NOVEMBER 1983 $2.35* NZ$2.75

eti

ELECTRONICS TODAY INTERNATIONAL

SPECIAL OFFERS

Beti terminal

Texas Instruments printers

ROBOTS

they're here!

...for home, education and personal use.

Microbee multiPROM interface

VIC-20 program potpourri

Yamaha MT44 home studio

Perreaux hi-fi system

New 25-550 MHz scanner

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

Without paying top dollar.

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."

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

Add the ADE devices and make it work for you.

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

DT11

DMP40

DMP29

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.

ADE

P.O. BOX 422, CLAYTON, VICTORIA 3168, AUSTRALIA. PHONE: (03) 544 3444. P.O. BOX 341, PENNANT HILLS, NSW 2120, AUSTRALIA. PHONE: (02) 848 8533. Adelaide: 46 4062. Perth: 387 6055. Hobart: 34 4522. Canberra: 58 1811. Brisbane: 352 5788. Newcastle: (049) 63 3918. Wellington: 69 3008. Auckland: 59 0249. Christchurch: 4 3001. Darwin: 81 2712. Singapore: (65) 449 4433. Bendigo: (054) 42 4322. Wangaratta: (057) 21 6443.

EDITOR
Roger Harrison VK2ZTB

ASSISTANT EDITOR
Jennifer Whyte B. App. Sc.

EDITORIAL STAFF
Geoff Nicholls B.Sc./B.E.
Jane Nicholls

ASSOCIATES
David Tilbrook VK2YMI
Jonathan Scott
B.Sc./B.E. (Hons) VK2YBN

DRAUGHTING
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PRODUCTION
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ADVERTISING SALES
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ART STAFF
Ali White B.A.
Bill Crump
Dean Shirley

READER SERVICES
Carmel Gatt

ACOUSTICAL CONSULTANTS
Louis Challis and Associates

HEAD OFFICE
140 Joynton Avenue, (PO Box 227)
Waterloo, NSW 2017.
Phone: (02) 663-9999 Sydney.
Telex: 74488, FEDPUB.

ADVERTISING OFFICES AND AGENTS:

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

South Australia and Northern Territory: The Admedia Group, 24 Kensington Road, Rose Park, SA 5067. Phone: (08) 332-8144 Adelaide. Telex: 82182, ADMDIA.

Queensland: Geoff Horne Agencies, 16 Bellbowrie Centre, Bellbowrie, Qld 4070. Phone: (07) 202-6813 Brisbane.

Western Australia: Cliff R. Thomas, Adrep Advertising Representative, 62 Wickham Street, East Perth, WA 6000. Phone: (09) 325-6395 Perth.

New Zealand: Chris Horsley, 4A Symonds Court, Symonds Street, Auckland. Telex: 260753, TEXTILE.

Britain: Peter Holloway, John Fairfax and Sons (Australia) Ltd, Associated Press House, 12 Norwich Street, London EC4A 1BH. Phone: (01) 353-9321 London. Telex: 262836, SMHLDN.

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

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FEATURES

SIGHT & SOUND

COMPUTING TODAY

TECHNICAL

COMMUNICATIONS

GENERAL

WE are a No.1 Kit Supplier

SERIES 5000

As designed by ETI

PRICES SLASHED Till end of Nov. '83

PREAMPLIFIER

PRICES SLASHED this month only

~~$269~~ $239

SPECIFICATIONS

Frequency response:	High-level input: 15Hz-130 kHz, +0, −1 db Low-level input — conforms to RIAA equalisation, ±0.2 dB
Distortion:	1kHz <0.003% on all inputs (limit of resolution on measuring equipment due to noise limitation).
S/N noise:	High-level input, master full, with respect to 300 mV input signal at full output (1.2V): >92 dB flat > 100 dB A-weighted. MM input, master full, with respect to full output (1.2V) at 5 mV input, 50 ohm source resistance connected: >86 dB flat >92 dB A-weighted. MC input, master full, with respect to full output (1.2V) and 200 μV input signal: >71 dB flat >75 dB A-weighted.

POWER AMPLIFIER

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

SPECIFICATIONS

Power output:	100W RMS into 8 ohms (±55 V supply).
Frequency response:	8 Hz to 20 kHz, +0−0.4 dB 2.8-Hz to 65 kHz, +0−3 dB. NOTE: These figures are determined solely by passive filters.
Input sensitivity:	1V RMS for 100W output.
Hum:	−100dB below full output (flat).
Noise:	−116 dB below full output (flat, 20 kHz bandwidth).
2nd harmonic distortion:	<0.001% at 1 kHz (0.0007% on prototypes) at 100 W output using a ±56 V supply rated at 4 A continuous. <0.003% at 10 kHz and 100 W.
3rd harmonic distortion:	<0.0003% for all frequencies less than 10 kHz and all powers below clipping.
Total harmonic distortion:	Determined by 2nd harmonic distortion (see above).
Intermodulation distortion:	<0.003% at 100 W. (50 Hz and 7 kHz mixed 4:1).
Stability:	Unconditional

Price Slashed ~~$299~~ $279

THIRD OCTAVE GRAPHIC EQUALIZER

SPECIFICATIONS E.T.I. Dec. 1982

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

1 unit $179
2 units $355

MX-1200 MICROPHONE/AUDIO MIXER

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

~~$699~~

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

FADER & CONTROLLERS
12 channel fader: Slide, 60mm, LOG 25%
2 Master fader: Slide, 60mm, LOG 15%
12 F/B Volume, 300, LIN
1 F/B Master level, 300, LIN
12 Effect Send, 300, LIN
1 Effect Return, 300, LOG 15%
2 Phono, 300 LOG 15%
1 Head Phone, 300, LOG 15%
S/N, 58DB
FREQUENCY RESPONSE 20-20 KHz
TOTAL HARMONIC DISTORTION. Less than 0.1%
METERS 2 illuminated VU Meters 0db = 0.775V
PEAK INDICATOR 12 LED Peak Indicators
VOLTAGE 240 VAL 50Hz
POWER CONSUMPTION 7.2 watts
DIMENSIONS. 620 (W) x 385 (D) x 108 (H) mm
(supplied complete with carrying case)

EXTRA FEATURES OF OUR KITS

POWER AMPLIFIER

KIT PRICE $299 P&P $8.00

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

only $425

**All parts available separately for both kits.*

PREAMPLIFER

KIT PRICE $259 P&P $8.00

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

only $425

Errors and omissions excepted.

Bankcard mail orders welcome

ORDER FORM

Please Debit my Bankcard

No.....

Expiry Date.....

Name.....

Signature.....

ROD IRVING ELECTRONICS

2 BRANCHES:

425 High St. Northcote, Ph.: (03) 489 8131
48-50 A'Beckett St. Melb. Ph.: (03) 347 9251
Mail orders: P.O. Box 235 Northcote, Vic. 3070

ADVERTISERS' INDEX

COMMENT

"We must make our choice between economy and liberty, or profusion and servitude."
— Thomas Jefferson

IT'S TIME TELECOM took its head from the 'sands 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 'freeing 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 amongst 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 it 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 Harrison
Editor

NEXT MONTH

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 8 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 'Bee's parallel port. Complete with software.

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

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AUSTWIDE

NEXT DAY DELIVERY

ALTRONICS 008-999-007

VIA JETSERVICE
(CAPITAL CITY & SUBURBAN AREAS)

ALTRONICS • BANKCARD JETSERVICE DELIVERY NEXT DAY • ALTRONICS • BANKCARD JETSERVICE DELIVERY NEXT DAY • ALTRONICS • BANKCARD JETSERVICE DELIVERY NEXT DAY • ALTRONICS

GO ANYWHERE 12-240V POWER

MASSIVE 300 WATTS

These great inverter kits enable you to power 240V appliances from a 12V DC power source. Tremendous for camping, fishing etc. Install into your Car, Boat or Caravan.

A fully regulated and overload protected design, featuring XTAL locked frequency. Use to power hi-fi, TV sets, even electric drills for short time periods.
MANY OF THESE KITS ARE NOW IN USE FOR EMERGENCY LIGHTING PURPOSES.
ALTRONICS' KIT features – Gold plated edge connector and PCB buss – Low age rate XTAL – Sockets for all IC's – High Efficiency Transformer.

K6750..... (EA JUNE '82) ... **$199.50**

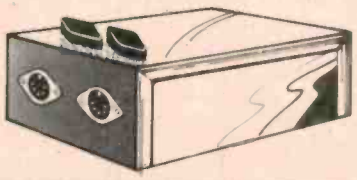
($10 DELIVERY AUSTRALIA WIDE)

TWO GREAT 40 WATT MODELS

GENERAL PURPOSE

Suits small appliances, ie. Turntables, Tape Decks, Shavers etc. Variable frequency adjustment enables speed control of turntables. Works as a trickle charger when mains power is available.
EASY CONSTRUCTION VALUE PLUS

K6700..... **$55.00**



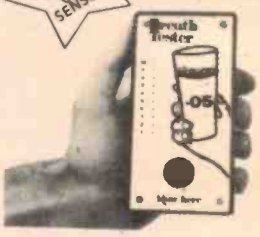
FLUORESCENT LIGHTING

Operates above the audible frequency range and is capable of driving one 40 watt or two 20 watt fluorescent tubes to 150% of their normal 240V efficiency. Install permanently into caravans. **COMPLETE BOXED KIT, INCLUDING ALL WINDING WIRE.**

K6505..... **$37.50**

GENUINE FIGARO GAS SENSOR

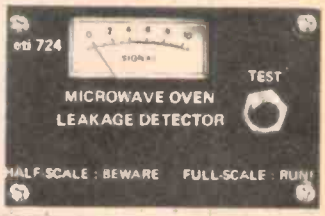
ALCOHOL BREATH TESTER



K1583 ONLY **$29.95** (SEE EA MAY 1983)

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

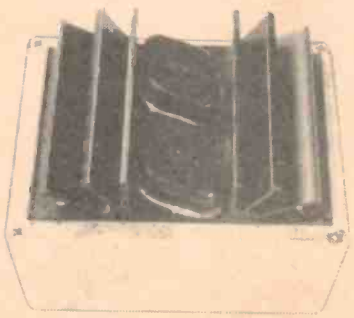
MICROWAVE OVEN LEAK DETECTOR



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**

TRANSISTOR ASSISTED IGNITION WITH DWELL EXTENSION



The Altronics Kit includes all components for the modifications, detailed by Electronics Australia Feb. 1983.
Yes, it's bad enough paying $2.00 a gallon for petrol without wasting a fortune on an out of tune engine. Fit this transistor assisted ignition kit in minutes and start saving money from the very next petrol stop. Easy to build!

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

POWER DOWN
MAINS APPLIANCE TIMER
(ETI JULY '82)

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

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

See EA November, 1982

POWER UP

A MUST FOR YOUR COMPUTER SYSTEM

This great new Project from EA is the answer to a Maidens Prayer.
What Does it Do?
A single 240v mains plug and lead feeds one unswitched master 240v outlet plus 4 switched 240v outlets. With say a hi-fi system, plug your main equipment item (e.g. Amp) into the master outlet and whenever you "switch on" your amp – presto – mains power is applied to the other 4 outlets i.e. simply "turning on" your amp turns on your tape cassette, tuner, turntable, graphic equaliser without mains spikes, plops etc.
Just the shot for your Computer System. The Altronics Kit includes case and all outlets.

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

• FOR DESPATCH P&P CHARGES AND ADDRESS DETAILS PLEASE REFER TO OUR AD. ON PAGE 95

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 Altronic's 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 etd, or for computer demonstrations.

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

K5830..... Only..... **$45.00**

SINGLE OUTPUT

INVERSE AND NORMAL OUTPUT
Brilliant new kit from EA. **Super cheap** and **Super Effective.** Whilst our K5830 is suitable primarily for VCR use this video amplifier is best suited to use with computers. The EA documentation supplied is extremely well written and provides details for installation into television sets.

NO MORE SMEARY COLOURS, SIGNAL BEATS OR RF INTERFERENCE

NOTE • NOT SUITABLE FOR USE WITH LIVE CHASSIS TV SETS.

