulse or chirp centred at f0 and extending over a range B in frequency and T in time.

Note that the dispersive nature of the device arises because of the non-uniform spacing of the IDT fingers rather than as a consequence of any dispersion during propagation. The chirp slope of the DDL is simply B/T and the device time-bandwidth product, N=BT, is an important parameter.

In the radar application (Figure 10) the DDL output is amplified, transmitted, reflected from the target and the returned echo applied to the receiver. The heart of the receiver is a second DDL, the dispersion characteristic of which is the exact inverse (i.e. chirp slope of -B/T) of the transmitter DDL.

The effect is to compress the returned signal back to a pulse resembling the transmitter impulse, except for 'side lobes' due to the finite bandwidth of the expansion-compression process. The time between the excitation impulse and the appearance of the compressed pulse is directly related to the range of the object in the radar beam.

This may appear to be an unnecessarily complex scheme but in practice a major advantage emerges. In all radar systems the detection sensitivity is proportional to the transmitted energy and the time resolution is proportional to the transmitted bandwidth.

Figure 7b. Response of TV IF filter (courtesy of Signal Technology Ltd).

Figure 8. Overlay of the responses of 20 SAW filters (courtesy of Anderson Laboratories Inc.).
that since \( T/BT = 1/B \), the compressed pulsewidth or time resolution is of the order of the reciprocal bandwidth.

The side lobes of the compressed pulse may be a problem in some radar applications since a weak echo can be obscured by the side-lobes of a nearby strong echo. It can be shown that if the frequency spectrum of the chirps is uniform, the first side-lobe is down only 13 dB with respect to the peak of the compressed pulse. A partial solution is to taper the chirp spectrum of the receiver DDL impulse response, a process known as 'weighting' the chirp. The result is a broader compressed pulse exhibiting side-lobes down 40 dB or so.

SAW technology has been embraced enthusiastically by radar designers and most major SAW device manufacturers sell DDLs (weighted and unweighted) primarily intended for radar use. The ruggedness of the devices makes them ideal for use in environments such as aircraft, ships and other surroundings usually considered hostile to electronic components.

Before returning to SAW DDL's in their second major application, spectrum analysis, it is worth expanding on the concept of matched filtering, of which pulse compression is a particular example.

**SAW devices as matched filters**

If a signal is written as a function of time, denoted by \( s(t) \), then the impulse response of a filter 'matched' to the signal is \( s(-t) \) i.e. a time-reversed form of the signal. The output from such a filter is known as the auto-correlation function of the input signal and is the output exhibiting the best signal-to-noise ratio obtainable in the presence of white noise.

In general, a matched filter cannot be built because causal principles would need to be violated. The output would need to precede the input but, in practice, excellent approximations are possible.

Referring to the chirp radar system in Figure 9, it is clear that the receiver DDL is a matched filter for the transmitter chirp since the compressor impulse response is the same as the expander chirp reversed in time. The classic \((\sin x)/x\) compressed pulse can indeed be shown to be the auto-correlation function of the transmitted chirp.

SAW matched filters can of course be designed for any waveform and such filters will undoubtedly find application in both radio and line circuits used for the transmission of digital data. Already SAW devices are being used as code generators and correlators in modern spread spectrum communication systems.

... to be continued.
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Jonathan Scott

IT HAS BECOME the trend to include some indication of power delivered to the speakers by a power amplifier. This is a basically sensible idea. You have some idea of when you are getting near the limitation of the amplifier or the speakers, or perhaps it tells you whether the power amp is producing signal when trying to find out where the music went. It will even indicate if you are liable to be aggravating the neighbours by shaking their ceiling, assuming you are losing touch with the actual volume delivered, as one does after a long while of high level.

Many amplifiers do not have these facilities, however, my ETI Series 5000 included. (So it doesn't have much to do with actual sound quality.) Some expensive, up-market power amps come with two calibrated panel meters, which seems to be something of a waste of $40 or so, considering how often you actually need the facility. Some include only a LED 'clipping' indicator which is even less useful if it only warns of clipping, rather than getting close to it, because the ear can report this fairly reliably.

This project was specifically designed to go in my Series 5000 power amplifier, to allow it to have some output indication while consuming only a minute amount of panel room, of which there is precious little left due to the front panel heatsink design. It sports three LEDs which turn on at power levels of one, eight and 50 watts (into 8 ohms). Should you wish to adjust the turn-on points to suit a system other than 8 ohms or power levels higher or lower than these, the equations for figuring the correct values to substitute are given in the How It Works section.

The main features of the circuit are that it does not load or interfere with the signal as the unit has a 10k input impedance, it costs very little and takes up very little room inside the case. It is also very flexibly designed, allowing the selection of any set of levels to suit different applications.

Boards can also be cascaded to give six-level readout if desired, simply by running two in parallel and selecting the appropriate resistors to get the desired levels. While I did design it as a retro-fittable addition for my 5000 amplifier, you can install it inside almost any amplifier, even a commercial one if you wish, as it has its own on-board voltage regulator and can run on any suitable filtered dc supply, and consumes little 'backroom' space and so little panel space. It could also come in useful in applications requiring a LED meter whose scale is neither linear nor logarithmic, as these are the functions often implemented in LED meter circuits.

Construction

The construction of the circuit itself is very elementary, and can be undertaken as soon as you have worked out where you are going to mount the pc board and LEDs. You should figure out where you are going to fit the board(s) and drill the appropriate holes for them and the LEDs first. You will find it convenient to use the bare board as a template for locating the mounting bolt holes.

If you are fitting a pair to a Series 5000 amplifier, you will find that they fit neatly in the space behind the power switch, bolting to the aluminium members running from the heatsink/front panel to the rear panel. It is then convenient to use the two spare windings on the adjacent power transformer to power the meters, using the circuit given here, mounting the components on a tag strip attached to one of the mounting bolts. The LEDs can then be mounted easily in two columns of three above the power switch. After drilling the LED mounting holes you
may wish to dab a little black point on the panel to cover up the exposed metal.

The LEDs are quite good looking and unobtrusive if no mounting circul are used at all, but rather the bare component inserted in a correct-sized hole painted black. They can be kept in place with a dab of glue on the rear of the LED body.

The pc board can be completed once the drilling is over. Simply insert and solder the components in place as per the overlay diagram. Be sure to get the diode, IC and tantalum capacitor in the right way around.

You may delete the regulator from the second board and run the ground and +15 volt connections across from the first board directly.

Mount the boards in the chassis, leaving lengths of hookup wire free to be run to the appropriate places. Connect the LEDs and the power supply lines. Be sure to get these the right way around, or you will almost certainly destroy all the polarised components.

HOW IT WORKS — ETI-272

The circuit consists of a power supply regulator, which acts as the voltage reference as well, an Input buffer/full-wave rectifier, and three identical comparator stages each of which drives an LED.

The circuit is designed to run on a single +15 volt supply line, which is generated by an on-board three terminal regulator. It should be noted that the supply regulator may be deleted from subsequent boards if the 15 volts line from the first board is used to directly power others. One 7815 will power four boards easily, though it might need heatsinking if handling more than two. It can also be deleted if a 15 volt supply is available already from the amplifier in which it is mounted.

IC2a and surrounding components form the full-wave rectification (or 'absolute value') circuit. It has an overall gain of 2.27, allowing Input peaks of +/-50 volts comfortably. This corresponds to an RMS power level of over 150 watts into 8 Ohms, or double that into 4 Ohms. When the level on the Input side of R1 is negative, IC2a drives its Output positive in order to maintain the inverted Input at zero volts; this arrangement produces a gain of -R2/R1, or -0.27. When the Input is positive, D1 prevents the output of the op-amp from having any effect as the diode is reverse biased. The gain input-to-output of the stage is then R3/(R2+R1), or 0.27 again. Thus, full-wave rectification takes place.

Each of the remaining three op-amps is in an identical configuration. The rectified signal is fed to the non-inverting input of each. The LED connected to the output is driven on when the voltage on the non-inverting input exceeds the voltage on the inverting input. The inverting input is fed with a constant level derived from the supply rail of 15 volts by a resistive divider. Selecting the resistors and hence the division ratio fixes the level at which the LED turns on. The equations for selecting these resistors are given later.

Whenever the instantaneous excursion of the Input signal exceeds the appropriately set level the associated LED illuminates. Thus, when the Input just peaks above set level for one LED it just illuminates for a small fraction of the cycle, giving a dim glow. When the signal comfortably exceeds the set level the LED remains on for a large fraction, giving a bright glow. The effect on the set of LEDs gives an impression of more than three discrete levels due to the analogue action appearance of the LED response. Because of this, three LEDs at carefully selected levels gives a very informative readout of amplifier activity.

In order to select the resistors associated with each comparator use the following formulae, as in the example below:

\[ V_{on} = 15(R5/(R4+R5))/0.27 \]

where \( V_{on} \) is the voltage at the input where the required to turn on LED 1. Similar formulæ are applicable for LEDs 2 and 3.

Because Power = \( V^2/R \), (V in Volts RMS) the peak voltage associated with an RMS power level in the loudspeaker of R ohms nominal is given by:

\[ V_{peak} = \sqrt{2PR} \]

Thus, the value of 1k2 and 15k for R5 and R4 give \( V_{peak} = 4.12 \) and this is within 3% of the value of \( V_{peak} \) for 1 watt into 8 Ohms.

To select resistors to give a reading of \( \frac{1}{2} \) watt into 4 Ohms

\[ V_{peak} = \sqrt{2 \times 4 \times 4} = 2 \]

then choosing 10k for R4 we get that R5 should be about 375 Ohms; 390 is the closest, being about 4% off.

Those values could be used as R7/R8 or R10/R11 equally well.

Finally, the current limiting resistors in series with the LEDs chosen are not equal. This is in order to give rather more maximum possible brilliance to the LEDs corresponding to higher power levels. Any resistor less than a few hundred ohms will not have an effect because the current limiting effect of the op-amp output stages will dominate. A value of 82 ohms is the minimum recommended value; 1k gives slightly less brilliance, and 1k8 gives about half brightness. It is possible to have all the LEDs the same, in which case any resistors of 82-220 ohms may be used, and the op-amps will define the intensity possible.
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Welcome here.
<table>
<thead>
<tr>
<th>Board No</th>
<th>PCB Price</th>
<th>Description</th>
<th>Kit Price</th>
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Telex AA 38897
Power up

There is no calibration required, but you may wish to test the circuit to convince yourself that it is telling the truth. Simply take the input wire for each board and, before connecting it to the speaker terminal, connect it to a variable power supply or a pot of about 50k ohms to make sure the connections are at ground and amplifier rail, such that a crude source of voltage in the appropriate range is obtained, as shown in Figure 1. Connect a voltmeter to the same connection, and observe what the meter reads at each point where a LED comes on. These points will be about 4.11 and 26 volts respectively if you are using the resistor values, given or the calculated Vpeaks if you have your own values substituted.

PARTS LIST — ETI 272

Resistors

<table>
<thead>
<tr>
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<th>Type</th>
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<tbody>
<tr>
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<td>10k</td>
</tr>
<tr>
<td>R2</td>
<td>2k</td>
</tr>
<tr>
<td>R3</td>
<td>4k7</td>
</tr>
<tr>
<td>R4</td>
<td>15k</td>
</tr>
<tr>
<td>R5</td>
<td>1k2</td>
</tr>
<tr>
<td>R6</td>
<td>1k8</td>
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<tr>
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<td>R8</td>
<td>5k6</td>
</tr>
<tr>
<td>R9</td>
<td>1k</td>
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<tr>
<td>R12</td>
<td>52R</td>
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Capacitor

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<tr>
<td>C1</td>
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Semiconductors

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<tr>
<td>IC1</td>
<td>7815</td>
</tr>
<tr>
<td>IC2</td>
<td>µA324, LM324</td>
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<td>LED1, 2, 3</td>
<td>TIL220 5 mm LEDs</td>
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Miscellaneous

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<tr>
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</thead>
<tbody>
<tr>
<td>EIT-272 pc board; hookup wire; nuts, bolts, etc.</td>
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Estimated price: $7-59

Table 1. Alternate resistor values for LEDs 1, 2 and 3 to light at different power levels.

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<tr>
<th>Power level</th>
<th>R4</th>
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<th>R7</th>
<th>R8</th>
<th>R10</th>
<th>R11</th>
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<tbody>
<tr>
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<td>15k</td>
<td>560R</td>
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<td>1/2W</td>
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<td>12k</td>
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<td>-</td>
<td>-</td>
<td>-</td>
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</tr>
</tbody>
</table>
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ETI November 1983 – 117
Use these electronic switches to control things from your computer

Here are two 'electronic switches' which you can use to control mains-operated devices or appliances from your microcomputer.

As opto-isolators are used, they allow safe interfacing directly from the computer or a controller board and can be driven over a simple two-wire cable for a considerable distance.

Graeme Teesdale

There comes a time in every true-blue computer hobbyist's life when he/she wants to use the computer to actually control something in the real world. Like, turning lights on and off, or motors, etc. It's an understandable ambition. A computer which draws clever pictures on a video screen and - even the lines of a computer, have been provided on most microcomputers released in recent years. While generally used to communicate with printers, modems and other peripheral devices, a port can be used to control things that are electrically operated — like lights, motors, etc. as suggested before. However, the circuit in a computer which 'drives' an output port is generally not capable of switching substantial currents or voltages, and not even the current required by a small relay, so some means of switching larger currents form the signals available on the lines of a port is necessary. For that, an 'electronic switch' can be used.

A 16-channel computer output driver was described by Geoff Nicholls in the November 82 issue of ETI. Project 653. It employed transistor output switches capable of 'sinking' or switching currents up to three amps and was designed to connect to a computer expansion port where the address and data bus lines are brought out.

From feedback, 16 channels was up to a dozen too many and switching ac-operated (particularly mains-operated) devices was not possible, except via a suitable relay. In addition, the use of a computer parallel port, which can be readily driven from BASIC, such as on the popular Microbee, was deemed desirable.

However, to switch mains-operated devices, it is essential to have adequate isolation between the mains and the computer. In addition, the controlled device and the computer may be located a long way from one another and long wires are susceptible to picking up interference which can cause spurious operations you didn't plan on.

These requirements can generally be met by one simple electronic device — the opto-isolator.

For a lot of applications, and particularly where absolute 'fail safe' operation is not required (e.g. switching lights), electromechanical relays can be replaced by a solid-state switch — a triac or SCR. They can be used in ac or dc circuits, but in ac applications solid-state switches come in two types:

(i) zero crossing switch action, and
(ii) non-zero crossing.

The zero crossing type turns on or off only when the ac voltage is passing through zero, regardless on what part of the ac cycle the electronic switch is activated. This prevents the 'commutation', or switching, interference generated by the high inrush currents that may be generated when an SCR or triac is turned on during a part of the cycle when the ac voltage is substantial.

One of the problems with zero crossing electronic switches however, is that, in most designs, the switching device (e.g. a triac) is given a short duration positive- or negative-going pulse just after the ac voltage passes through zero. When inductive loads are used (e.g. a motor), the current often fails to reach the minimum 'latching' current required by the switching device before the pulse disappears. Most triacs are also generally not symmetrical in their gate trigger requirements and a positive trigger during the negative half of the ac cycle is often less sensitive compared to a positive trigger during the positive half of the ac cycle.
Optocouplers use a beam of infrared radiation (or occasionally, visible light) to convey the signal from one part of the circuit to the other without any electrical connection whatsoever between the parts. They are sometimes called photon-coupled devices or as opto-isolators. They may be employed to replace conventional relays when a fast response is required or when sparkling at relay contacts must be avoided.

An optocoupler device consists of an infrared emitting device or other photon emitter on its input side and some form of detector for the radiation on the output side, both the emitter and detector being in a light-tight enclosure.

The silicon detector itself may be a photo-transistor, a photo-Darlington device, an opto-triggered triac or SCR, or even a field effect phototransistor.

No matter which of these device types is employed, the silicon detector has its maximum sensitivity at a wavelength quite near to that at which the gallium arsenide photocell is used, with its maximum intensity. In other words, the input is not polarised. That is, it doesn’t matter which way round you connect the two wires. One goes to the computer output port line, the other to common (or 0 V) for active-high outputs or the positive supply for active-low outputs.

To cover the widest possible range of applications, I chose a common triac rated at 16 amps/400 V — the RCA type T6000D. The continuous current rating of ordinary mains outlets is 10 amps, so it is adequately rated for mains-operated devices or appliances. However, if you happen to operate an ac device from a lower voltage, via a transformer for example, then you may need the higher current capability. The T6000 triac is rated to withstand peak surge full-cycle currents of 150 amps.

For the zero crossing switch, I chose an IC specially made for this application — the TDA1024. It is cheap (around £3) and generally readily available. It will happily drive the T6000 triac. RCA make the T6006 triac specifically for zero crossing switch applications, but I found it not so easy to get as the T6000. As the TDA1024-T6000 combination seems to operate reliably, why worry? Other triacs, such as the SC141 — a 6 A/400 V device, can be used also if you don’t require the 16 A rating of the T6000.

The TDA1024 provides a positive-going mains-synchronised trigger pulse for the triac whenever its control input is activated. Since the current and voltage in the load must be in phase for mains-synchronised switching, only resistive (or substantially resistive) loads can be attached to the TDA1024. Other loads, such as the SC141 — a 6 A/400 V device, can be used also if you don’t require the 16 A rating of the T6000.
This is the non-zero crossing switch which is suitable for both reactive and resistive loads (e.g: motors or lamps, respectively). However, commutation interference is generated with reactive loads and the use of a line filter between the unit’s mains input and the mains is recommended.

The input signal from the computer turns on the photon emitter in the optocoupler which in turn triggers the triac which turns on, supplying current to the load during both positive and negative half cycles of the ac mains cycle.

The optocoupler used here, a type MCS2400 by G.I., features a photo-SCR output. This was chosen mainly for its better dv/dt capability over the photo-triac output types, such as the MOC3020.

For full-wave ac control using the MCS2400, it is necessary to use a diode bridge in the triac trigger circuit. This bridge is provided by diodes D5-D8 here. Resistor R3 provides surge current limiting and keeps gate currents to the triac to safe limits. Resistor R2 is included to render the photo-SCR in IC1 insensitive to rapidly rising voltages across the junction or isolation capacitances of the diodes in DS-D8 bridge, and insensitive also to currents generated by leakages and discharges of stored charge during turn-off. The selection of R2 is a compromise between the minimum current required by the Input photon emitter and the photo-SCR being completely immune to dv/dt and other extraneous effects. I found the value of 27k to be a good compromise.

Resistor R4 shunts dv/dt currents passing through the DS-08 bridge diode capacitances from the triac gate.

Voltage transients that might destroy the triac are 'snubbed' by a metal oxide varistor, VAR1—a 250LA20A MOV II type by General Electric. This type of device provides far more protection than can be achieved by using the traditional series-RC network. The varistor will 'switch on' when a transient exceeds its rated peak voltage, acting rather like back-to-back zeners, and offering a very low impedance path to the transient. It is connected in parallel with the triac here.

The V250LA20A is capable of handling a transient peak current of 4500 A for a duration not exceeding 20µs. Its energy rating is 72 joules, dc switching voltage 330 V. Varistors do not require discharging by the triac, as is the case with a series-RC network.

So that the switch's input circuit need not be polarised, making it more versatile, I have added a diode bridge to 'steer' the input current correctly, regardless of polarity.

In series with the optocoupler's photon emitter input I have added a LED to indicate the 'on' condition. Resistor R1 acts as a current limiter. If the unit is to operate from a source providing greater than 5 V drive level, it is only necessary to increase the value of R1 to limit the input circuit current to around 15-20 mA.

Construction
The two pc boards have mechanically similar layouts, as can be seen from the photographs and overlay diagrams. The board for the zero crossing switch, ETI-1514b, is slightly larger. The triac on both is located on one end with the input and indicator LED at the opposite end, keeping them well separated from the mains wiring.

I mounted the prototype ETI-1514b in a small aluminium diecast box which I turned into a type of plug pack using a right-angle type power plug attached to the rear and a surface-mount mains socket attached to the lid, as can be seen in the photographs. A scrap of aluminium bent up as a bracket was used to provide both a heatsink and mounting for the triac. Note that the triac's metal tag has to be insulated using a mica washer and insulating bushes. For safety's sake, the case is earthed. I haven't given drilling details as this is simply one suggested form of construction and many variations are possible.

The board could be mounted in the equipment being controlled, for example, or a number of boards could be mounted in

Power Socket Viewed From Rear

 mains neutral

 mains active

input

output (to load)

load active

load neutral

DIN socket (rear)

input

output (to load)

load active

load neutral

DIN socket (rear)
This is the zero crossing switch. It can only be used on resistive (or substantially so) loads as mains-synchronous switching is employed.

In this unit, the input signal from the computer turns on the photon emitter in the optocoupler (IC1), the output of which activates the control input of the zero crossing driver, IC2. When the mains voltage passes through zero, the trigger output of IC2 turns the triac on, supplying current to the load during both positive and negative half cycles of the ac mains cycle.