K5850..... **$14.95**

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

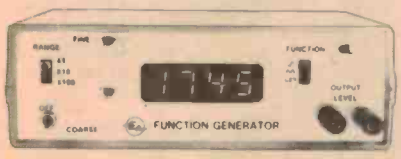
Synthesize realistic stereo from virtually any monophonic source by simply connecting this unit between the source and your stereo amplifier.

- Quality Phillips MN3001 (not second source dropout).
- 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 solar.

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

K5810..... **$55.00**

FUNCTION GENERATOR



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

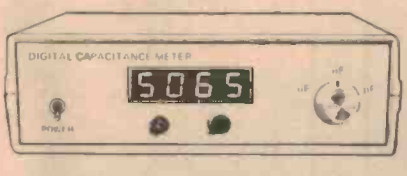
A truly versatile unit at a bargain price.

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

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

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

DIGITAL CAPACITANCE METER



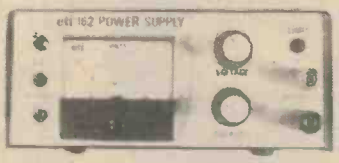
NEW DELUXE FINISH
We are pleased to announce the release of the Digital Capacitance Kit housed in our Deluxe H0480 ABS Instrument Case.
This superb Test Instrument Kit now compliments our top selling Digital Frequency Counter and Function Generator Project Kit. Electronics Australia Project. Measures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

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

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

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 enthusiast and professional requirements..... READ ON.



BENCH STANDARD
- 3-30v Output @ 1 Amp.
- Fully Regulated, Fully Protected from Thermal 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
- ± 1.3 to ± 22v 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 Volts @ 3 Amps. • + 12 Volts @ 2 Amps. – 12 Volts @ 200 milliamps.
This universal design has enough grunt to power most disk drives.

K3350..... **$59.50**

13.8 VOLTS @ 10 AMPS HAM'S & CBER'S
Save the expense of a Mains Powered Rig.

K3250..... **$89.50**

HIGH CURRENT — DUAL METERING

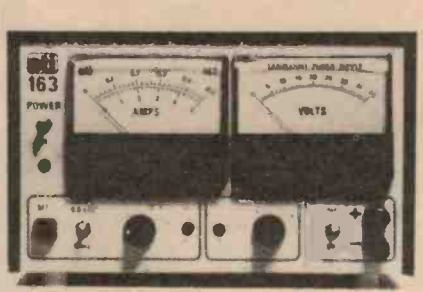
EA SWITCH MODE DESIGN
- 2-50 Volts at massive 175 Watts.
- CLEVER DESIGN — a fully mains isolated supply with a "Switchmode" low voltage circuit.
- Easy to build.

K3300.. (EA MAY, JUNE '83).. **$139.00**
K3301... (10 TURN VOLTAGE CONTROL OPTION) ... **$10.00**
K3302..... (± 12V OPTION) EA JULY '83..... **$12.50**

ETI SERIES REGULATOR DESIGN
- 0-40 Volts @ 5 Amps — **thats 200 Watts.**
- Current limiting 0-5 Amps variable.
- Specifications Second to None.
- Free from the hum and noise sometimes associated with other techniques.

A PROFESSIONAL SUPPLY

K3325.... (PICTURED).... **$175.00**



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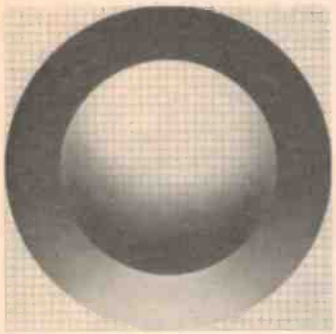
You could well pay up to 32½% more.



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.

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.

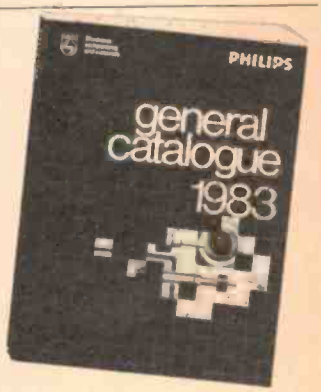
The Federal Minister for Communications, Mr Michael Duffy, said the new network will provide programmes with a greater amount of local material and would involve the establishment of new ABC studios and the upgrading of others.

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 Photovolataic Research Group is headed by Dr Martin Green.

SHAPING THE FUTURE — WITH NATIONAL

Visitors to National Panasonic's '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.

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 on 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 Modicaon 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.**

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, Mattell, JVC, Westpac, Videoactiv, 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 enticements in home video technology and programs, creative music keyboards, new video and computer games, in-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 electonics technology," says Kevin Rebbechi, 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 30 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, called 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 somersaults in his grave, warming up to escape velocity.

Joseph John Thomson shattered the idea of the indissoluble 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.

"The muon, who ordered that?" quipped one physicist.

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 particles known as leptons.

The daunting prospect is that there could be hundreds of 'fundamental' particles. However, Murray Gell-Mann, a 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 somethings 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 restlessly 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. These inlcude 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 community. 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 beome commonplace in our homes."

Hard Copy Colour Graphics is a Breeze . .

With YEW's new PL-1000 A3, four-colour plotter. No other method of producing superb quality graphs or charts even comes close in either cost or simplicity.

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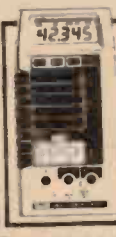

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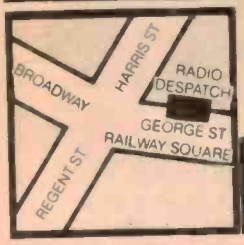

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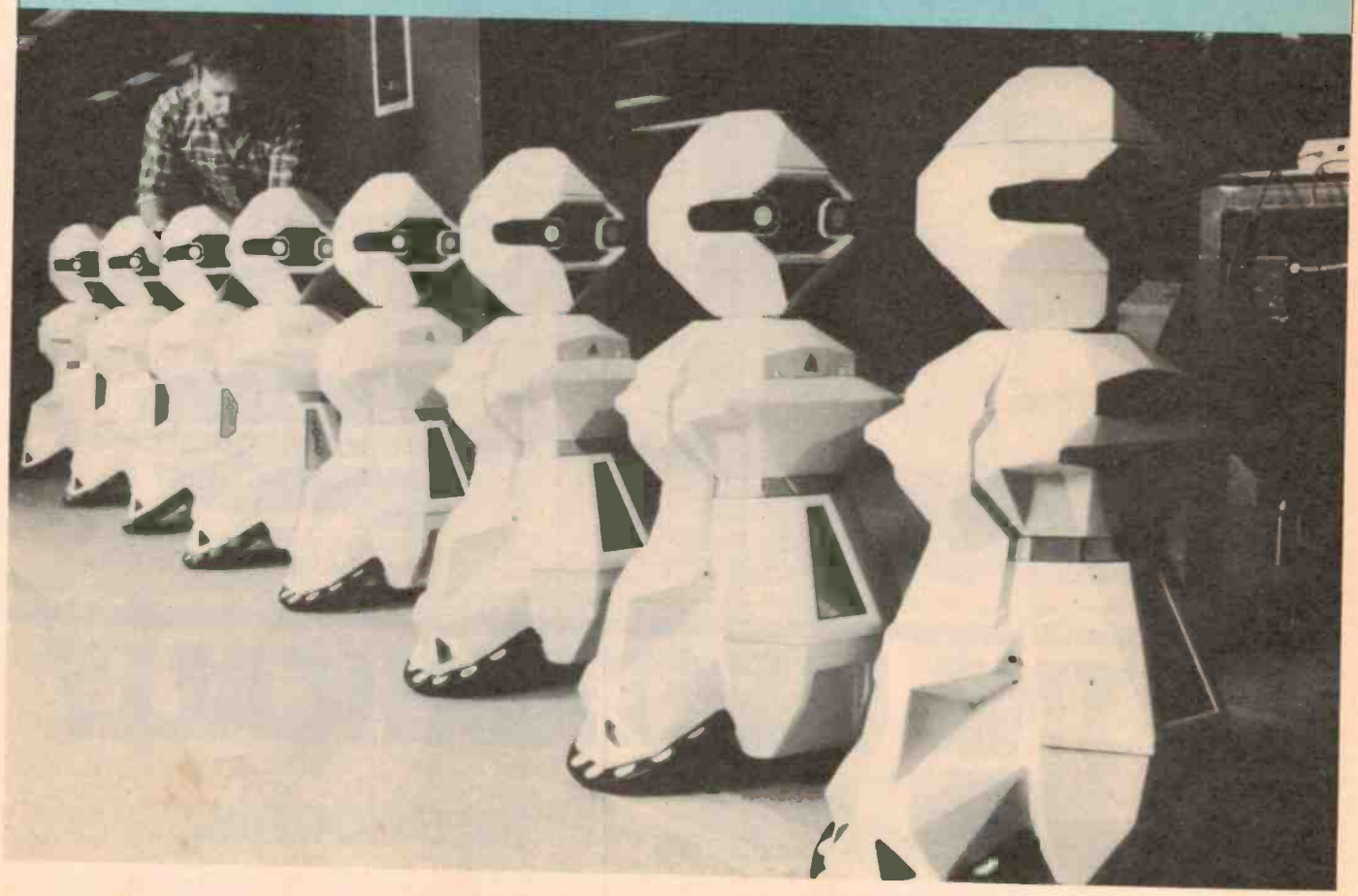
The robots aren't coming — they're here!

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.

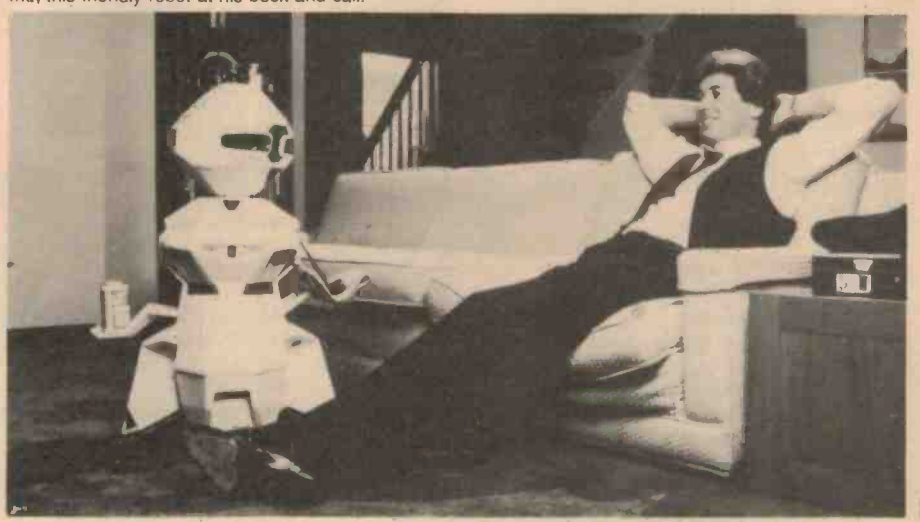
For example, if you have guests on the patio you can load up Topo with drinks and snacks in the kitchen and say "Patio Topo" and he will trundle out to the guests with his load following the route you previously 'walked' him over and taught him was 'patio'.

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.

Nolan Bushnell, the Chairman of Androbot (above). The 'big daddy' of BOB, Topo and FRED, he is shown revealing the 'brains' of BOB.

Beer, Norm? (below). Norm can now live life to the fullest in front of his TV and won't even have to move, with this friendly robot at his beck and call.



Robots in the classroom. These educational devices can be programmed to teach almost anything. Learning in the schoolroom or at home should be much more fun when the instruction is given by a patient, friendly robot.

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? . . . it?), 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.

BOB trundles up to a specially-made Android fridge that will become a standard patio accessory to team with a barbecue in the more affluent homes. To get a beer out of this specially designed fridge you simply press a button and out shoots a beer. BOB is programmed to roll up to this Android fridge, press the button and catch the beer in his scoop arm. This he carries back to his master languishing by the swimming pool.

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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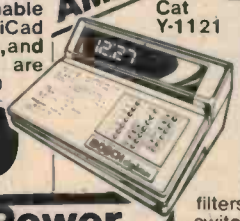

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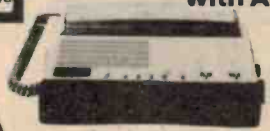

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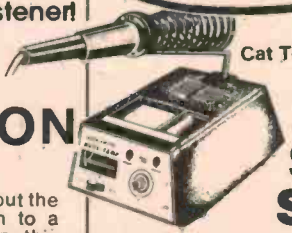

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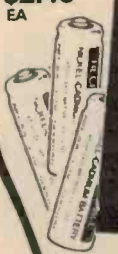

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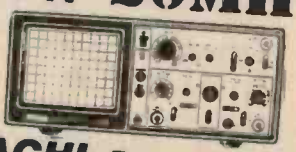

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BETA HI-FI ARRIVES

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 400 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 outputs 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.**

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 a pair including pedestals. For further information, contact **Scan Audio, P.O. Box 242, Hawthorn Vic. 3122. (03)819-5352.**

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 PL340 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 TX940 tuner, a CT1040W double cassette deck, an SG540 graphic equaliser, a DT540 timer, a JR-L4A lamp, a CS949 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.**

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 mono-crystals that are almost identical in physical shape, and free from the physical deformities.

The uniform, small particles allow smooth, even coatings with excellent high-frequency resolution and low noise characteristics. This translates to brilliant colours, sharp contrast and exceptional picture reproduction.

Initially, the new tape will be released in the three-hour, VHS format (E180), but Beta L500 and a new VHS-C compact 30-minute cassette will soon follow.

For further information, contact **BASF Australia, 55 Flemington Road, North Melbourne Vic. 3051. (03) 320-6555.**

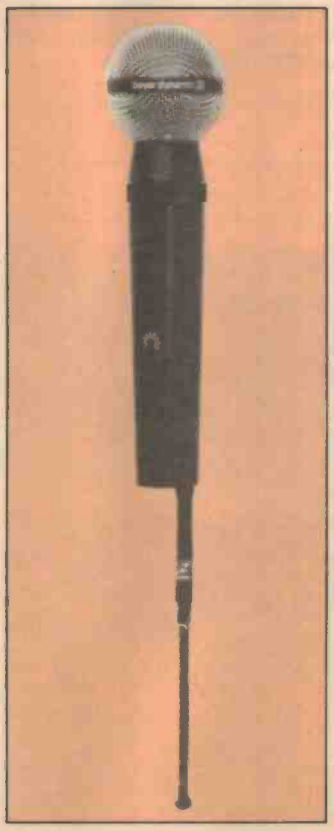
BEYER'S WIRE-LESS MIC

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, 16 Suakin Street, Pymble NSW 2073. (02) 449-5666.**



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.

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 high-performance car stereo systems.

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

The two top-of-the-line models, the HPL-525 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.**

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.

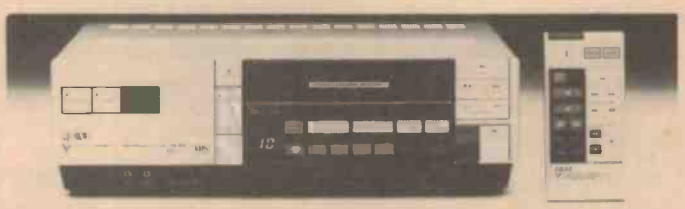
In the long-play mode, a four-hour cassette will record for up to eight hours.

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

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 handpiece, measures 440 x 135 x 360 mm.

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



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)698-7300.**

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 restructing 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'Riordon Street, Alexandria NSW 2012. (02)699-4506.**

THE TWEEK METHOD

Tweek, a fluid formulated to prevent oxidisation 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, 237 Gooch Street, Thornbury Vic. 3071. (03)481-7828.**

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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, hangers-on 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 the circuit in the hope of scoring better-paying gigs or perhaps that one-in-a-zillion 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 scraping 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 MSIO 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 any combination of inputs is possible. 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 serious omission in 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 sweat really needs in detecting input distortion is a good pair of ears. But, regardless of keeping production costs to a minimum, input-overload LEDs can be a helpful indulgence, especially for the novice.

The channel faders feel firm but slide smoothly, as do the other faders and rotaries. Interestingly, the four main channels each include an internal echo-send rotary, which returns on a separate fader. The echo-circuitry is of the BBD variety (bucket brigade delay) and, although lacking somewhat in sound quality, it can be quite effective on percussion or voice if used with some discretion.

One remarkably effective way of using this BBD-echo is to use it as pre-echo, which I will describe further on. The other feature on each input channel is the facility for panning left and right in the stereo-bus output.

The mixed stereo output can be further equalised via a seven-band graphic equaliser providing a ±12 dB boost or cut centered at 60 Hz, 150 Hz, 400 Hz, 1 kHz, 2.4 kHz, 6 kHz and 15 kHz respectively. The appealing LED peak meters across the stereo output channels range from −20 dB to +6 dB with levels below 0 dB displayed in green and those above 0 dB in red.

Overall, I would have preferred the greater flexibility of having separate left and right aux-in, BBD echo return and master faders, but I admit there is really little space to spare on the front panel of this very compact system.

The recorder

The front panel of the multitrack contains four sets of LED displays, similar to those on the mixing panel, corresponding to each main channel on the mixer. Immediately below each channel display are the playback/record selectors whose indicators glow green or red depending on the status of the play/rec selectors. There are also four rotary record level controls.

Immediately to the left are the stereo headphone socket and level control, with tracks 1 and 3 permanently assigned to the left channel and tracks 2 and 4 assigned to the right. There is a handy pitch control which adjusts tape speed over a ±10% range (or just over one half-note).

The noise reduction circuitry gives you Dolby B or Dolby C for even quieter recordings. I was very impressed by the sound quality and low noise. Even after several generations of track-bouncing, the original signals remained clean and crisp. The individual channel tone controls and output graphics were of great assistance in achieving this goal.

The cassette compartment is front-loading with a removable lid so that routine maintenance such as tape transport and head cleaning, are no problem. The tape speed is the same as for regular cassette decks. Consequently, tapes recorded on either kind are perfectly ▷

The Yamaha Multitrack Recorder (front and back).

The Yamaha Multitrack Mixer (front and back).

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-strip (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

The Yamaha Multitrack Patchbay.

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 mic/line inputs to the mixer. There are also the aux-inputs, mixer line-out (for connecting to an external stereo tapedeck, say, when mixing down multitiple 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 a concert of 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 vocalists, 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

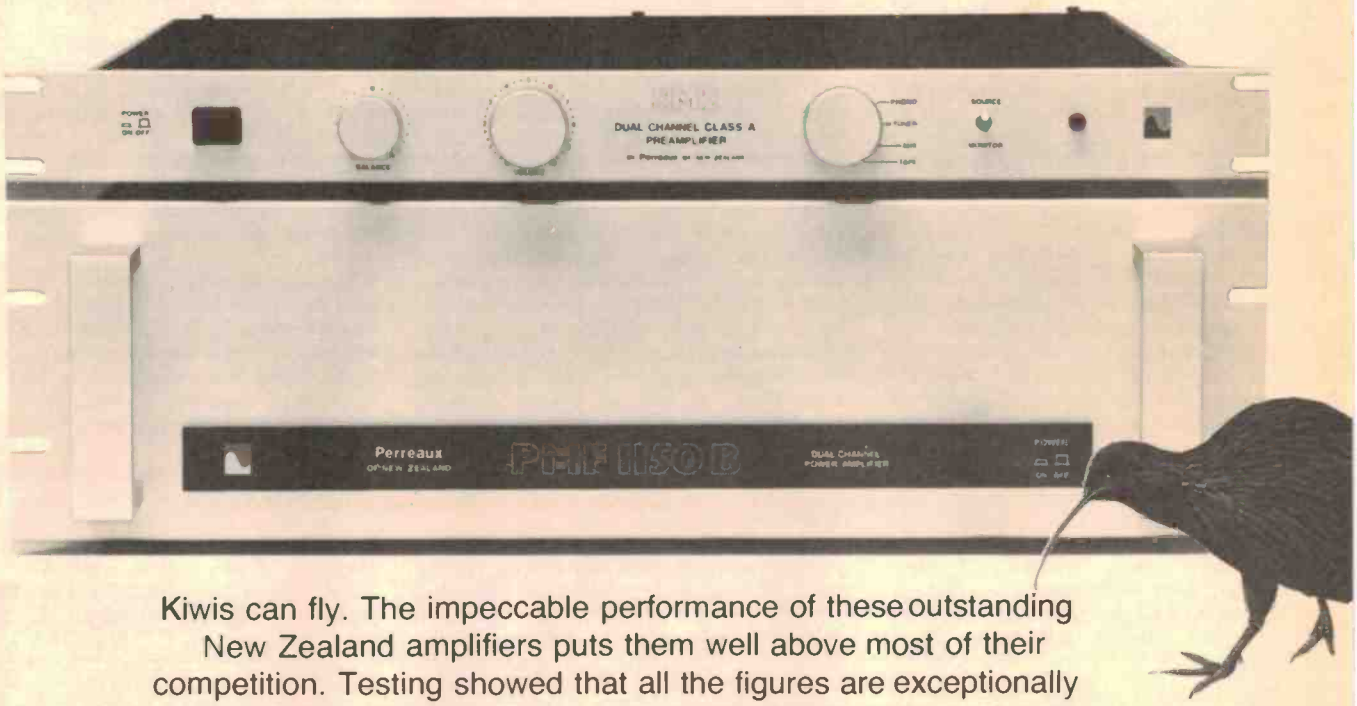
But it was at home, multitracking my own compositions together and playing all the parts myself, that I realised the vast potential of this portable studio as being more than just a recording tool. For me, the Yamaha Multitrack Recording System can become an extension of the composer's mind as parts 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, preceeded 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 tremolo. With careful and systematic planning (and indeed, *panning*) your musical ideas can explore new dimensions using the Yamaha Multitrack Recording System. ●

Perreaux SM2 preamplifier and PMF 1150B amplifier



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

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 aluminium finish and neatly executed black silk-screened lettering on the front fascia. This preamplifier has fewer controls than any I have reviewed before.

PERREAUX SM2 PREAMPLIFIER AND PMF 1150B AMPLIFIER

SM2	
Dimensions:	*482 mm (19") wide x 45 mm high x 318 mm deep*
Weight:	*3.3 kg*
Price:	*Rrp $1216*
PMF 1150B	
Dimensions:	*482 mm (19") wide x 185 mm high x 400 mm deep*
Weight:	*16 kg*
Price:	*Rrp $1245*
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.*

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 phono, tuner, auxilliary and tape, a source monitor switch and a small light emitting diode. And that is that!

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 torroidal 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

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 are for a tuner, auxilliary, 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 bolts the heat sinks together, with four TO-3 transistors mounted at either end.

The circuit designations 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.