In this unit, like the ETI-1514a, the input circuit employs a diode bridge, D1-D4, so that the input need not be polarised. A LED in series with the optocoupler's photon emitter indicates the 'on' state, R1 providing current limiting.

The optocoupler used here has a transistor output and a number of types can be used — such as 4N25, 4N26, MCT2 etc.

The TDA1024 (IC2) zero crossing switch is designed to derive its own supply from the mains and can drive a medium-sized triac from its trigger output.

A block diagram of the TDA1024 is shown. The comparator features Schmitt-trigger action and compares the control voltage at pin 5 with the reference voltage at pin 4 and switches on when the control voltage exceeds the reference voltage. The comparator hysteresis is adjustable between 20-300 mV by selection of the resistor value connected between pins 3 and 1. Hysteresis is minimum with pin 3 open, so I have left it open.

An external series dropping resistor (R7 here) is needed to limit the repetitive peak in-rush current to the IC's internal zener supply to less than 80 mA. In fact, average current is approximately 10 mA. Diode D5 is added in series with pin 7 to 'block' the negative half cycle of the input, reducing the dissipation in R7 to half what it would otherwise be. When D5 is conducting, it charges C1 up to the stabilising voltage of the internal zener. The voltage between pins 1 and 8 should be no greater than eight volts. Any excess current is bypassed by the internal zener. Pin 6 is connected through R6 to the mains, providing the synchronising signal and, in addition, trigger pulse width control. With the value of R6 at 330k, the output pulse width is about 125 µs.

Board assembly is straightforward. Always check the pc board before commencing assembly to see that all the holes are correctly drilled and that there are no tiny copper 'bridges' between closely-spaced track, particularly between IC pins. There is no particular order of construction. However, make double sure your get semiconductors and polarised capacitors (C1 in the zero crossing switch) the right way round.

This can be increased by increasing the value of R6. The maximum rated trigger output current of 100 µA is obtained with a trigger pulse width of approximately 260 µs.

The trigger output of IC2 (pin 2), is an open emitter capable of sourcing a maximum of 180 mA, as stated above, and this is internally current-limited for protection against short circuiting. The output pulse amplitude is stabilised at 4 V for trigger currents up to the maximum value.

The series resistor must be connected between the trigger output of IC2 and the gate of Q1 to limit the trigger current. Resistor R8 was chosen to limit the output current to about 10 mA average.

When the voltage on pin 5 exceeds that on pin 4 (with respect to pin 1), and the sinusoidal voltage applied to pin 6 passes through zero, the comparator will switch, operating the control gate, triggering the output stage and a trigger pulse will be supplied to the gate of Q1 from pin 2 of IC2. When an input signal is applied to IC1, its output (pins 4-5) shorts R2, dropping the voltage on pin 4 of IC2 below that on pin 5, effecting a trigger.

For transient protection, a varistor is used in this unit too. However, it is not connected directly across the mains input to absorb mains-borne transients. As the load is turned on and off at zero voltage, 'snubbing' across the triac is unnecessary.
In use

The switches require a 5 V-level input, capable of sourcing around 15 to 20 mA. For example, say you attached one of these switches to an output line of the ETI-673 Microbee MultiPROM Interface board. One of the switch’s input wires would go to the +5 V supply (pin 12 of the '673’s I/O socket, SK); the other wire would go to the appropriate output line pin. The ETI-514 switch would then be activated when that particular output line was programmed on. Simple, what?

Where the input of a '514 switch is driven from a 5 V-level output and extra interference protection is required, as might be necessary when running the switch’s input cable over very long distances, a varistor can be added across the line where it attaches to the computer or interface. The General Electric type no. V8ZA2 would be suitable in such applications.

Where long cable runs between the switch are necessary, use a medium to heavy duty ‘figure-8’ cable to keep resistive voltage drop along the cable low. Shielded twin-pair cable can be used, but ground the shield only at the computer or interface end, not at the '514 switch end.

When installing a '514 board, always run the mains leads directly away from the input leads so as to minimise possible interference being induced into the input circuitry.

There are two basic ways of switching mains power to a load — either via a mechanical switch or via a solid-state switch such as a triac. Mechanical switches are fairly slow-acting devices, they suffer from severe arcing at the moment of switching and generate a great deal of RFI (radio frequency interference) at switch-on and switch-off. This RFI can often be heard on domestic radio and TV sets and can cause malfunctioning of some electronic equipment, particularly digital equipment.

Tricas are fast-acting devices and do not suffer from arcing problems. Nevertheless, they are still capable of generating considerable RFI at switch-on.

Why? As the triac turns on, the load current may rise from zero to several amps in a mere couple of microseconds; since this current flows through the mains wiring, the wiring may radiate a great 'splurge' of RFI in response to this heavy surge current.

The magnitude of the RFI is proportional to the value of instantaneous mains voltage at the moment of triac turn-on. If a 100 ohm load is being driven from 240 Vac mains, the surge current will be 3.4 A if switch-on occurs at a 'crest' value of 340 V, or a mere 3.4 mA if switch-on occurs at a 'near zero crossover' value of 3.4 V.

RFIs are self-latching devices. If they are turned on by a brief gate signal, they remain on until their main-terminal (MT1-MT2) currents fall below a minimum 'holding' value of a few milliamps. They automatically turn off at the end of each mains half cycle as their main-terminal currents fall to near-zero. They can be turned on near the start of each half cycle as soon as their main-terminal currents are capable of exceeding the minimum holding value.

Thus, a triac can be persuaded to generate virtually zero switch-on RFI by feeding it with gate current only when the instantaneous mains voltage is close to the zero or crossover value at the start of each half cycle. This technique is known as 'zero crossing switching'. Special triac-driving ICs are available from a number of manufacturers for zero crossing switching applications, such as the CA3059 by RCA and the TDA1024 by Philips/Signetics.

Thus the degree of triac switch-on RFI is proportional to the value of instantaneous mains voltage at the moment of triac turn-on. If a 100 ohm load is being driven from 240 Vac mains, the surge current will be 3.4 A if switch-on occurs at a 'crest' value of 340 V, or a mere 3.4 mA if switch-on occurs at a 'near zero crossover' value of 3.4 V.

It is a good idea to keep resistive RFI at mains levels, the wiring may radiate a great 'splurge' of RFI in response to this heavy surge current.

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The 3212 is simply designed so it's easy to use and gives absolute maximum performance at a reasonable price.

It has a high current measurement capacity (AC, DC 10A), overvoltage protection to AC250V in both current (except 10A) and Ohms ranges and it is Autoranging (except current).

It also has Lo Ohms for in-circuit resistance measurements and continuity test results are reported by an audible tone.

The Hioki 3212 is a no-nonsense, down to earth meter with all the features you need to do the job. And do it well.

Special introductory price $82. Normally $96.

Specifications:
- Display: 3 1/2-digit LCD, maximum reading of "9999.9", auto-polarity, unit and other annunciators.
- Ranging: Auto (manual ranging in current ranges).
- Overrange Indicator: "1" in MSD column, audible tone (No audible tone for Ohms, no indicator or buzzer for DC 1000V, AC 600V).
- Battery Low Indicator: BAT mark in MSD column, audible tone (No audible tone for AC 100V, AC 600V).
- Sampling Rate: 2 per second.
- Environmental Conditions (Operating): 0 - 40°C, <80% RH (no condensation).
- Maximum Allowable Input: Volts, DC 1000V max, AC 750V max, 10A AC 250V max.
- Dielectric Strength: AC 3000V/1min.
- Power Source: Two Size AA (SUM-3) batteries, battery current: 5mA.
- Dimensions: 160 x 85 x 30 (mm), 9.45 carrying case supplied.
- Optional 90-114 N Probe.

Measurement Ranges and Accuracy:

<table>
<thead>
<tr>
<th>Range</th>
<th>Accuracy</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>200mA</td>
<td>1% of reading + 1 digit</td>
<td>0.1mA + 1 digit</td>
</tr>
<tr>
<td>20mA</td>
<td>1% of reading + 1 digit</td>
<td>0.01mA + 1 digit</td>
</tr>
<tr>
<td>2mA</td>
<td>1% of reading + 1 digit</td>
<td>0.001mA + 1 digit</td>
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For further information about Hioki multimeters or to order a Hioki 3212 multimeter, fill in this coupon. Send it to Nilsen Rowe Australia Pty. Ltd., PO. Box 349, North Melbourne, Vic. 3051.
IDEA OF THE MONTH

Tone operated switch

Ian Johnston, Mt Eliza Victoria

This is a new approach to the idea of operating a switch by means of a tone, such as a whistled note. It avoids the problems of acceptor filters formed by twin-T networks in the feedback paths of op-amps. They either oscillate or fail to discriminate against loud noises pitched just outside the acceptor frequency.

Gate IC3a squares up the input waveform and triggers IC1a and IC1b on the rising edge of its pulse. IC1a produces a short pulse (approximately 20 μs) which is applied to gate IC1b.

IC1b is set to a time delay that equals the period of the accepted frequency. It forms a reference which measures the period of every cycle of the incoming signal.

IC2a is triggered on its negative edge by the output pulse of IC1b. At the desired frequency the pulse from IC2a (which is short — about 20 μs) will appear at the gate almost simultaneously with the pulse from IC1a. These two pulses overlap, causing an output pulse at the gate.

The output pulses appear at intervals of T (period of the acceptor frequency) and since IC2b is timed longer than T, it is repeatedly retriggered and its output remains high for the duration of the signal.

(Note diagrams of waveforms). When the incoming signal is too low in frequency, pulses do not coincide at gate IC3b.

When the incoming signal is too high in frequency, IC1b is prematurely retriggered, remaining permanently high at pin 10 (Q), causing elimination of any pulse output from IC2a.

1. Ideally, C in IC1a and IC1b should be the same value to equalise start up delay upon triggering, but with small values of C this delay is negligible.

2. Frequency of acceptance is controlled by R and C on IC1b. Bandwidth of acceptance is controlled by R and C on IC2a.

3. A 4011 can be used in place of the 4093 for IC3, but the latter is probably preferable.

4. ICs 1 and 2 are 4528 dual retriggerable monostables.

5. IC2b can be connected to be positive or negative edge-triggered; it does not matter which. IC2a, however, must be negative-edge-triggered.

6. The input signal should rise to a peak which is about equal to the supply voltage to ensure reliable triggering.

7. The circuit will not trigger at one half or one quarter of the acceptor frequency.

I intend to use the circuit in a 'hands-free' whistle-switched intercom in my workshop (where I frequently have dirty hands).