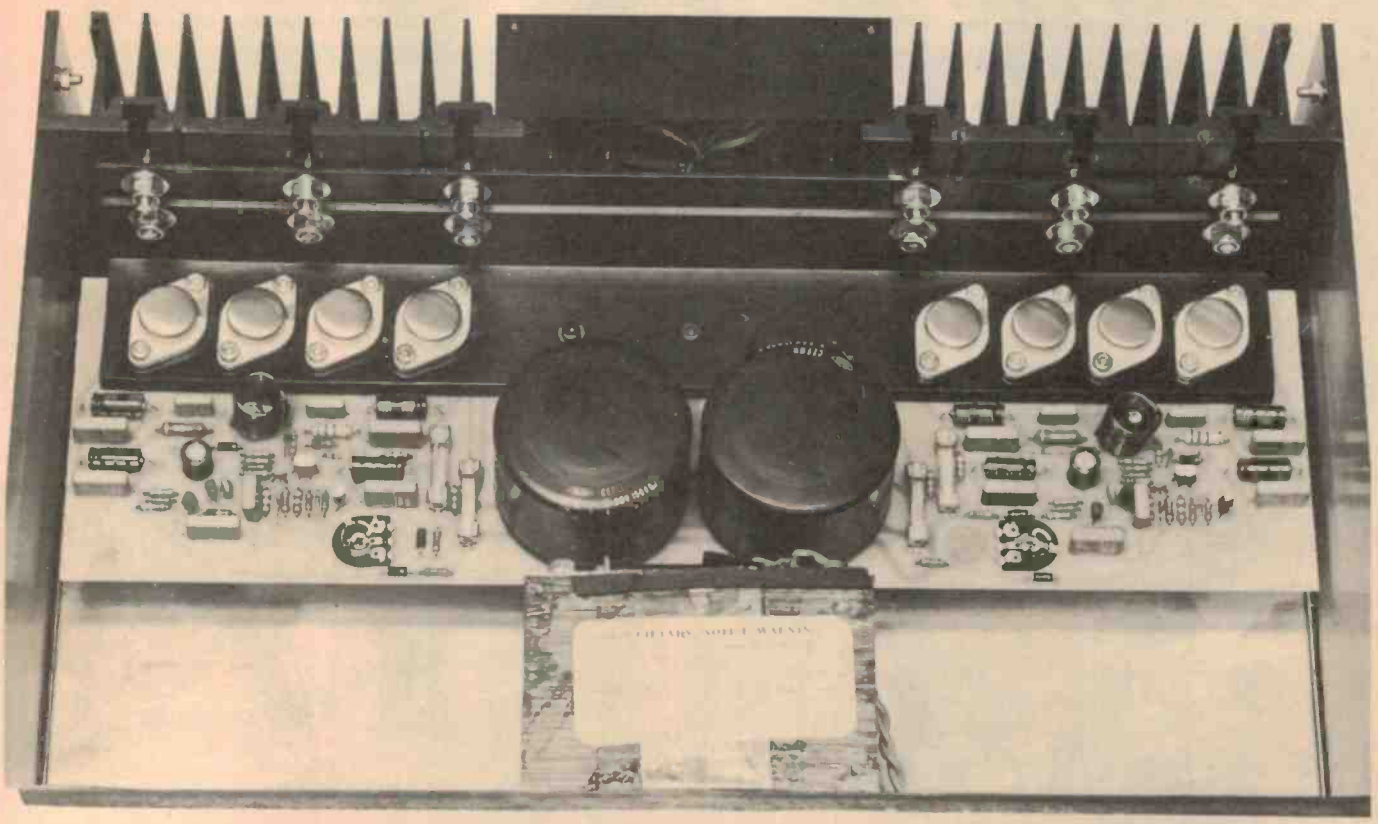
I find this approach of hiding component details rather hard to reconcile with what I believe is current good practice. The least that the designers at Perreaux should have done would have been to add their own in-house designations.

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 mains 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

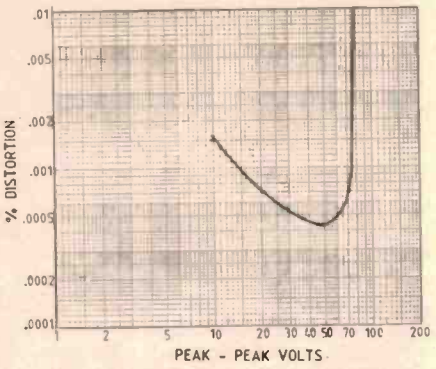
I was a little surprised to find how well both the preamplifier and the main amplifier performed. The objective testing confirmed that they achieve a frequency response which extends from 2.3 Hz to beyond 120 kHz.

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, 0.0002% at 1 kHz and 0.00026% at 6.3 kHz.

I was even more surprised to find that this particular preamplifier is capable of providing 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.



Perreaux SM2 preamplifier. IEC high frequency total difference frequency distortion.

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 performance 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 0.0066% 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 and the distortion 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.

SM2 PREAMPLIFIER

FREQUENCY RESPONSE: No Tone Controls Fitted

(-3dB re 1 Volt Output, 0.5V Input to Aux.) Left 2.3 Hz to 100 kHz; Right 2.3 Hz to 100 kHz

SENSITIVITY:

(for 1 Volt output)	Left		Right	
AUX	76.0	mV	76.0	mV
TUNER	76.0	mV	76.0	mV
TAPE	76.0	mV	76.0	mV
LOW GAIN PHONO	2.15	mV	2.2	mV
HIGH GAIN PHONO	275	μV	285	μV
LOW GAIN OVERLOAD	1400	mV	1400	mV
HIGH GAIN OVERLOAD	180	mV	180	mV

INPUT IMPEDANCE:	Left	Right
AUX	27 k ohm	27 k ohm
TUNER	27 k ohm	27 k ohm
TAPE	27 k ohm	27 k ohm
PHONO	47 k ohm	47 k ohm

OUTPUT IMPEDANCE: 470 ohms (@ 1 kHz)

HARMONIC DISTORTION:

(A) (At Rated Output of 1.5 Volts)

	100Hz	1kHz	6.3kHz	
2nd	99.8	117.7	113.7	dB
3rd	89.1	116.4	116.4	dB
4th	120.5	-	-	dB
5th	117.1	-	-	dB
THD.	0.0037	0.0002	0.00026	%

TRANSIENT INTERMODULATION DISTORTION:

Very low Less than 0.1% (3.15 kHz square wave and 15 kHz sine wave mixed 4:1)

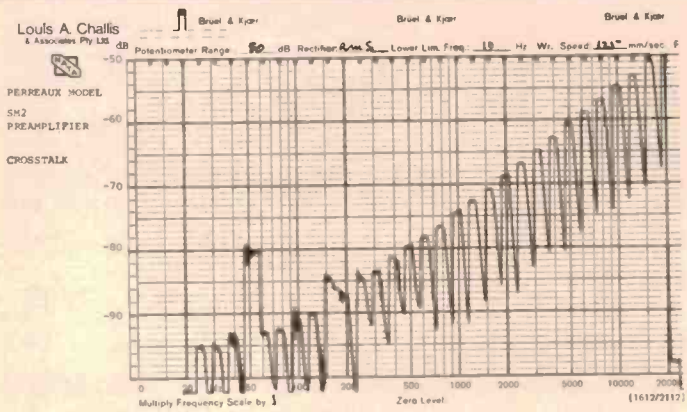
NOISE & HUM LEVELS:

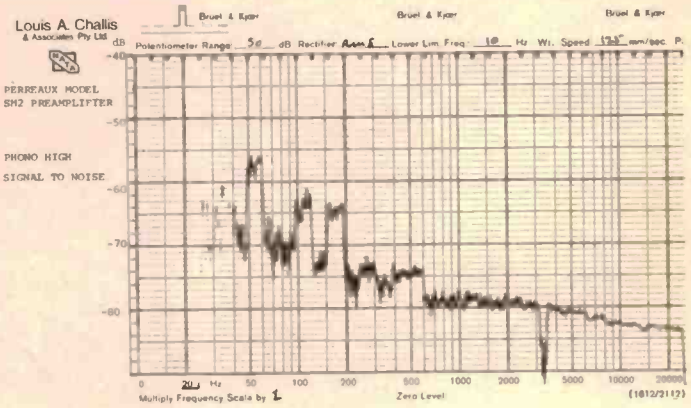
(re 1 Volt)
(with volume control set for 1 Watt output with,
0.5 V input (Aux.)
5 mV input (Phono M/M)
0.5 mV input (Phono M/C)

AUX.	-80 dB	(Lin) -88.5	dB(A)
PHONO LOW	-71 dB	(Lin) -80.0	dB(A)
PHONO HIGH	-54 dB	(Lin) -67.0	dB(A)

MAXIMUM OUTPUT VOLTAGE AT CLIPPING POINT:

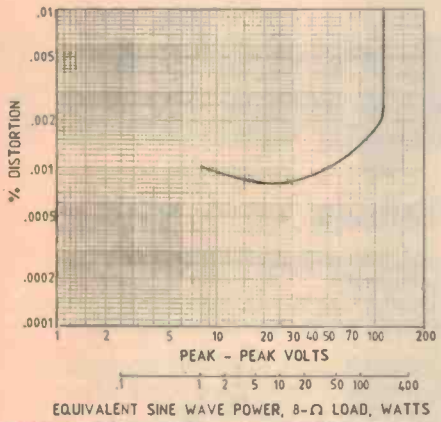
78.0 V P-P
= 27.6 V RMS
Dynamic Headroom = 25.3 dB (re 1.5 Volts)





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.

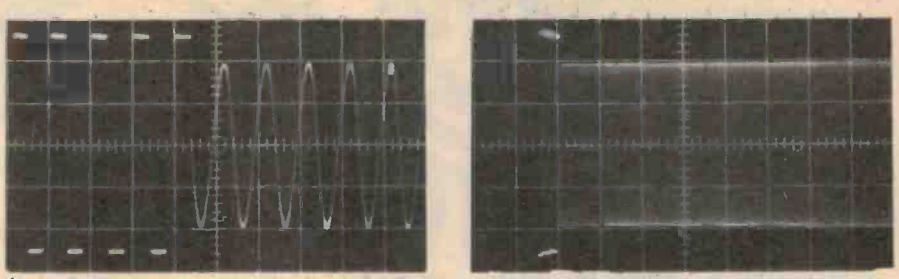
The provision for bridging is a decided advantage. In this mode it can supply 400 W of output power without the need for a separate bridging transformer, so that you can couple the two inputs without the need of any other external circuitry. This makes it attractive for a wide range of other commercial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



Perreaux PMF 1150B power amplifier. IEC high frequency total difference fequency distortion.

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 transient overload recovery test (IHF-A-202). 10 dB overload re 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 record 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. ●

PMF 1150B POWER AMPLIFIER

FREQUENCY RESPONSE: Tone Controls Defeated

(-3dB re 1 Watt, 0.5V Input to Aux.)			
	Left	5 Hz to	100 kHz
	Right	5 Hz to	100 kHz

SENSITIVITY:

(for 1 Watt in 8 ohms)	Left	Right
AUX	140 mV	138 mV

INPUT IMPEDANCE:

	Left	Right
AUX	47 k ohms	47 k ohms

OUTPUT IMPEDANCE: 25 milliohms (@ 1 kHz)

HARMONIC DISTORTION:

(A) (At Rated power of 100 Watts into 8 ohms = 28.3 Volts)

	100Hz	1kHz	6.3kHz	
2nd	89.6	109.0	104.6	dB
3rd	80.5	99.7	96.9	dB
4th	118.8	122.9	109.2	dB
5th	99.9	114.0		dB
THD.	0.01	0.001	0.0016	%

(B) (At 1 Watt into 8 ohms)

	100Hz	1kHz	6.3kHz	
2nd	97.2	115.3	-	dB
3rd	83.8	115.8	106.8	dB
4th	113.1	-	-	dB
5th	106.1	-		dB
THD	0.0066	0.00024	0.00046	%

TRANSIENT INTERMODULATION DISTORTION:

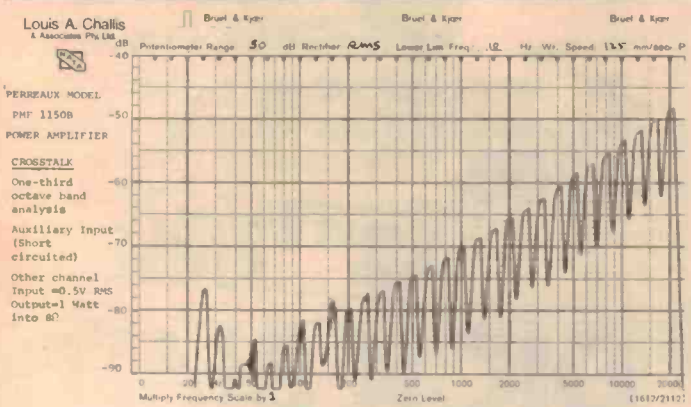
Very low Less than 0.1%
(3.15 kHz square wave and 15 kHz sine wave mixed 4:1)