In a breadboard assembly using two complete circuits, the values of C and R must be chosen for IC1b low note — In, 1M5; high note — In, 1M. Cheap greencap capacitors were used. The frequencies of acceptance measured were 900 Hz and 2 kHz respectively. This arrangement can be made to switch on to a few whistled bars of 'I did it my way', and switch off to a few bars of 'Colonel Bogie'. Needless to say, the circuit will also find use in less frivolous applications.

When a sine wave (peak value equal to supply voltage) is applied to the input and output will go high within a certain narrow range of frequencies. Outside this range the response will be zero.

The frequency at which the circuit responds is a function of the time constant set by the capacitor and resistor on IC1b. The 'breadth' of the response range depends on the time constant set by the capacitor and resistor on IC2a.
The Hioki 3200 digital multimeter has a large Bussman 600V HRC fuse built into it.

This way, if you make the wrong manual range selection when measuring on high energy power systems, you won't be seriously injured.

Normal multimeters can't offer this full over voltage protection up to AC 600V (Ω, μA, mA ranges).

And the HRC fuse is only one of a whole range of safety features offered by the Hioki 3200.

It's been shock-tested to withstand drops onto concrete of up to one metre.

The internal circuitry has been sealed against dust entry. A neon lamp indicator warns over voltage in ohms and → ranges.

The safety collar terminals and safety test leads provide maximum protection against electrical shock.

All the controls and terminals have been positioned according to research in human engineering, therefore minimizing any chance for operator error.

So while all these features may come as a surprise, they certainly won't shock you, now or in the future.

Special introductory price $119. Normally $141.

For further information about Hioki multimeters or to order a Hioki 3200 digital multimeter, fill in this coupon. Send it to Nilsen Rowe Australia Pty Ltd., PO Box 548, North Melbourne, Vic. 3051.

Please send me further information □ a Hioki 3200 digital multimeter □

Name _____________________________ Cardholder's signature _____________________________

Address _____________________________ Postcode ________________

Card No. ________________ Expiry date ________________

I enclose cheque/postal note for $119 or debit my Bankcard account number.
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.

Low voltage alarm
A little ingenuity should find numerous applications for this circuit. It was designed by R. Sinclair of Arncliffe, NSW who says that it provided reliable service in an amateur station.

This circuit was originally used in conjunction with an automatic mains/battery dc supply for transceiver operation. It detected the drop in dc voltage (mains supply normally 13.6 V, battery 12 V) to give visual and audio warnings of the voltage decrease.

It is suitable for any application requiring detection of a drop in normal dc supply voltage with the advantage of an audio warning. This would be particularly suitable in a vehicle where a visual indicator may be easily overlooked.

D1, R1 and R2 provide a stable voltage reference and the preset R2 is adjusted so that D2 lights under normal conditions. D4 is then forward biased, keeping D3 off.

When the input supply causes a voltage drop across Q2, D3 turns off and Q3 now turns on through SW1. The voltage on pin 4 (reset) of the 555 goes positive, enabling the 555 which is connected as an astable. The frequency is varied by R9.

To disable the audio alarm function, SW1 is operated cutting Q3 off, but D3 will still give visual indication.

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

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

*Breath of copyright is now a criminal offence.*

Title of Idea

Signature

Name

Date

Address

Postcode

IDEA OF THE MONTH' CONTEST

PRIZE WORTH $90!

Scope Panavise Multi-Purpose Work Centre.

Scope Panavise Laboratories, which manufactures and distributes soldering irons and accessory tools, is sponsoring this contest with a prize given away every month for the best item submitted for publication in the 'Ideas for Experimenters' column — one of the most consistently popular features in ETI Magazine. Each month, we will be giving away a Scope 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 $60! 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, The Federal Publishing Company Pty Limited, ESN, The Litho Centre and/or associated companies.

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

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

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

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

This contest is invalid in states where local laws prohibit entries. Entrants must sign the declaration on the coupon that they have read the above rules and agree to abide by their conditions.
Specifications
Display: 3 1/2-digit, maximum reading of “1999”, autopolarity, unit and other annunciators.
Ranging: Auto.
Overrange Indicator: “1” in MSD column blinks.
Battery Low Indicator: BATT mark lights.
Sampling Rate: 2 per second.

Environmental Conditions (Operating):
0-40°C, <80%RH.

Maximum Allowable Input:
Volts: 700 VDC or DC+AC peak: 250 VAC max.

Dielectric Strength: AC 2000 V/1 min (between input terminals and case).

Power Source: Two SR-44 or LR-44 batteries. Battery current approx. 3mW.

Dimensions: 163L x 19W x 28H (mm).

Measurement Range and Accuracy

For further information about Hioki multimeters or to order a Hioki 3211 Pen – DMM multimeter, fill in this coupon. Send it to Nilsen Rowe Australia Pty. Ltd., PO. Box 349, North Melbourne, Vic. 3051.

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Name: __________________________________________________________
Address: _________________________________________________________
Postcode: ____________________ Expiry date: ____________________________
I enclose cheque/postal note for $78 or debit my Bankcard account number.

This is the sensational new Hioki 3211 Pen – DMM, a technological breakthrough in digital multimeters.
Designed to be held in one hand like a large pen, it is extremely useful for troubleshooting and maintenance work on computer systems and other microcircuits.
The controls and display panel have been positioned according to results from research into human engineering.
The Hioki 3211 Pen – DMM even has a display hold function. This way, you can take readings after the meter has been removed from a point that’s difficult to reach.
But you won’t really know how good it is until you give it a try.
Special introductory price $78.
Normally $92.
JOE CARP ELECTRIC GAMES: ADVICE FOR PROGRAM-SOFTWARE! ...

STOCK SLEEVOR

This program is an attempt to create a stock or product data base which provides an on-line access to a large database. This system would involve the concept of being continuously and easily updated to reflect all changes in inventory and accounting procedures on hand.

Crt. XE-6950 $15.95

HOUSEHOLD REGISTER

This program will simplify the task of determining the status of household bills, due dates for insurance purposes, as well as providing descriptions of all items in the event of their loss or destruction. Effects are catalogued by name, description, date of purchase, nine separations of the record label, and up to 28 items may be listed in each.

Crt. XE-6950 $15.95

STOP: PACK - STATISTICS

This program is a general personnel graph plotting, personnel, logistic, personnel, etc., to simplify the operation. It features a test of significance for the correlation coefficient. The range of these figures is a distribution of minimum (3), maximum (15), and average (10).

Crt. XE-6999 $14.95

PROGRAMMING HINTS

Contains a series of hints which you may use to improve your own BASIC programs. You will be linked to different sections by the display which allows you to R.U.N. or LIST each section.

Crt. XE-6990 $14.95

PROSPECTOR

An adventure game in which you are the prospector attempting to get gold and diamonds which are scattered across the land, and up to two thousand bandits that are chasing you.

Crt. XE-6980 $15.95

BASIC TUTORIAL

This is a step-by-step guide for any programmer. Basic Tutorial is a set of 8 interactive lessons which have been designed for teaching Basic to the computer novice. No previous knowledge is assumed. Basic Tutorial uses a unique dual screen technique to display both the normal computer output and the tutorial exercises at the same time. This allows you to see the output as it is being created.

Crt. XE-6940 $20.00

BASIC TUTORIAL - DEDICATED - SOFTWARE

Consists of 8 interactive exercises designed for helping Basic programmers. The exercises are presented in regular text as topics they are to the Microbee computer. Only a general knowledge of BASIC and the computer language is necessary. However, Machine Tutorial is necessary to bridge the gap between BASIC programming and the microcomputer language.

Crt. XE-5230 $25.00

BUDGET - SPREADSHEET

This program is designed to help you keep your financial records and the data sheets which you wish to keep. The program provides data sheets for you to enter the data and display the information.

Crt. XE-6890 $16.95

SE-80 - SPORTS GAME

A sports game between two ships from the days of Neptune, or against the computer. You may play against a friend, against an operator being limited motion graphics for the war battle exercise. As well as the enemy fleet must survive hazards such as hurricanes, disease, and your own gunners who do not always shoot straight.

Crt. XE-6945 $14.95

DECIDE

Dedicate 1000 years in the life of a computer, learn computer programming, and be a computer. This program allows you to try 1000 years of experience in the field of computer programming.

Crt. XE-6940 $20.00

FIREY

Crt. XE-6975 $14.95

FILE

FIREY is a larger version of Cartel, but harder to handle a larger game, and is easier to find the "card".

Crt. XE-6970 $14.95

FOSSIL

This program has been designed for students of geology, but can be used by anyone interested in the history of life on earth. The program allows you to explore for fossils, examine rocks, and learn about the evolution of life on earth.

Crt. XE-6965 $14.95

MINE DROP

You are a tank running around a maze gathering all the weapons you can. It sounds easy, but you have a guided missile on your tail. Your only weapon is a machine gun which when dropped and exploded at will. A very fast flick

Crt. XE-6970 $14.95

PENDENTOR

A low resolution graphic version of the popular game "Sparrow." You must shoot the rackets and bomb the radios in an effort to get to the next stage which is even harder. This game can be either controlled by a joystick or by keys. Being in Lose graphics it is a very fast game. If you are

Crt. XE-6960 $14.95

SPACE PATROL

A fast little Pendentor, but it has high resolution graphics. You must battle your way through the various stages. In the last stage you have four chances of blowing up a neutron bomber. If you are successful, the next round is a lot harder.

Crt. XE-6955 $16.95

METEROE RESCUE - MYSK

Your mission is to rescue several astronauts. You are the commander of the Landing Module docked in space with the mother ship. It is your responsibility to guide the landing module through a meteor field, down to the surface of the planet, and to safely land on a landing pad. An astronaut will then run to your landing module and board on your microbuses. If necessary and quick with the mother ship. The Landing Module must be shunted off to the mother ship.

Crt. XE-7000 $17.50

CORVILLE CASTLE

Corville Castle is an adventure which will take you into the action of the old style corville, fantasy castles, fancy monsters and evil warlocks. You must enter the Hellcastle, find the dark castle, and eventually destroy the dark warlocks which will help you to destroy the warlocks. But remember you have until dark.

Crt. XE-6825 $16.95

CARACE

A fast evolving game for the Microbee. You must weave your way through a field of cards and stay alive to produce the highest score. If you're too good at one speed then try the next (10) speed to choose four!

Crt. XE-6700 $11.95

EYE OF MIN (32X)

An adventure game which allows you to see in that it gives you a picture of where you are. Once you have picked this perfect floor plan normal it may be a little more engaging the reality improve.

Crt. XE-7025 $14.95

MORSE CODE TUTOR

Perfect for the young amateur. Quality program which covers the full alphabet, numbers, and symbols to enter a sentence in English and plays it back in Morse, plus.