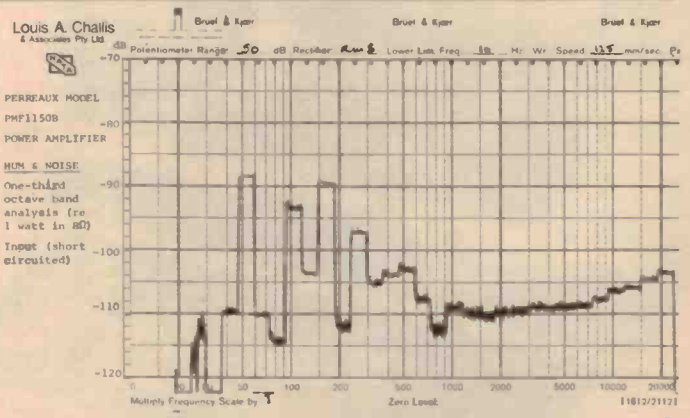
NOISE & HUM LEVELS:

re 1 watt into 8 ohms) AUX. -84 dB (Lin) -95 dB(A)
(with volume control set for 1 Watt output with, 140 mV input

MAXIMUM OUTPUT POWER AT CLIPPING POINT:

(IHF - A - 202)
(20 mS burst repeated at 500 mS intervals) 120 V P-P
= 225 Watts
Dynamic Headroom = 3.5 dB (re 100 Watts)





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more computer

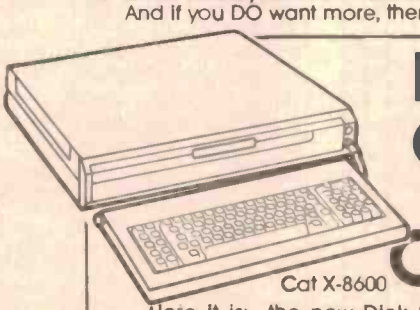
We agree! The IBM PC is a superb computer. But look at the price – way over six thousand for a usable computer – then you have to start buying programs!
Now there's a brilliant alternative: the Dick Smith Challenger. For less than half the price of the IBM PC you get much, more computer. Just for starters, how about 128K RAM as standard – expandable to 256K (IBM give you 64K) and BOTH Centronics and RS232C ports as standard? (IBM charges you extra!)
And the quality is guaranteed!
Each Dick Smith Challenger is individually 100% computer tested and accompanied by it's own test certificate confirming it meets all specifications. Beat that, IBM PC.

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 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.

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.



Cat X-8600

Basic 16 bit Computer

Only $995

Here it is: the new Dick Smith Challenger. It's the ideal computer for the business user, the professional or the serious hobbyist. Featuring a HUGE 128K memory – more than you're likely to need – with an equally large 40K ROM.

includes

- RF/ Video output
- Microsoft Extended BASIC , plus diagnostic in ROM.
- Four I/O ports: cassette, joystick, light pen & Centronics – type for printer.
- 84 key high tactile keyboard (detachable).
- Built-in speaker for sound programs

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

YOU SAVE OVER $700

DICK SMITH

Send for your FREE information pack!

See page 16 for

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!

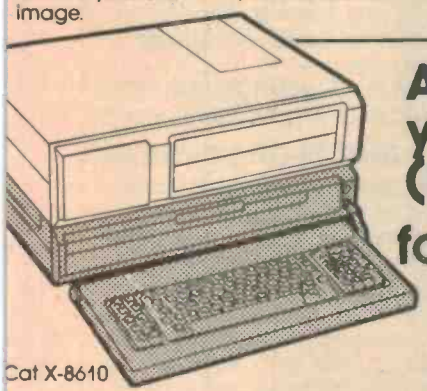
Yes – over a thousand dollars' worth of famous Micropro software included – at no extra charge. Try and get that with your IBM PC! And not useless software, either! WORDSTAR – the most-used word processing system in the world! CALCSTAR – the electronic spreadsheet to beat them all! MAILMERGE – turn your WORDSTAR into an electronic mailing list!

WORDSTAR

Normally around $485.00 extra . . . yours FREE with the Dick Smith Challenger.

CALCSTAR & MAILMERGE

Normally around $475.00 extra . . . yours FREE with the Dick Smith Challenger.



Cat X-8610

All the expansion you're likely to need (hardware & software) for only $1995 EXTRA

Add the Challenger Expansion unit and you get unbelievable computing power – far more than the IBM PC gives you. Twin 320K disk drives included. Not one, but TWO disk operating systems (DOS) included. Both Centronics and RS-232 interfaces included. Plus (of course) everything the Challenger itself offers.
And full IBM PC compatibility – not just software, but the plug-in hardware devices too!

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

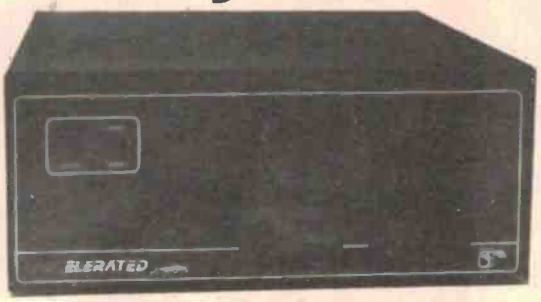
ELECTRONICS

full address details.

A621/LL

$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. Or 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 Z80A 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.

*** NOW WITH UNIQUE EXTENDED 2 YEAR WARRANTY**

Manufacturing & Systems Division

140A Victoria Road
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Phone: (02) 896 1791
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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 iapX186 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 Tramont, the Australian subsidiary of the Belgium conglomerate, Tractionel.

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 Percompasia '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.

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.**

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

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 S100 buss compatibility.

For further details, contact **Elston Micro, 53 Waverley Road, East Malvern Vic. 3145. (03)211-5542.** ▷

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TOP 30 BEST SELLERS
Survivor
Program of the Month!

JUST RELEASED
FUTURE CHART
TOPPER!

NEW!

SURVIVOR 250.079

The Aliens are attacking the earth and it's up to you to blast them with your attack fighter before they blast you! With a Joystick . . . . you're in control. $14.95

With Joystick $49.95

GAMES

VIPER 250.096
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. $14.95

REELS 250.098
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. $14.95

CHESS 250.022
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. $14.95

MICROSPACE INVADERS 250.020
A fast moving Microbee action game. Stop the aliens landing on earth or you will be destroyed. $14.95

ROBOTMAN 250.039
You must eat as much energy pellets as you can and try to escape from the Robotmen before they eat you. $14.95

CANNIBALS AND MISSIONARIES 250.084
Take the cannibals and missionaries across the river but make sure there's not too many cannibals or . . . . GULP! $14.95

AND MANY MORE! . . . .

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

CHESS TUTOR 250.076
Now you can study the classic moves of the masters 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

YAHTZE 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 with 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 prowling 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 physics students to analyse Periods, Elipses and Areas. $14.95

WORK-A-BEE 250.062
This program actually helps you write your own educational software. Ideal for teachers. Manual included. $19.95

UTILITY PROGRAMS

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

PCG TUTORIAL 250.037
Opens up the 'mysteries' of Microbee's programmable 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, extensible, 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. $49.50

MICROBEE PASCAL *NEW* 250.300 IN ROM
A good step into a new language. It incorporates an editor, a p-code single pass com-piler 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

MORSE CODE TUTOR 250.077
Now you can learn the code that you thought was only the domain of the dedicated radio Ham. $14.95

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

microbee computer shops

1 Pattison Ave,
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Phone (02) 487 2711

729 Glenferrie Rd,
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Nedlands, Perth.
Phone (09) 386 8250

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DIRECT ORDERS
PHONE (02) 487 2711

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, 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.

QLD: **Software 80,** 105 Milton Road, Milton. **Electrographic Office Systems,** 25 Grafton Street, Cairns. **Town and Country Computers,** CTL Centre, Anne Street, Aitkenvale, Townsville.

TAS: **Central Data,** 14A Goodwin Street, Launceston.

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SPHERE COMPUTERS

PRESENTS AN INTELLIGENT TERMINAL

FANTASTIC VALUE

OEM DEALERS WELCOME

SPECIFICATIONS

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
- Audible keyclick enable/disable
- Auto repeat enable/disable
- Keyboard lock enable/disable
- Repeat rate 20 characters per second
- 5 cursor control keys, 10 editing function keys with 14-key numeric key-pad

Communication
- Code: 128 ASCII characters
- Baud rate: 75, 110, 150, 300, 600, 1200, 1800, 2400, 4800, 9600, 19,200
- Parity: Odd, even, mark, space
- Operating Mode: Full duplex, half duplex or block mode
- Interface: EIA RS-232C or 20-mA Current Loop

Emulation
- LEAR SIEGLER ADM-3A, HAZELTINE 1500, ADDS VIEWPOINT

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

Editing Function
- Cursor: up, down, left, right, home
- Insert character, delete character, insert line, delete line, erase to 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.

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

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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-beaut CBM 8096-SK machine 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-ers 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-plotter (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 co-operation of TAA, who flew 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.

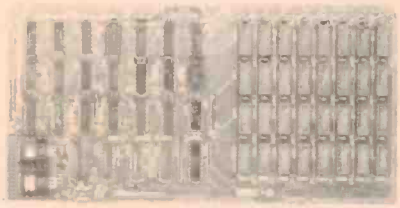
For further information, contact Mostyn Enterprises, 35 Alexander Street, Dundas NSW 2117. (02)871-6297.

K-NAR COMPUTER CARDS

S100 Z80 System Card Specialists

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

$415 OUR PRICE

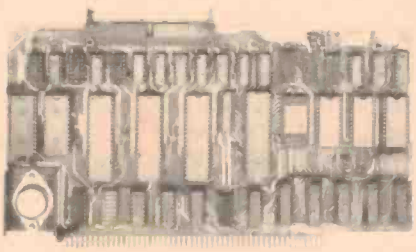


256 DYNAMIC RAM - DRC-II.
- Companion RAM for SBC-800
- Ideal for CP/M plus 3.0. List Price $865.

$795 OUR PRICE

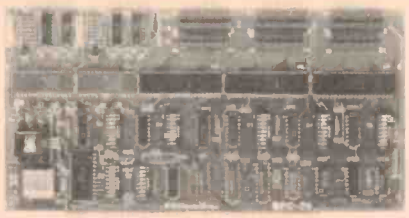
FDC-II. Enhanced floppy disk controller, IBM 3740 compatible, operates 5" & 8" and single/d density drives, handles up to 4 drives, runs multi-density CP/M2.2 & MP/M 2. Vectored interrupt operation optional.
List Price $465.

$389 OUR PRICE



CRC-64. Fool-proof memory system. State-of-the-art 64K CMOS memory card with memory protection, on board battery back-up, compatible with DRC-II, write protection enable/disable. List Price $675.
Our Price $565.

$593 OUR PRICE

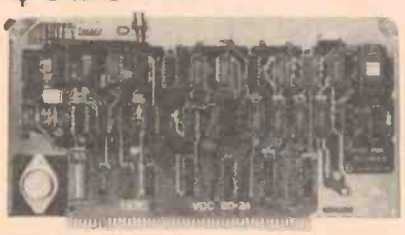


SPC-29. High performance dual serial & 9 parallel port I/O CARD, with full I/O address decoding. Switch selectable baud rates. Link patch area, programmable modes for strobed/latched I/O.
List Price $295.

$247 OUR PRICE

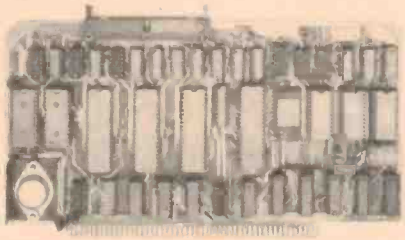
COLOUR GRAPHICS SYSTEM.
CMC-100/GDC-512. Combine one palette mixing card with up to eight display cards. Resolution 512 x 490, up to 256 colours simultaneously, user programmable intelligence, software available. • Build your own CAD/CAM System. • Remarkably low cost for a high performance graphics system.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

$825 OUR PRICE



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 halt intensity video, flicker free screen updating. Battery backed option offers diagnosis of system shut downs. List Price $325.

$278 OUR PRICE



SERIAL MULTICHANNEL I/O MPC-6.
Intelligent 6 channel RS232C communications with I/O buffering and drivers. • Build a multi-user, multi-tasking system.

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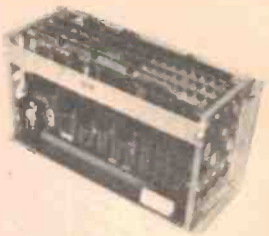

MINI CARD CAGE. Compact card cage frame with 5-slot motherboard plated through hole. Five edge connectors.
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S-100 WIRE WRAP CARD. Gold-plated edge connectors, through hole plating, provisions for four regulators, distributed power rails. I/O connector provision on top of card.