Crt. XE-6880 $14.95

PSYCHOTEC

Psychodetic provides a stimulating example of artificial intelligence, allowing a dialogue in English between computer and operator, the computer playing the role of psychodetic and the operator being a "patient" on the screen. Leaves other "fuzzy" words alone.

Crt. XE-6875 $15.90

SWING BY Dreamsland

Martian is a 32X program which simulates the English language during the dark ages. Your task is to search through the dark forest inhabited by robbers, outlaws, and creatures with amazing magic powers to find a legendary spell. An excellent adventure.

Crt. XE-6860 $20.00

VANTAGE

The famous old addictive dice game, Try to better your own current score. Up to 3 players.

Crt. XE-6865 $14.95

UNDERWORLD OF YUX

Underworld of Yulk is a remote adventure, average playing time completing the game is anywhere between 5 to 12 hours; however, it is recommended for experienced adventurers.

Crt. XE-6855 $14.95

BACUS

A program to assist you in making back up copies. Allows you to load in a file loaded and save it again at 200 baud or 1200 baud.

Crt. XE-6710 $11.95
MORE OF THE BEST

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4000/1 4-way System Cat. CE-2430
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$42.95

Following the spectacular success of the DPM2010 Digital Multi-tuner kit, we now have an ENGINE ANALYSER KIT! But the spectacular thing is the price! It is ACTUALLY CHEAPER than the DPM205 Display and Case! The Minitune will measure voltage, resistance (down to a very low range), RPM and Dwell Angle. Cat. KJ-7012 TEST LEADS TO SUIT ONLY $2.95 $42.95

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Ref: EA 11/82

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- 91dB sensitivity
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- 5,000-40,000Hz
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Over $199.50

"Free INSURANCE for Road & Registered Post over $200" All heavy or bulky items (over 20kg) must today freight $10.00 anywhere in Australia.

SHOP HOURS CARLINGFORD, CONCORD & HURSTVILLE Mon — Fri 9am — 5.30pm Sat — 8am — 12pm. Thurs nights 8.30pm

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MAIL ORDERS AND CORRESPONDENCE: BOX K 39 HAYMARKET, SYDNEY 2000

GUITAR BOOSTER FOR STEREO AMPS

REF: EA JUNE 1982

Use your Electric Guitar on your home Hi-Fi. Saves you the expense of a practice amp.

Complete kit — ONLY $14.50

Touch Sensitive

Light Dimmer

Ref: EA April 1983

only

$19.95

Cat. KA-1508

Complete kit including quality HPM wall plate with attractive brushed metal face. The Juyan-MI is absolutely complete including a small dial spring which can be used to connect the PCB to the wall plate. (Bonus of other kits that does not includes this). In addition to the above, we supply the High Voltage Resistor. ALREADY ISOLATED in a foolproof safety feature.

SUPER SIRIN

new low price

Ref: EA November 1982

The complete kit including Pico siren. NORMALLY SELLS FOR $20.00 FOR NOVEMBER BUYERS THE COMPLETE KIT — ONLY $14.95! Super Siren shortonta Cat. KA-1646 — ONLY $5.00 Incl. Post to suit $5.95

JAYCAR

121 YORK ST. HAS

CLOSED — WE ARE

NOW TRADING AT

117 YORK ST.

OUR TELEPHONE NUMBER REMAINS

UNCANGED

(02) 264 6688
ETI-673 Microbee multiprom interface

This project is being sold wholesale and retail by Avtek Electronics in Sydney (02)267-8777. At time of going to press it is also available from Altronics in Perth — inwards line (08)99-9001 (a 12c call). Rod Irving Electronics in Melbourne has indicated they'll be stocking it, too.

As the pc board is copyright to Avtek, we have not reproduced the artwork. Prims will not be available either, as it is a double-sided, through-hole plated board.

ETI-1514 electronic switches

Kits will be available from Rod Irving Electronics in Melbourne, but try Altronics in Perth also. Printed circuit boards will be available from the suppliers listed in this column in the September issue.

If you're hunting up bits then try the following: The 4N27 is generally widely available — try Avtek, radio Despatch Service and Sheridan Electronics in Sydney, Billco and Radio Parts in Melbourne. The higher isolation voltage 4N25 and 4N26 might be obtained from Truscotts, Active Electronics and Eastern Communications, all in Melbourne. The 4N28 is widely available, but the higher isolation types are preferred for mains applications.

The G.E. varistor, V250LA20A, shouldn't be too difficult to locate. Try Sheridan Electronics in Sydney and Billco, Raycross Electronics and Radio Parts in Melbourne.

The TDAJ024 zero-crossing driver might be obtained from Jaycar, Sheridan Electronics or Radio Despatch Service in Sydney, Billco in Melbourne. Try Altronics in Perth, too.

The T6000D triac is made by RCA and distributed by AWA Microelectronics in Sydney. Try Radio Despatch Service and Sheridan Electronics in Sydney, Billco in Melbourne. The MCS2400 SCR-output optocoupler is made by General Instruments (G1) and distributed by RIFA in Melbourne. Only Billco in Melbourne had any in stock prior to going to press. That situation is likely to change, though you might politely ask Avtek in Sydney.

If you want to etch and drill your own pc boards, positive or negative film of the artwork can be obtained from ETI-1514 Artwork, ETI Magazine, P.O. Box 227, Waterloo NSW 2017 for the princely sum of $2.70. Make sure you ask for a positive or negative according to your requirements.

ETI-272 LED power level indicator

At time of compiling this column, Rod Irving Electronics in Melbourne and Dick Smith Electronics had expressed interest in supplying kits for this project. However, all components are readily available over the counter and pc boards will be available from the suppliers listed in this column in the September issue.

For those making their own pc boards, same-size positive or negative film can be obtained for $1.00 from ETI-272 Artwork, ETI Magazine, P.O. Box 227, Waterloo NSW 2017. Make sure you ask for a positive or a negative, according to the photoresist you're using.

MINI-MART

- We'll publish up to 24 words (maximum) free of charge for you, your club or your association. Copy must be with us by the 1st of the month preceding the month of issue. Please — please — print or type advertisements clearly, otherwise it may not turn out as you intended! Every effort will be made to publish all advertisements received; however, no responsibility for so doing is accepted or implied. Private advertisements only will be accepted. We reserve the right to refuse advertisements considered unsuitable.

AUDIO

FOR SALE: VIDEO tape, 1/2 Sony V32 (7 reel 2370 ft), new in sealed container, $7 each. Or little used in perfect condition, $4 each. G. Terel, 8 Wurth Pl, Chifley ACT 2606. (062)81-5091.

FOR SALE: VIDEO cartridge, Sanyo VC20C, new in sealed cartons, $8 each. G. Terel, 8 Wurth Pl, Chifley ACT 2606. (062)81-5091.


COMMUNICATIONS

FOR SALE: NATIONAL DR-31 SW/MW/FM receiver, only 16 months old. Bargain at $240. John (09)363-7773 ah.

COMPUTERS

WANTED: SINGLE parent pensioner wants B/W or green screen monitor in very good condition for son. (02)542-3685.

FOR SALE: OSCILLOSCOPE Kikusui 680A 35 MHz, dual trace, $1000. HP 8800 signal generator 10-480 MHz, recently calibrated, $400. T. Collins, 32 Elanora Rd, Armadale WA. (09)399-3418.

FOR SALE: STRUCTURE — IBM 370 Model S, 5000 issues; call (02)713-9473.

FOR SALE: INTEGRAL EQUIPMENT 1.2 A 1700-1200 MHz,發布

FOR SALE: PRINTER for TRS80-PC1 and Sharp PC1211 pocket computer. All the accessories included, $95. Frank Rees, 27 King St, Boornt Vic. 3537.

MICROBEE: 32K, EDASM, Wordbee, Ritron monitor, Sharp cassette player. Heaps of games, etc, on tape, 85995. Andy Hardy (045)705-2184 bh.

LINE PRINTER: General Electric Terminett 300. Standard RS232, 30 cpl, quality printing, 120 character width, pin feed, excellent condition, robust, $350ono. (040)26-5713.

VIC-20 COMPUTER: Excellent condition, hardly used, includes all connecting cables, bargain price, $250. (09)31-0319 ah.

FOR SALE: MICROACE computer. Leads, manuals, newsletters, power supply, modulator and direct video. Many programs, 2K RAM, 4K ROM, details for expansion, $130ono. (07)717-7841.

SUTHERLAND SUPER 80 Group is a recently formed informal group. For more information ring Jim Traeger (02)525-2018 or David Naylor (02)521-6092.

SELL: ZX81 as new, leads, manual, 1.2A power pack, tapes etc. Also 16K RAM pack, $50. Many constructional projects. Write to F. Papadopoulos, 13 Krombant St, Dulwich Hill NSW 2203.

WANTED: TOYSCREW SM-72 solid state stereo platter and centre screw. 9 Billing St, Mount Waverley Vic 3149. (03)277-6978.

FOR SALE: SINCLAIR ZX81, 17K RAM, printer, software, manuals, power supply, leads, $490. (03)758-9124 ah.


SELL: COMMODORE CBM 4032 (Fat Forty) computer with Programmer's Toolkit in ROM, $580. Also CM/PET to IEEE cable. $45. (02)855-5433.

WANTED: INFORMATION or an address for the Apple User's Group. John Calme, 178 Avoca Drive, Green Point NSW 2250. (03)469-1052.

FOR SALE: 8 floppy disk drive, single sided. No controller, box or power supply. IBM370 Microcode loader, $150ono. Steven (03)757-2566 bh.

MICROBEE: MYTEK Machine Code and BASIC tutorials. Brand new and still in original packaging. Works on pre-IC models only. $12.50 each. (02)713-9473 ah.

WANTED: MISCELLANEOUS and game programs to suit Commodore Vic-20. M. Kershaw, 4-141 Hotham St, St Kilda East Vic. 3163.

MISCELLANEOUS

WANTED: TALKING ELECTRONICS Nos 3, 6, 7, 8 and 9. Will buy or swap magazines for same. Sell DX160 speaker, S10. T. Dodsworth, P.O. Box 917, Ingham Qld 4850.

BARGAIN PACK: Mixed components includes resistors, IC sockets, desolder braid, battery snaps, assembled pc board, all new, plus other items at $10 including postage. T. Firman, P.O. Box 498, Cheltenham Vic. 3192.


FOR SALE: GEL-type sealed rechargeable batteries, brand new from Power-Sonic USA, 12 V, 1.5 Ah, 19. Size: 34 x 60 x 177 mm. Joe (02)451-3170.
ROD IRVING ELECTRONICS
FOR NEW PRODUCTS AND SPECIALS

IT'S TIME TO BE SECURITY CONSCIOUS

ALARM CONTROL MODULE

Ideal for homes, business and factories/security. Control module allows access entry and exit. Automatic alarm reset, 12VDC operation, both normally open for heat, smoke, vibration and normally closed for doors, windows etc.

- Each delay approx. 1 minute, 20 seconds
- 10 second closed circuit delayed alarm
- Instant alarm for open circuit
- All weather protection
- Power 12VDC
- Compatible with 2mA system

EARLY DETECTION TECHNOLOGY

SEALED LEAD ACID BATTERY

- Rechargeable and new sealed battery system, many applications - alarm systems, emergency lighting, video camera, portable TV and VCR etc.
- Features - ABS plastic case
- Minimum self discharge
- Fully sealed & leak proof
- Long service life

Specifications
- Voltage: 12VDC
- Capacity: 20 hour rate: 1.2A
- Discharge current: 22 hour rate: 60mA
- Charging Current/Time: 120mA @10-14 hours
- Size: 100L x 85W x 423H
- Weight: 600 grams

$150595 $9.95 $19.95

THE ULTIMATE INDOOR ANTENNA

The ultimate indoor antenna - built-in mixer for UHF, VHF/FM - wide frequency band from 50MHz to 2000MHz - directional fine tuning possible with variable direction. (šíver loop) - easy to mount and will hang on the wall - PS still balance with external cable and plug.

Video library storage area - looks just like hard cover book - with identification card pocket.

A $150500 $49.50

B $150526 $2.95 $2.25

RING AND ASK LOU BLASCO HOW GOOD THEY ARE

CD-424 14 BIT P.C.M. HIGH RESOLUTION DIGITAL DELAY

- Two quality with high signal to noise ratio and wider frequency response. Long delay time from 0 to 1,250,000V - 8 way switch selectable from 51.2465kHz.
- A & B combination effects with main and sub-delay. * 2 Inputs and 3 Output levels. * Low/high equalizer for sound variation

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STREET, MELBOURNE. (03) 347 9251

GREAT ATTENTION GETTER

Smoke flash - variable function ideal for parties - Disco dancing etc.

240V 50Hz - flash rate from 0.1 to 1 second per second (improved model)

With these units you have great fun show displays, emergency situations, attention and stock promotions.

A150545 $39.50

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1 6 10+ $29.50

AA $150200 $1.85 $1.65

C $150201 $5.95 $5.50

D $150202 $6.95 $6.10

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ZX Spectrum Personal Computer

 ZX Spectrum Full range of software in stock.

IN JOB LINES

DIRECT IMPORT PRICES SLASHED FOR THIS MONTH ONLY

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C12010 $6.95

C12012 $14.95

WE ARE SITUATED AT TWO CONVENIENT LOCATIONS:

CITY STORE: 48-50 A'BEGECK STREET, MELBOURNE
425 HIGH STREET, NORTHCOVE, 3070

(03) 489 8966, (03) 489 8131

Mail Order仑 (03) 489 1436. Wholesale Enquiries (03) 489 7099

5 A16mm Material Horn Speaker Brand Range: 600-5000Hz Max Power 8W

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MICRON SUPER 80

A FEATURE
PACKED DOT MATRIX
PRINTER FOR UNDER $500

Your 'Super 80' printer will enable you to print letters, reports, graphics generated pictures, etc. and importantly for the programmer, hard copy of program listings.

Operating under microcomputer control from any general purpose microcomputer, the Super 80 features 10 different print types including emphasized 'LETTER QUALITY' bidirectional print action ensures smooth, quiet operation.

228 ASCII Characters, handles 4" to 10" paper

STANDARD CENTRONICS INTERFACE

VALUE PACKED AT D1174 $499.50

INTERFACE CABLE TO SUIT MICROBE D1190 $45.00

SPARE RIBBON D1175 $12.50

CENTRONICS PLUG

36 WAY D1192 $14.95

When you buy one of our printers you'll need a centronics plug. If you are a MICROBEE USER, have a look at our INTERFACE KITS on the opposite page.

UK MADE GOLD PLATED D RANG CONNECTORS

SAVE 25% ON BULK QUANTITIES!

SOFTWARE

JUST PHONE OR WRITE & ASK
WE'LL SEND YOU OUR SOFTWARE CATALOGUE

HONEYSOFT • MYTER • DREAMCARDS

The all new MICROBEE IC has got to be the most value packed low price personal computer available today. New enhanced BASIC enables 64 x 16 or 80 x 24 screen format while networking and the clock speed is now a snippy 2.375 MHz with over 512K worth of software included in the box. The absolutely dazzling wordreverser word processor package or editor assembly

Screen Format 64 x 16 OR 80 x 24 WHILE NETWORKING EG. USED AS A TERMINAL

The all other exciting features that have made the MICROBEE famous.

D1020 16K IC $499.00
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ARCADE GAMES, BUSINESS AND EDUCATIONAL APPLICATIONS

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BANKCARD JET SERVICE DELIVERY NEXT DAY

NEXT DAY DELIVERY

VIA JET SERVICE
(CAPITAL CITY & SUBURBAN AREAS)

ADJUSTABLE AZIMUTH DATA CASSETTE

At last a Data Cassette Recorder/Player you can afford. The Micron D1120 is fully adjustable azimuth (absolutely essential in our opinion) and incorporates tailored audio frequency response audio stage together with low distortion. Now you can save and load software in your Micro with confidence.

WHY PAY OVER $80?

D1140 C10 Data Cassette Tape $1.10
D1141 C20 Data Cassette Tape $1.20

D1120 Micron Data Cassette $49.50

GREEN PHOSPHOR MONITOR

12" SCREEN - 10-20 MHZ BANDWIDTH

SCREEN INVERT - 240VAC OR 12VDC OPERATION

12 VDC/1.1A Power

HIGH RESOLUTION

MICRON 12

MICRON 12 HIGH RESOLUTION Green Phosphor Monitor has a reverse or invert screen function where by simply rotating the control knob clockwise the screen information and background are reversed. This is especially valuable in poor lighting conditions. Amazing Definition Incredible value.

D1112 $199.50 See Review June EA, P. 137

THE FANTASTIC MICROBEE IC HAS ARRIVED

NEW 3.375 MHZ CLOCK SPEED

The new MICROBEE IC has got to be the most value packed low price personal computer available today. New enhanced BASIC enables 64 x 16 or 80 x 24 screen format while networking and the clock speed is now a snippy 2.375 MHz with over 512K worth of software included in the box. The absolutely dazzling wordreverser word processor package or editor assembly

Screen Format 64 x 16 OR 80 x 24 WHILE NETWORKING EG. USED AS A TERMINAL

The all other exciting features that have made the MICROBEE famous.

D1020 16K IC $499.00
D1035 32K IC $599.00

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A SINGLE BOARD CP/M COMPUTER
"THE LITTLE BIG BOARD"
64K on board RAM, 280A based running at 4Mhz (top speed) Floppy disk controller, Real time clock.

That's right, a fully configured 280A computer running at maximum capacity, on a single PCB, on board disk controller, floppy drive up to four, double sided, double density drives either 8 or 5.2, by RS232 or ports, both may be software configured, use one for a terminal or modem etc. battery backed real time clock software accessible for automatic saving of documents, timing during games. Fully 170 bus compatible — choose from thousands of really available disk or cartridge.

KIT FEATURES
Versatile, from the worlds Bootstrap Monitor Software Configured, Controller, modems, etc.

**PCB**
- Microbee 16 & 32 IC's
double sided, plated through holes, 126 pin IC, 1000 bass operation through plug in... included (I/O Ports, memory, etc.)
- 4K KEEK.
- CP/M diskettes...
- Integrated RAM, Z80A, Z80B
- Printer interface kits...
- SOFTWARE SELECTABLE...
- ULTIMATE MICROBEE 16 & 32 IC's double sided, plated through holes. Complete set of IC sockets.
- Double sided board through holes PCB....
- Solder mask and determined.
- The Microbee kit comes complete in every way.
- Double sided, plated through holes.
- Assembled connection lead to Microbee.
- Fully documented.
- Cassette monitor included (plus sourcecites).
- **THE MICROBEE KIT OF 1983**

**CABLES**
- Simple kit to build — takes about 20 minutes, save on the cost of a bulk interface and save the cost of a serial printer.

**EPROM PROGRAMMER**
- **K9668**
- Versatile, low cost and easy to build.
- 270A, 2716, 2716N, 27326 and 27326N.
- Your own programs and eliminate cassette supply forever.
- Now only $5.00...

**RADIOFREQUENCY DECODER**
- K9733
- New Review.
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**MICROBEE LIGHT PEN**
- K9649
- $19.95...

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- K9733
- $24.50...

**KIT SUPPORT FOR THE MICROBEE**

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44K OF PROGRAM STORAGE * FULLY SOFTWARE SELECTABLE * SUITS BOTH IC AND PLUS MACHINES * 8 OUTPUTS FOR CONTROL APPLICATIONS *

A sensational new kit for the Microbee requires no modification to the computer except for the lifting of a 50 pin expansion socket. This project is easy to build and will allow you to store and software select up to 44K of eprom storage — just like a mini disk drive system with the speed of RAM. Extra units may be added to further increase storage.

**PRINTER INTERFACE KITS FOR THE MICROBEE**

PARALLEL TYPE

**BUILD YOUR OWN INTERFACE AND SAVE $55**
A simple kit to build — takes about 20 minutes, save on the cost of a bulk interface and save the cost of a serial printer.

**K9767**
- (Only)...
- $17.50...

**K9768**
- Versatile, low cost and easy to build.
- 270A, 2716, 2716N, 27326 and 27326N. Your own programs and eliminate cassette supply forever...

**K9769**
- $499...

**CP / M Diskettes**
- 8 9600 baud.
- $150...
- 16 9600 baud.
- $300...

**50 PIN EXPANSION SOCKETS**
- Right angle type to suit Microbee, floppy disk controllers etc.
- Mounts on PCB and mates with IC sockets.

**K9671**
- $29.95...

**K9672**
- (Only)...
- $17.50...

**K9673**
- $99.50...

**K9679**
- $7.50...

**K9680**
- $8.50...

**K9681**
- $10...

**K9682**
- $7.50...

**K9690**
- $55.00...

**K9733**
- $19.95...

**K9649**
- $19.95...

**K9734**
- $26.50...

**FOR DESPATCH P&P CHARGES AND ADDRESS DETAILS PLEASE REFER TO OUR AD. ON PAGE 95**
Remember the 'good old days' of amateur radio? When an amateur built his own gear - and was so proud of it!

Sadly, those days passed. With incredible advances in technology, it became economically and technically impossible to compete with commercially built equipment.