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All in working order. DRC-II, limited no. only.

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Authorised distributor of SME Systems products.

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

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 offset 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.

A BREATH 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 telex 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.**

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 $553.

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.**

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.

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 disk-drive cleaner in the United States.

The system is designed to clean the interiors of disk drives of all debris 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.**

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.

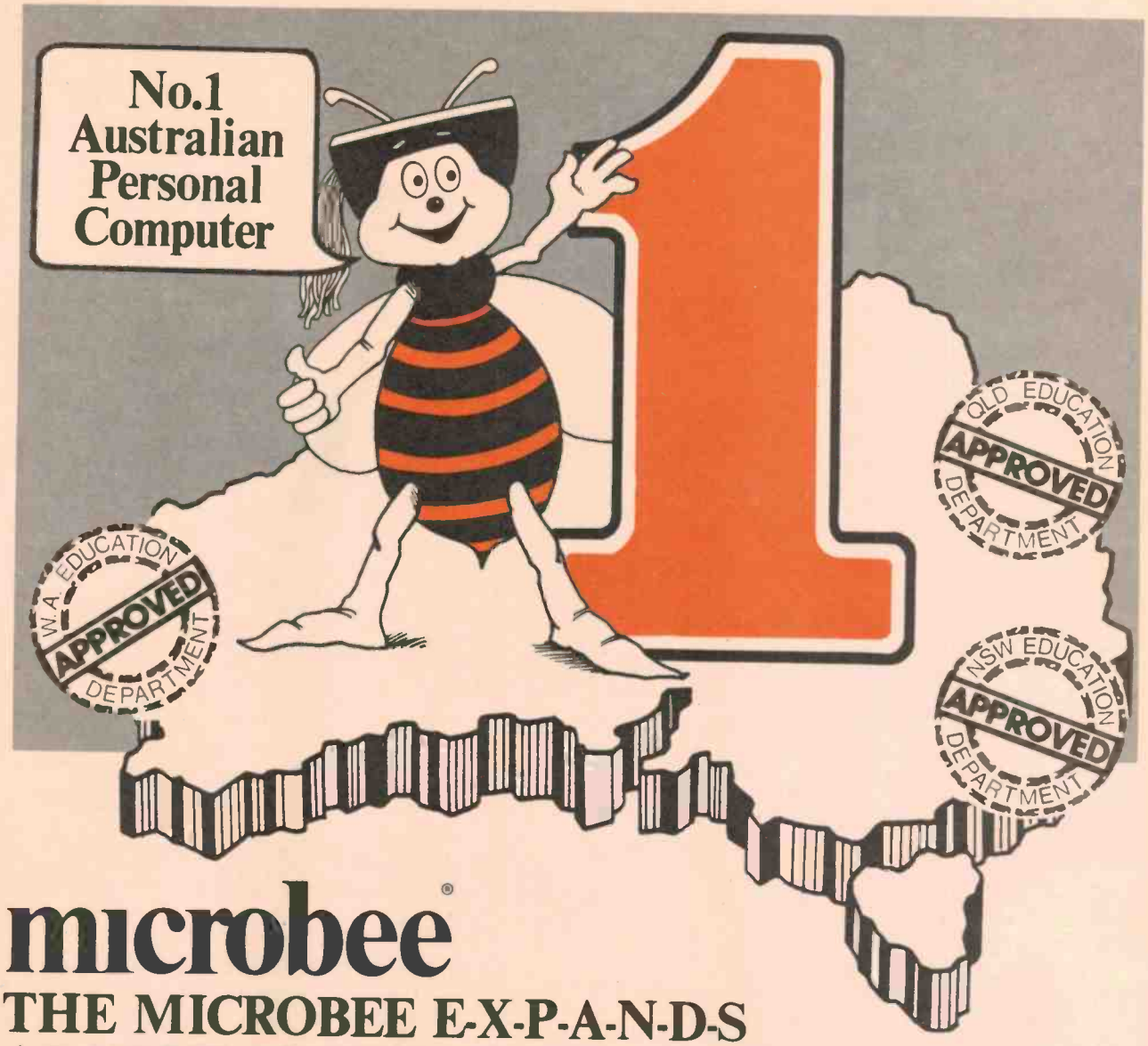
For further details, contact **Tandy Electronics, 91 Kurrajong Avenue, Mount Druitt NSW 2770. (02)675-1222.**

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 mutlibus, 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 nsec/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.**



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. . . . 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 1/0 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.

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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.

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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.

Software worth much more than the $500 charged

64K/SINGLE 400K DRIVE/SOFTWARE $1495

64K/DUAL 400K DRIVE/SOFTWARE $1795

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
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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

NEW RELEASES

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 M/SOFT 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 competant programmer in Microworld Basic. Prepared by two Australian school teachers, this practical course is an ideal companion for your Microbee. $14.95

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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, 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.

QLD: **Software 80,** 105 Milton Road, Milton. **Electrographic Office Systems,** 25 Grafton Street, Cairns. **Town and Country Computers,** CTL Centre, Anne Street, Aitkenvale, Townsville.

TAS: **Central Data,** 14A Goodwin Street, Launceston.

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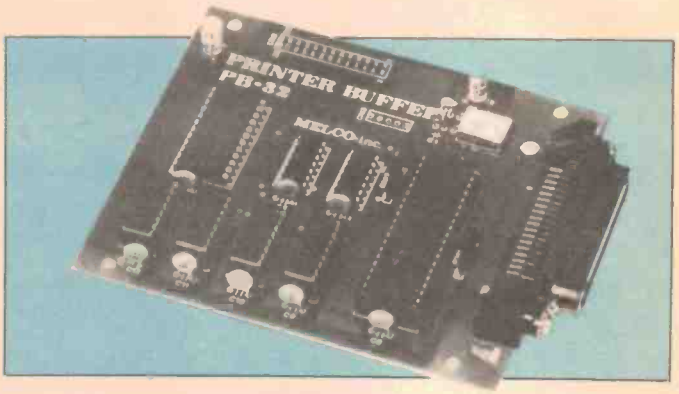
DICK'S DOT-MATRIX PRINTER

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.**

COMMODORE ADD-ONS

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

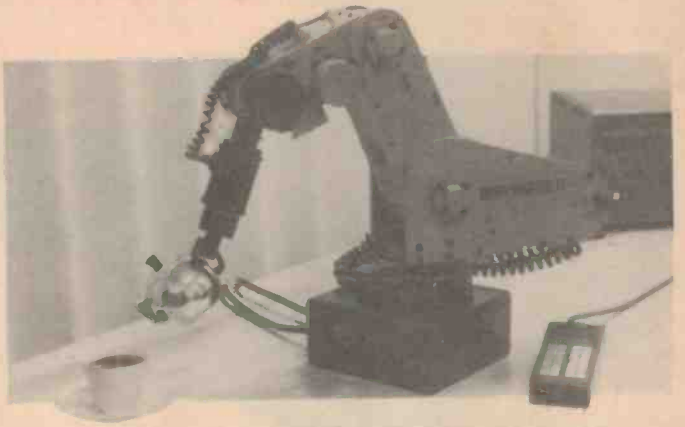
The 1520 printer/plotter is a four-colour printer with high-resolution illustrations. Retailed at $360, it uses four separate ballpoint ink pens to achieve multi-coloured graphs, charts and other types of illustrations which are enhanced by the use of colour.

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 lower-case 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.

For further information, contact **Commodore Computer, 5 Orion Street, Lane Cove NSW 2066. (02)427-4888.**



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. Dc 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.**

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 $5499, 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 compatability allows upgrading to a Model 4 without obsoleting present software, and makes 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, upgradable 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

Discwasher 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.**

FIRST THE MOUSE, NOW THE MICE

Microtek's Mice (for microprocessor in-circuit emulator), now available in Australia, is a development tool that emulates most of the industry-standard microprocessors.

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 part access, memory examine/display/fill, 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.**

'how I wun a pryze in a short storey competish- un fer gud Inglish.'

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.

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P.O. Box 364, Edgecliff. N.S.W. 2027. Ph.: 389-6388.
Please send me full details of your **WordPlus** and **Punctuation and Style** systems.

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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-keay keyboard, built-in speaker, interface for program storage/reading to and from cassette, 20-digit, 14-segment alphanumerical green tube display, 48 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-like 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.

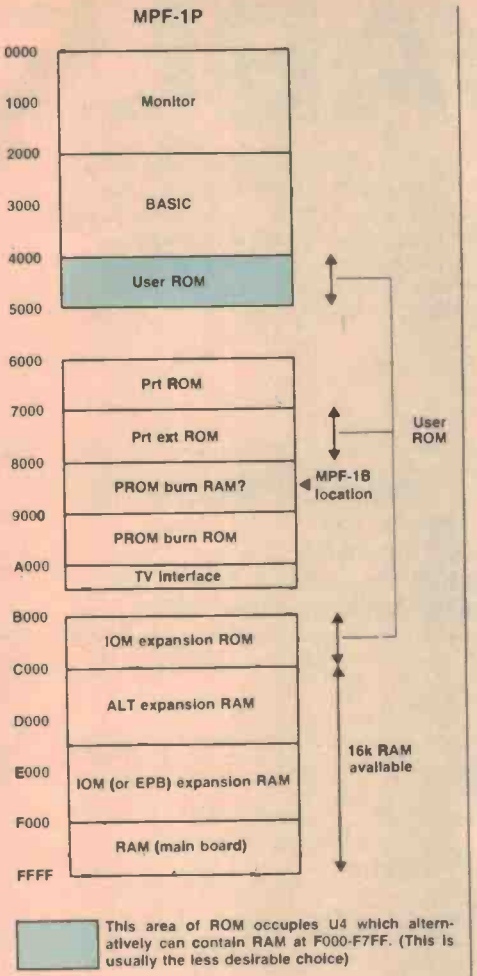
There is a full range of accessory boards including printer, EPROM programmer, interface and memory board, speech and sound generation boards. A TV interface board is mentioned in a glossy brochure. However, no further details were available on this interesting option which promises to make the Microprofessor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



design apparatus than the MPF-1B.

The monitor of the MPF-1B is restricted to operating the machine. So it is more limited in what it can do but its operation is easier to understand.

As you probably know, the monitor is the software, usually resident at the bottom of the memory, which controls particular operations; i.e: when the user is accessing the system via the keyboard or during initialisation after the micro has been turned on or reset. At other times the computer may be under the control of a user program, either directly or via an interpreter. These may access the monitor subroutines for such purposes as display or data input.

In other words, the monitor acts as a general housekeeper, looking after certain facets of the machine's operation. It is possible to load data into desired memory locations via the monitor, either directly from the keyboard or from a tape recorder.

Functions provided by the MPF-1P monitor also include a text editor, as well as a line assembler and two-pass assembler which will process assembly language including symbolic addresses.

Documentation

Included with the Microprofessor is a User's manual, Monitor Program Source Listing manual and an Experiment manual. Multitech has produced well-detailed documentation in the MPF-1P Monitor Program Source Listing manual. However, 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 beenin 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 transfered 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

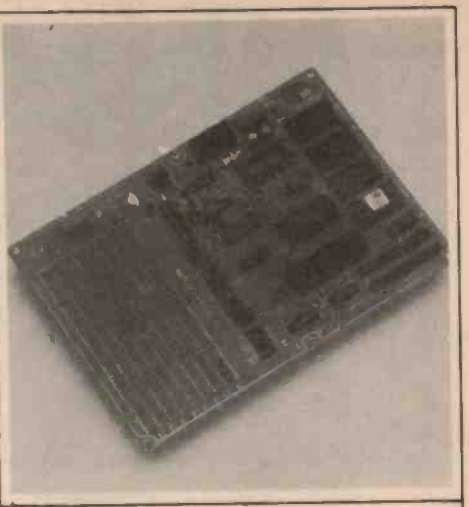
The IOM board is an interface option for the MPF-1P and provides the Parallel I/O chip (PIO), the Counter/Timer Chip (CTC) and the Communication Interface Chip (USART 8251). Thus experiments in both parallel and serial interfacing are possible.

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).