Now home brewing is here again! And what's more, with the all-new Dick Smith UHF Explorer, you'll end up with a transceiver less than the cost of a commercial unit - and not just as good, it's better!

YES! A completely up-to-the-minute design featuring phase-locked-loop frequency synthesis.

**Exclusive to Dick Smith Electronics**

Unit shown is fitted with optional upgrade kit.

---

**WE APOLOGISE . . .**

Hundreds of amateurs have wanted this outstanding new kit . . . far more than we could supply! Now for the good news:

We've made up more kits for distribution to our stores and mail order centre. Be warned - some parts are still pretty scarce so we haven't been able to make all the kits we wanted to. To avoid further disappointment, order your kit NOW!

And for those waiting for the upgrade kit . . .

It's now available! Yes, you can give your transceiver full 438-439MHz repeater capability with standard 5MHz offset, PLUS 'S' meter, and a brand new front panel to suit. Once again, supplies of this kit will initially be limited so hurry in and get yours now!

**SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Frequency Coverage</th>
<th>438.025-439.000MHz in 25kHz steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Channels</td>
<td>40</td>
</tr>
<tr>
<td>Mode of Operation Supply</td>
<td>FM</td>
</tr>
<tr>
<td>Receiver Sensitivity</td>
<td>13.5v DC. Receiver 340mA with full audio output and all options. Transmitter 2A more (5 watt output)</td>
</tr>
<tr>
<td>Receiver Selectivity</td>
<td>0.4uV for 20dB quieting</td>
</tr>
<tr>
<td>Adj. Chan Reject Transmitter Power Output Deviation Spurious Emissions</td>
<td>+/-7.5kHz - 6dB, +/-15kHz - 60dB, Better than 80dB</td>
</tr>
<tr>
<td>TRANSMITTER</td>
<td>5W (typical)</td>
</tr>
<tr>
<td>Deviation</td>
<td>+/-5kHz</td>
</tr>
<tr>
<td>Spurious Emissions</td>
<td>Better than -60dB</td>
</tr>
</tbody>
</table>

**DICK SMITH EXPLORER UHF TRANSCEIVER**

**ONLY $199**

Cat K-6300

**OPTIONS AVAILABLE:**

- Upgrade Kit (Cat K-6302) (Repeater, S meter, additional atal, user & new front panel) **ONLY $24.50**
- Antenna Kit (Cat D4014) (1/4 wave stainless steel whip, co-axial fed UHF antenna base. PL-259 plug. 3.5m low-loss UHF co-ax, gutter grip mount and cutting instructions) **ONLY $24.50**

**DICK SMITH ELECTRONICS**

Full address details on page 16 (Stocks may still be limited in some stores).
VHF/UHF RECEIVER FEATURES
CONTINUOUS COVERAGE OVER
25-550 MHz

Featuring three reception modes and continuous coverage from 25 MHz to 550 MHz, the AR-2001 communications receiver just released by Emona Electronics is a combination programmable receiver and scanner that takes up where the usual ‘communications’ receivers leave off.

The three reception modes are: narrowband FM (NBFM) of ±7.5 kHz deviation, wideband FM (WBFM) of ±50 kHz deviation, and AM for modulation bandwidths to 50 kHz. The AR-2001 covers from 25 MHz to 550 MHz in 5 kHz, 12.5 kHz or 25 kHz steps. Twenty memory channels can be programmed and scanned at will or you can scan across selected bands by programming the upper and lower limit frequencies. Scanning rate is given as five channels per second.

The unit is powered from a 12 Vdc source, either battery or mains plugpack. The display is a liquid crystal type that shows reception mode, channel number and frequency. The receiver is a triple-conversion type with a crystal-controlled frequency synthesised local oscillator.

Performance specifications are quite good, sensitivity being given as 0.3 µV for 12 dB SINAD on NFM, 1 µV for 12 dB SINAD on WFM and 0.5 µV for 12 dB SINAD on AM. The squelch threshold is quoted as 0.2 µV on AM and on NFM, 2.5 µV on WFM.

The AR-2001 measures a compact 158 mm wide x 80 mm high x 200 mm deep overall and has the front panel angled upwards making it suitable for either under-dash or benchtop mounting. An internal speaker is included. Audio output is given as one watt.

We had the AR-2001 for a brief review at ETI and found it a very good performer indeed. Sensitivity proved excellent and we found few troublesome spurious responses. It sure pulls-in the signals and the audio sounds clean.

 Programming it is quite easy and the sensor-touch elastomeric keyboard has a positive feel. Priced at just under $700, it represents good value for money, especially considering the continuous coverage it offers.

For complete details on the AR-2001, contact Emona Electronics Pty Ltd, P.O. Box K21, Haymarket NSW 2000. (02)211-0531.

MARINE
‘HANDY TALKY’

The Nirecom model NR-6000 VHF FM marine handy talky has been released by G.F.S. Electronic Imports. They claim that at $366 it is possibly the lowest cost VHF marine transceiver available in Australia.

The Nirecom NR-6000 is approved by the Department of Communications and is supplied complete with a set of crystals for channel 15, the emergency calling channel. It is capable of having six channels installed including those of the Seaphone service.

Other standard accessories are rechargeable NiCd batteries, ’rubber duck’ whip antenna, battery charger and a carrying case and earphone.

The NR-6000 is small enough to fit in a coat or life-jacket pocket and its receiver sensitivity is extremely high. For further information, contact G.F.S. Electronic Imports, 17 McKeon Road, Mitcham Vic. 3132. (03)873-3777.

ETI November 1983 – 135

DESTRUCTION-PROOF
AERIAL FROM SCALAR

The Scalar Model LPA4, a low-profile automotive aerial specifically designed for use where an antenna of normal length would be prone to damage, has been released by Scala Industries.

The antenna incorporates a plastic weatherproof ultra-violet light-inhibited radome. It is carwash-proof, and designed to resist deliberate attempts at destruction.

Ground independent, it will operate on both metal and glass-fibre bodies, on the UHF mobile radio band.

The LPA4 comes complete with an RG58 cable tail or, as an option, can be fitted with a connector in the base to enable the use of a lower loss cable.

A rubber gasket is provided for mounting the antenna.

Meanwhile, Scalar Industries is releasing a new range of antennas to complement the extended 1500 GHz frequency operation range of its UHF coaxial base.

The further development to the coaxial base — patent number PF5532-82 — has provided what Scalar Industries describes as a new concept in ground-independent antennas for mobile use, particularly at frequencies above 500 MHz.

The four new antennas are the GRHC high-band VHF (148-174 MHz), GRNC red (450-470 MHz), GRNC blue (470-500 MHz) and GRNC green (500-520 MHz). The frequency range encompasses all VHF and UHF bands to 1500 MHz.

For further details, contact Scalar Industries, 20 Shelley Avenue, Kilsyth Vic. 3137 (03)725-967.

Communications NEWS
25 W INSTRUMENTATION AMP

A new 25 W class A linear amplifier covering 1 MHz to 500 MHz from ENI is claimed to represent a major achievement in instrumentation amplifier design.

ENI's Model 525LA is a solid-state design that features a gain of 50 dB and is claimed to be unconditionally stable. It will operate continuously into any load impedance including an open or short circuit, according to the makers.

For those applications where slightly higher distortion levels can be tolerated, the unit is claimed to deliver more than 40 W from 1 MHz to 50 MHz and over 35 W to 500 MHz.

The unit is ruggedly built and includes a power supply and forced air cooling. It operates from either 115 or 230 Vac. Input and output impedances match to 50 ohms.

ENI claims the wide frequency range and linear phase response makes the unit ideal for amplifying AM, FM, SSB or TV signals. It can be used to raise the power output of a signal or sweep generator.

Applications include RFI/EMI susceptibility testing, communications system testing and design, as a laser modulator driver, for power meter calibration, in NMR spectroscopy, as a linear accelerator driver and for general laboratory instrumentation.

For more details, contact Elmeasco Instruments, P.O. Box 30, Concord NSW 2137. (02)736-2888.

VIGILANT TO G.F.S.

Vigilant Communications Ltd of the UK has appointed G.F.S. Electronic Imports as their Australian distributor.

Vigilant manufactures a wide range of commercial and marine high frequency communications receivers covering 50 kHz through to 30 MHz.

Top of the range are Vigilant's microprocessor receivers, the SR-532 (military) and the SR-539 (marine). Both units feature a 200-channel memory and full remote control features via a modern and single pair line.

The model SR-500 marine receiver covers the frequency range of 50 kHz to 30 kHz in 100 Hz steps. It also has six programmable memory channels and is designed to operate across a temperature range of -15°C to +55°C.

The SR-500 is priced at $3196, plus tax. For further information, contact G.F.S. Electronic Imports, 17 MeKean Road, Mitcham Vic. 3132. (03)873-3777.

Just for Listening!!!

SAIKO SC7000
Computerized Programmable Scanning Receiver

AMAZING FUNCTIONS . . .

- 70 Memory channels
- Scans the Aircraft Band, the UHF Band and the VHF (High and Low) Band
- 2.5 KHz channel steps on VHF and Aircraft Bands
- 240 volt and 12 volt operation.
- Tape Recording Connections

You may want to listen for many reasons... whatever the reason, the SAIKO SC7000 offers a truly "state of the art" receiver with microprocessor technology and far more features than competitive receivers.
WE'RE NO. 1 FOR NEW PRODUCTS TOO!

NEW

WELLER CONTROLLED TEMPERATURE DESOLDERING TOOL

FITS WTCP WELLER IRONS

Only $39.50

This unit allows you to use your Weller WTCP Soldering iron to safely desolder temperature sensitive components. Shielding iron NOT included.

WELLER INSTRUMENTS

NEW

MACHINED PIN GOLD CONTACT IC SOCKETS...

Extensive, but the best for professional work. Each pin is machined out of solid material (not punched out of a flimsy sheet). High quality heat and plating inserts from the socket end of the pin. The pins are then precision moulded into a high quality plastic housing. Ideal for use in equipment where high field service exists or where high reliability is essential.

PI No. Desc. 1-9 10+ 12
PI 6452 8 Way Socket $0.90 $0.80
PI 6454 14 Way Socket $1.75 $1.00
PI 6456 18 Way Socket $2.15 $1.75
PI 6458 20 Way Socket $2.45 $1.85
PI 6640 28 Way Socket $3.05 $2.15
PI 6642 32 Way Socket $3.30 $2.35
PI 6644 36 Way Socket $3.25 $2.10
PI 6606 40 Way Socket $3.25 $2.15

NEW

UNIQUE TO-3 BUSH ASSEMBLY

TO-3 bush assembly. Why wasn't it thought of before? This moulded one piece plastic component replaces the loose TO-3 insulator bushes and insulates the stud terminal and two feeder connections from the surrounding chassis. Can also be used as a TO-3 marking template!