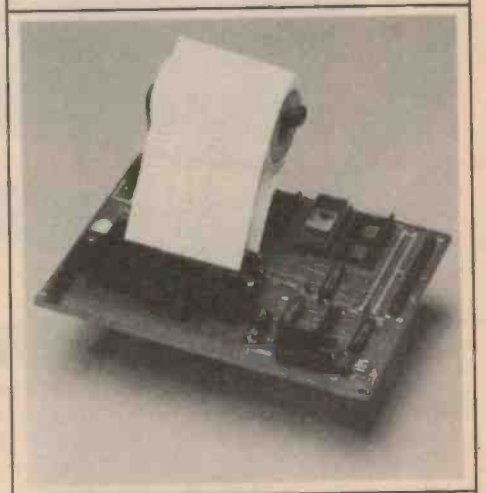
The printer accessory for MPF-1P is a 20-column matrix thermal printer with resident monitor EPROM and disassembler. The only significant difference from the MPF-1B's printer is the monitor software. There is, similarly, a vacant EPROM socket for the user.

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.

BASIC is supplied as an optional extra on EPROM and seems to be on a par with any other 8K floating point BASIC. It does contain library functions such as SIN and RND, however, details will not be given as the handbook was not availble.



IOM-MPF-1P Input/Output and Memory board. This provides the Counter-Timer chip, the Communication Interface chip and the Parallel I/O chip kits to interface with the outside environment. It provides an extra 6K RAM and 4K ROM.



PRT-MPF-1P printer. The optional micro-thermal 5x7 dot matrix printer has 4K control ROM and prints 20 characters per line. There is an optional 4K user EPROM and it has a built-in memory dump facility and dissassembler-listing utility.

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.●

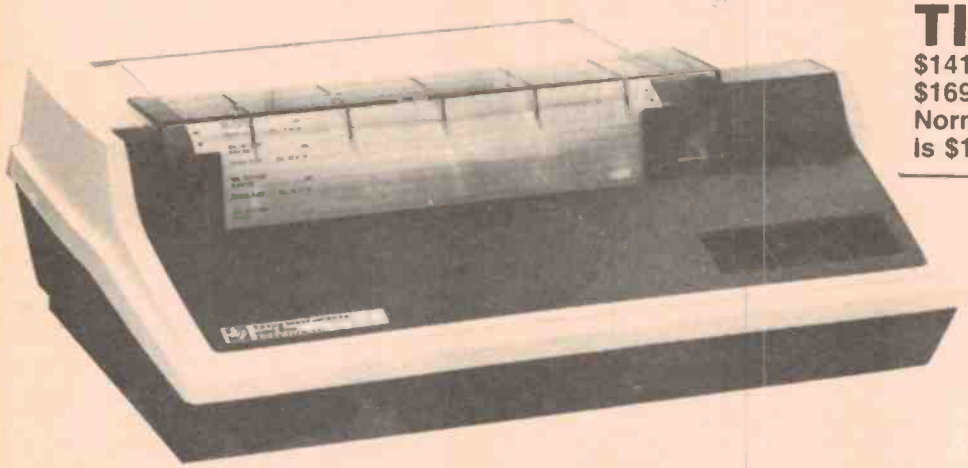
UNBELIEVABLE

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.

Delivery will be by freight to anywhere in Australia, fully insured. Shipments will be made ex-stock, but to cover unforeseen delays, please allow up to 4-6 weeks for delivery. This offer is made by Pacesetter Systems (a division of VSI Electronics Pty Ltd, incorporated in S.A.) and ETI is acting as a clearing house for orders. All orders must be via the coupon here, or a photostat thereof if you don't wish to cut the magazine.



TI 810 PRINTER

$1410 exc. tax
$1692 inc. tax
Normal list price on this printer is $1890 exc. tax; save $480!

TI 810 PRINTER

The Texas Instruments *Omni 800* Model 810 printer is a recieve-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 communciations 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 — but 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 cps machines are actually running at around 34 cps, 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.

SPECIFICATIONS TI 810 PRINTER

TI 810 PRINTER

PRINTER

Technique	Seven-wire matrix impact
Character matrix	9 x 7 (9 wide, 7 high) dot matrix
Character set	64-character limited ASCII
Characters per inch	10
Characters per line	132 maximum
Lines per inch	6 or 8 (operator — or software — selectable)

THROUGHPUT

Print speed	150 characters per second
Lines per minute	64 at 132 characters per line, and up to 450 at 10 characters per line
Line feed	33 milliseconds
Paper slew	170 mm per second (6.67 inches per second)

PAPER

Paper width	Adjustable from 76 to 381 mm (3 to 15 inches)
Paper loading	Rear or bottom feed
Number of copies	One original and five copies

CONTROL SYSTEM

Electronics	8080 microprocessor system
Printing method	Bidirectional
Buffer (FIFO)	256 characters
Horizontal tabs	Software Programmable
Vertical format control	Software and operator programmable
Self-test	Prints ASCII characters in a rotating pattern (barberpole)
Bell	Pulsing audible tone

COMMUNICATIONS

Interface	Serial (EIA RS-232-C)
Baud rates	110, 150, 300, 1200, 2400, 4800, 9600
Parity	ODD, EVEN or ignore

INPUT POWER

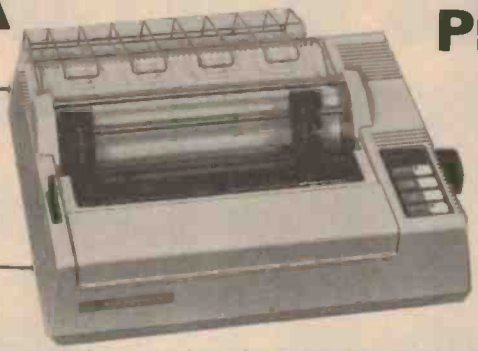
ac voltage	100, 120, 220 or 240 Vac (+ 10% to - 15%)
Frequency	47 to 63 hertz
Watts	200
Power fuse	100 or 120 Vac range, 5 A, 250 V fuse 220 or 240 Vac range, 2.5 A, 250 V fuse

PHYSICAL DIMENSIONS

Weight	25 kg (55 pounds)
Height	203 mm (8 inches)
Width	654 mm (25.75 inches)
Depth	508 mm (20 inches)

OFFER* TOP QUALITY TEXAS INSTRUMENTS PRINTERS

* until you've read it through



TI 850 PRINTER

$760 exc. tax
$912 inc. tax
Normal list price on this printer is $995 exc. tax; save $235!

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 COMPRESSED print made by the Model 850 Printer.

The Model 850 Printer made this example of DOUBLE-WIDE print.

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

SPECIFICATIONS TI 850 PRINTER

TI 850 SPECIFICATIONS

POWER REQUIREMENTS	
Voltage	90-132 Vac, 47-63 Hz, single phase or 187-264 Vac, 47-63 Hz, single phase
Power	100 W maximum
PHYSICAL DIMENSIONS	
Size	412 mm (16.2") wide 220 mm (13.0") deep 127 mm (5.0") high
Weight	6.8 kg (15lb) excluding options and accessories
CHARACTER SETS	
Type	Full US ASCII and 7 international
INDICATORS	
Light	Power, on-line, pitch SFL
DATA	
Parallel Interface:	
Line levels	0 or +5 Vdc
Characters per second	1000 cps maximum
Line control	Strobe acknowledge
Serial Interface:	
Specification	EIA RS-232-C standard subset
Line levels	−12 or +12 Vdc
Type code	ASCII and similar international codes
Bits per second	200, 300, 600, 1200, 2400, 4800, 9600
Receive buffer	256 characters, expandable to 4000 characters
Line control	Printer ready busy
PRINTER	
Method	Wire-matrix impact
Speed	Print 150 cps
Pattern	9 x 9 dot matrix (standard print) 15 x 9 dot matrix (enhanced print)
Characters per inch	10 cpi and 16⅔ cpi (standard) 5 cpi and 8⅓ cpi (double-wide)
Characters per line	80 characters at 10 cpi (standard), 132 characters at 16⅔ cpi
Line length	Full line at 10 cpi or 16⅔ cpi requires 203 mm (8")
Lines per inch	6 lpi and 8 lpi
Paper drives	Friction-roller or tractor
Paper width	76 mm to 254 mm (3 to 10 in)
PAPER	
Type	Sheet, roll or fanfold (single or multipart)
Width	254 mm (10in) maximum
Roll	127 mm (5.0 in), maximum diameter
Thickness	Single part 0.254 mm (0.01 in) Multipart, 0.34 mm (0.014 in) maximum for original plus two copies (No cards permitted except on last copy)

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..... 4K buffer(s) for 850 printer @ $..... tax free/tax paid*
plus freight: 850 printer — $10, 810 printer $20
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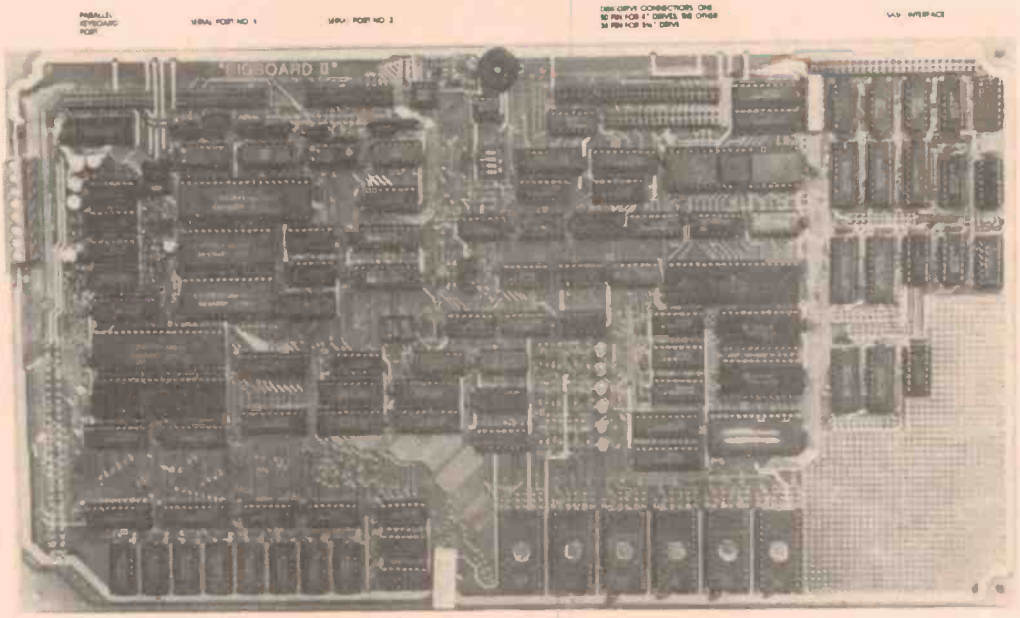
"BIG BOARD II"



STD Bus Connector

EPROMs shown only for clarity.

Prototyping Area

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

4 MHz Z80 — CPU AND PERIPHERAL CHIPS

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

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

"Big Board II" has the three memory banks. The first memory bank has eight 4164 RAMs that provide 60K of user space and 4K of monitor space. The second memory bank has two 2Kx8 SRAMs for the memory-mapped CRT display and space for six 2732 As, 2Kx8 staticRAMS, or pin-compatible E(E)PROMs. The third memory bank is for RAM or ROM added to the board via the STD bus. Whether bought as a bare board, a full kit, Or assembled and tested. it comes with a 450nS2732 EPROM containing the monitor.

MULIPLE-DENSITY CONTROLLER FOR SS/DS FLOPPY DISKS

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

VASTLY IMPROVED CRT DISPLAY

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

STD BUS CONNECTOR

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

DMA

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

"SASI" INTERFACE FOR WINCHESTER DISKS

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

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

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

TWO Z80-A CTCs = EIGHT PROGRAMMABLE COUNTERS/TIMERS

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

PROM PROGRAMMING CIRCUITRY AND SOFTWARE

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

CP/M

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

Pricing and Availability:

Available ex-stock

In single quantities, full kits cost $695 Inc. tax , and A&T'd computers cost $895. There are attractive discounts that range to 35% for OEM's and dealers. For details about them please call Rod Irving on (03) 489 7099. ie: 3 Ferguson II "Big Board" are less 20% off the one-off price, hard disks disk controllers, boxes and power supply to suit both 8" & 5¼" systems will be available.