PACK OF 4 ONLY $1.00

NEW

AMATEURS PLEASE NOTE

$39.95

GOLD PLATED WIRE WRAP SOCKETS

24 and 40 pin quality. A must for high cost LSIs.

Cat. 61519 24 pin $4.95 - $4.50 10+ $4.25 $3.90 12

Cat. 6530 40 pin $6.95 - $6.25 10+ $6.00 $5.75 12

NEW

SLASHED $3

UHF AMPLIFIER SENSATION

SLASHED TO $7.95

EPROM 2708

MN3001 BUCKET BRIGADE

This has been used in many projects lately and has been very hard to get. There are now available from us at a lower than normal price.

November only $15.50 each - Cat. ZK-8201

STAGGERING VALUE! ONLY $39.95! - Cat. ZK-8882

NUMBER 1 FOR KITS

POST AND PACKING CHARGES

$5 - $9.99 (5kg) $10 - $24.99 ($3.20)

$25 - $44.99 (5kg) $50 - $89.99 (10kg)

"Low Insurance for Road Risk" Registered Post over $200

All heavy or bulky items (over 20kg) sent courier Road Freight $12.00 anywhere in Australia.

SHOP HOURS CARLINGFORD, CONCORD & HURSTVILLE

Mon - Fri 9am - 5:30pm Sat - Sat 9am - 5:30pm Thurs night 6-8pm

SHOP HOURS SYDNEY

Mon - Fri 9am - 5:30pm Sat - Sat 9am - 5:30pm Thurs night 6-8pm

MAIL ORDERS AND CORRESPONDENCE: BOX 3535 HAYMARKET, SYDNEY 2000

Jaycar Incorporating ELECTRONIC AGENCIES

SYDNEY SHOWROOMS

111 YORK ST. - PHONE: 02) 264 9668 and 02) 267 1614
CARLINGFORD Cell: 02) 872 4444
CONCORD 115 - 117 PARRAMATTA RD. - PHONE: 02) 745 3077
HURSTVILLE 121 FOREST RD. - PHONE: 02) 570 7100

Jaycar

November 1983
M2896-63 THE MITSUBISHI RANGE OF DISK DRIVES
Slemite 8" Disk Drive, Double Sided, Double Density. No AC Power required. 3mm track to track. 1.5 mbabytes unformatted. 77 tracks/track. 10mb bit soft error rate.
$495 + tax. Box & Power supply to suit $105 + tax.

M2964 Standard size 6" drive. Double sides, double density. 3mm track to track access, 1.6 mbabytes unformatted. 77 tracks/track. 10mb bit soft error rate.
$475 + tax. Box & Power supply $105 + tax.

M4584 Slemite 5¼" disk drive, double density, 12 tracks, 640 mbabytes. 1.6 mbabytes unformatted. 3mm track to track access, 77 tracks/track.
$365 + tax. Box & Power supply $75 + tax.

LINEAR REGULATORS

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<td>7814</td>
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Hi-technology products and experience

10% off all Verbatim Discs for November
Offer ends November 30, 1983.

VERBATIM DISCS

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8½" VERBATIM

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<td>FD34-8000</td>
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</tr>
</tbody>
</table>

100MHz Probe Sets, great value @ $23.00 + tax

PROBE ACCESSORIES

Trios

CS1560 ALL CROS.

$445.00 + Tax

11% OFF ALL PRICES PLUS 25% TAX. TRANSISTORS PLUS 35% TAX. POST 2 HEAVY ITEMS EXTRA

Minimum mail order $20.00.
JUST RELEASED
WORLD'S FIRST
3 IN 1
• 3 Mode SCANNER
• 3 Mode COMMUNICATION RECEIVER
• 3 Mode VHF-UHF Monitor

FEATURES:
• 25-550 MHz continuous
• NBFM — for communication
• WBFM — for BC & TV monitoring
• AM — for Air band monitoring
• 20 CH memory
• Priority Channel
• Clock

Now you can listen to signals denied to you by all other scanners — Space shuttle, military and satellite comm. and many others!

SPECIFICATIONS:

| Frequency Range: 25MHz - 550MHz Continuous |
| Search Frequency Increments: 5KHz, 12.5KHz, 25KHz |
| Mode: Narrow band FM, Wide band FM, AM |
| Number of Memory Channels: 20 including Mode Informations |
| Sensitivity: Narrow FM 0.3uV, Wide FM 1.0uV, AM 0.5uV |
| Threshold Squelch: NFM 0.2uV, WFM 2.5uV, AM 0.2uV |
| Selectivity: NFM ±7.5KHz @600, ±20KHz @700 |
| WFM ±50.0KHz @600, ±250KHz @600 |
| AM ±5.0KHz @600, ±10KHz @700 |
| Spurious and Image Rejection: -50dB |
| Modulation Acceptance: NFM ±7.5KHz, WFM ±50KHz, AM 100% |

SWI FEES:
IF Frequencies: 1st IF 750MHz, SAW Filter
2nd IF 45.0275MHz, Crystal Filter
3rd IF 4.550kHz, Ceramic Filter
Reference Oscillator: Crystal Controlled
Scanning Rate: Approx. 5 Channels per Second
Search Scanning Rate: Approx. 6 Seconds per mega-Hertz
Scan Delay: Normal. Approx. 1 second
Search Delay: Approx. 2.5 seconds
Priority Sampling Rate: Approx. 2.5 seconds
Audio Output: 1W @12% or less Distortion
Speaker (Internal): 8 Ohms
Power Requirements: 12V - 14V DC
Frequency and Message Readout: LCD Type
FCC Certified: Part 15 Subpart C
Size: 138mm Wide x 80mm High x 200mm Deep
Weight: 1.1 kgs

AR-2001 ONLY $699
INCL. TAX

DEALER ENQUIRIES WELCOME
Here is the second part of our computer-sorted listing of frequency channels and the services that occupy them, for hobbyists and services interested in monitoring communications activity on the very high frequency bands. This portion of our list covers from 100 MHz, at the top end of the FM broadcast band, through to 400 MHz, just below the amateur 70 cm band. Our complete list has been compiled from a variety of sources, generally publicly available, and cross-checked where possible. We would welcome additions and corrections, if you know of them.

The listing is presented state by state, as before, with the channels listed in ascending frequency. The modulation mode is indicated in the second column — FM stands for frequency modulation, AM for amplitude modulation, SSB for singlesideband and CW for morse identification (on beacons). Brief details of the service using a particular channel is given in the last column. Note that some channels are shared but the services may be geographically separated. A number of channels for New Zealand Services are listed under National as, under enhanced propagation conditions, they may be widely heard.

As with Part 1, this section of the spectrum is used by many emergency and disaster services, particularly bushfire brigades, and listening on appropriate channels can give timely prior warning of events in your area.

Note that the 'maritime' channels around 156 MHz are commonly used nationally and activity may be heard in the vicinity of almost any major port, although they are only given in state listings here.

<table>
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**ACT**

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**NATIONAL**

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**METEOR (RUSSIAN) WEATHER SAT.**

**ATMOSPHERIC SATELLITES**

- ATM-1 GEOSTATIONARY SATELLITE
- ATM-2 SATELLITE DOWNLINK
- ATM-3 SATELLITE DOWNLINK
- ATM-4 SATELLITE DOWNLINK
After this flight I think I'll write a book, called... The Earth Beneath Me!

As reported elsewhere in this issue, ETI's ex-Managing Editor, Collyn Rivers, flew to Boston last month to study Wang's extraordinary new image processing computer.

Boston being on the opposite side of the world from Sydney, it occurred to Collyn that he might as well make a slight detour to call on one of the overseas editions of ETI (which, for reasons which will become clear shall be nameless).

Whilst he was there the following conversation took place between an advertising sales representative and the editor.

Adrep: "The last issue had too many left hand pages."
Editor: "You mean too many adverts on left-hand pages?"
Adrep: "No, too many left-hand pages — the previous magazine I sold used to have equal numbers of left and right hand pages — ours should be the same."
Editor, having taken several deep breaths and handed Adrep the previous issue:

"Well why don't you sit down and count them?"

Adrep, having completed counting: "Well I guess this one seems about equal — but I tell you most issues have too many left hand pages!"

Our accountant, affectionately known as 'The Bean Counter', commented that he felt much the same about the Australian edition — with the proviso that it had too many right hand pages as well!
Ladies and gentlemen, be seated.

(While you tune your receiver)

The best place to tune your receiver is where you listen to it, sitting down.

And with the new Yamaha R100 you can do exactly that.

Its unique remote control gives you push button command over the R100’s Computer Controlled Sound System which allows you to select from five different preset frequency response curves.

And that’s in addition to all input functions like phono, video auxiliary, tuner and both tape monitors as well as remote selection of any one of ten preset AM and FM stations.

The tuner itself has Computer Servo Lock Tuning to automatically select the optimum signal, a Dynamic Noise Canceller for exceptionally quiet, noise free reproduction from tape, disc or tuner and a Stereo Spatial Expander to broaden the total stereo sound field.

The new Yamaha R100 is literally the ‘state of the art’ in stereo receivers, a phrase often used by others but a level of perfection only Yamaha builds to.

And as with all Yamaha audio equipment, the R100 is covered by Yamaha’s unique 5 year full parts and labour warranty.

For a free brochure on the remarkable Yamaha R100, see your Yamaha dealer or clip the coupon below.

Post to: Yamaha R100 Receiver Brochure, Rose Music Pty. Ltd. 17-33 Market Street, South Melbourne, Vic 3205.

Name .................................................................

Address ..................................................................

Postcode ............................................................

...
Hear digital perfection.

Introducing the Sony Compact Disc Player.

When we used our long experience in digital technology to create the CDP-101 Compact Disc Player, we wanted to give you something more than the world's clearest sound.

**WIRELESS REMOTE CONTROL** Full-function remote control.

**3-WAY MUSIC SEARCH** Instant direct access to any selection with the 10-key pad on remote control unit. AMS (Automatic Music Sensor) allows access to the beginning of next or previous selection. 2-speed bi-directional search to find any desired music passage.

**REPEAT FUNCTION** Program to repeat the entire disc, one selection, or a specific portion of music.

**3-FUNCTION DIGITAL READOUT DISPLAY** Selection number. Time lapse of selection being displayed. Remaining time on the disc.

**LINEAR SKATE DISC LOADING** Just press the button, platter control and cueing are automatic.

Get even more perfect sound with the Sony Digital Audio Component System, "Precise Series".