Bare board with main chips now available (includes PCB, Manual. PALS, Monitor ROM, SMC chips). You have to add rest of components at $395 + tax

Errors and omissions excepted

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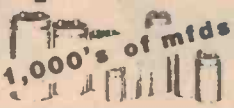

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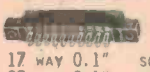

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25	PIN FEMALE SOCKET	$3.50	$3.00
25	PIN MALE PLUG	$3.70	$3.30
25	PIN PLASTIC COVER	$2.95	$2.55
37	PIN FEMALE SOCKET	$4.55	$4.00
50	PIN FEMALE SOCKET	$6.00	$5.25
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0.68uF	35v 0.60	2.2 uF	35v 0.60
3.3 uF	35v 0.60	15 uF	16v 0.70
15 uF	35v 0.95	22 uF	6v 0.60
33 uF	10v 0.70	47 uF	6v 0.70

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Comprises 2 boards, one had 8xDPDT push-button switches, similar to Isostat - the other has 8x100K multi-turn trimpots with 3 position band-change switches. LTD. QTY.

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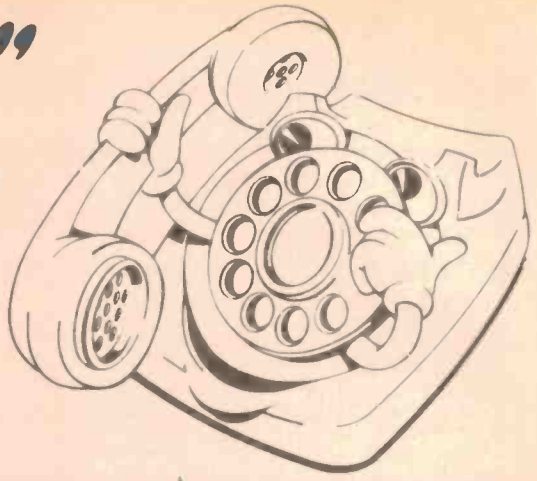

Is your phone tapped? NO? Well if you don't rate, then tap ours! If you ring or write and say "Phone Tap!" in November, you can get the special prices shown below.

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SPECIFICATIONS:

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0 – 250	0 – 1000
0 – 1000	AT 9,000 ohms/volt
AT 20,000 ohms/volt	

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dB: 20 to +22dB
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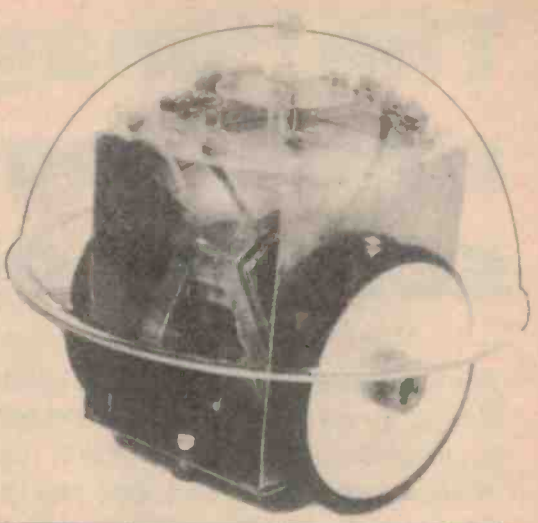
Grab One NOW

The HEBOT 11 turtle is not just a fun device, it is a positive aid to education, it takes programming out into the real 3 dimensional world instead of the flat two dimensional world of the VDU. When connected to the I/O ports of your computer and given a DC supply of 9–15V the turtle runs around under computer control moving forwards, backwards, right and left with independent control of each wheel, it has blinking eyes, will bleep with a choice of two tones and when ordered by the computer, presses down a pen to chart its progress and provide hard copy of the results of the program. When set free to run around the turtle discovers its enviroment. When the turtles shell bumps into an unmovable obstacle touch sensors send back data to the computer for it to calculate evasive or exploratory action.
If the computer has no I/O ports it doubtless has an expansion bus and the turtle can be controlled and listened to using this bus together with the universal computer interface board. This board enables the turtle to be treated as a memory mapped I/O device.



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UNIVERSAL INTERFACE CARD KIT Cat. XR1022 $39.50

save $100

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codemaster

Many of you know the clever parlour game that uses coloured tokens to stretch the brain to work out a hidden code in a minimum number of moves.
The people that came up with the game used a descriptive name which no-one else can use. It is a popular game and is well known under this name. Our game is similar to this game but - naturally - its electronic!! And, what's more, you can play against the machine - alone. Each XM7015 Codemaster measures 140(l)x85(w)x25(d) looks similar to a pocket calculator and runs off a standard 9V cell. Provision is made for a mains adaptor as well.
The Codemaster once sold for $29.50 but Jaycar has made a huge scoop purchase. You save a fortune!
Grab one now for only $4.98
* (For a further clue to the origin of this game read this page carefully)

ONCE SOLD FOR $24.50!

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Features:
- CMOS SAFE conductive plastic
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- Ground strap can be connected.
- One hand operation.

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Cat. No	Model	Description	Normally	NOW
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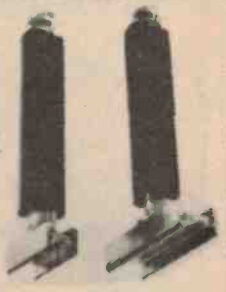
TH1812	CIT22	22 pin	$6.50	$4.55
TH1814	CIT2428	24 – 28 pin	$6.95	$4.86
TH1816	CIT3640	36 – 40 pin	$8.95	$6.26

LESS 30%



EXTRACTOR TH1818 ET480
Deceptively simple looking device. One piece metal construction. 8-40 pins
$2.95
NOW $2.06

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115 VOLT COMPUTER FANS

GREAT VALUE!

$14.95

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Great if you are making equipment for export to the USA – or use 2 in series! No problem!
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TWO WAY CROSSOVER
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Quality

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Cat. CE-2622 $22.50 ea

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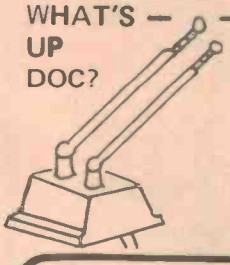
WHAT'S — UP DOC?



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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 job lot available at only $7.95 each.
ONLY 220 SETS AVAILABLE.
Cat. AA2005

~~$7.95~~ $6.95

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80 WATT HANDLING – ABOUT 40W R.M.S.
EUROPEAN QUALITY – MADE IN DENMARK
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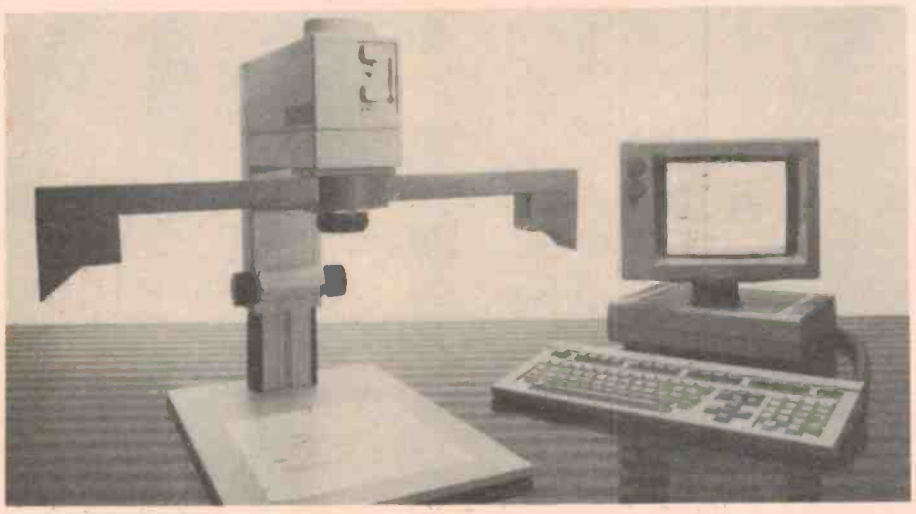
The "image computer", a new tool for business, science or engineering

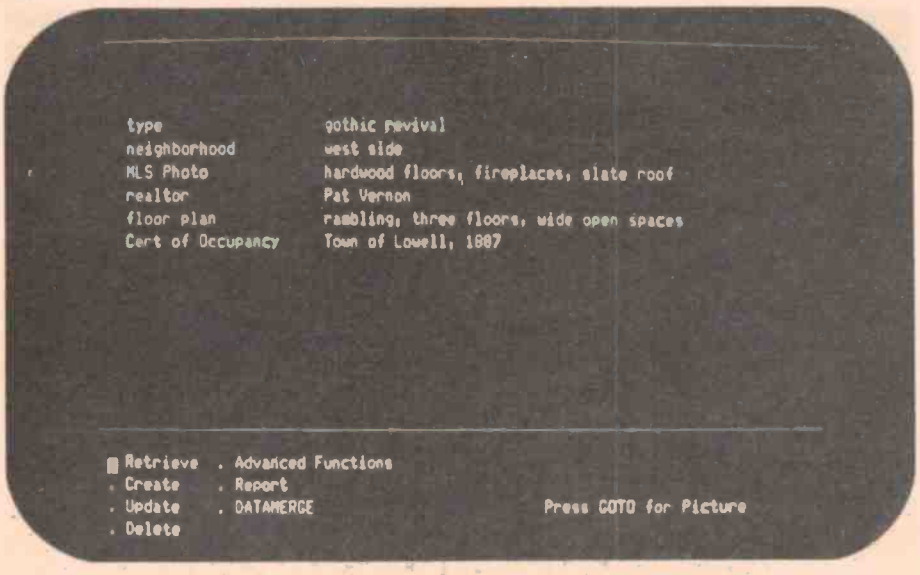
The computer tool currently revolutionising our working lives in almost every sphere is the word processor. Wang have taken it a quantum leap forward with the release of their PIC — professional image computer. This scoop report is exclusive to ETI.

Collyn Rivers



Powerful, but compact. The PIC comprises Wang's Professional Computer, Image Processor and Image Monitor, plus software. ▲

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.

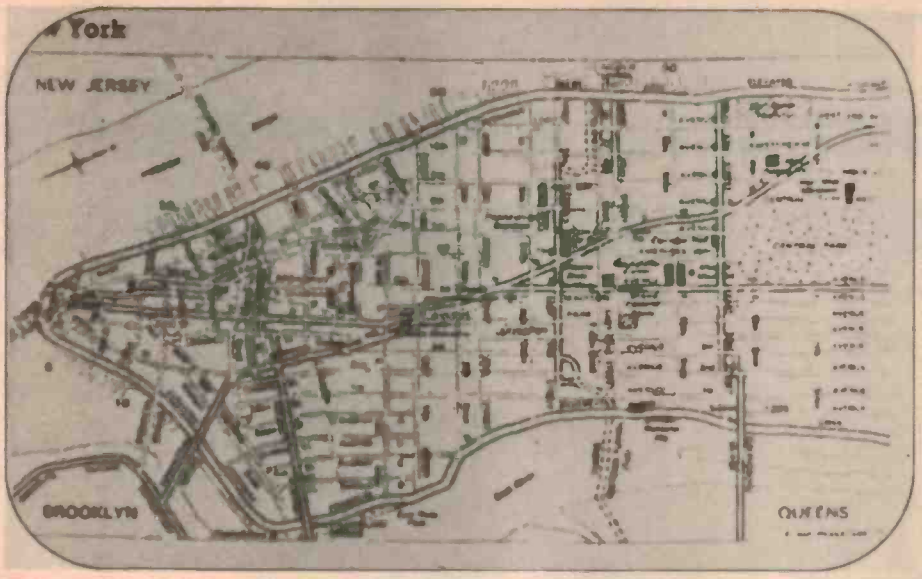
The technology combines many of the functions of the highest grade fascimile machines, micro-fiche storage, data-base systems, word processing, and electronic mail. The system processes drawings, photographs, handwritten material, and text, much as a word processor does with words.

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.

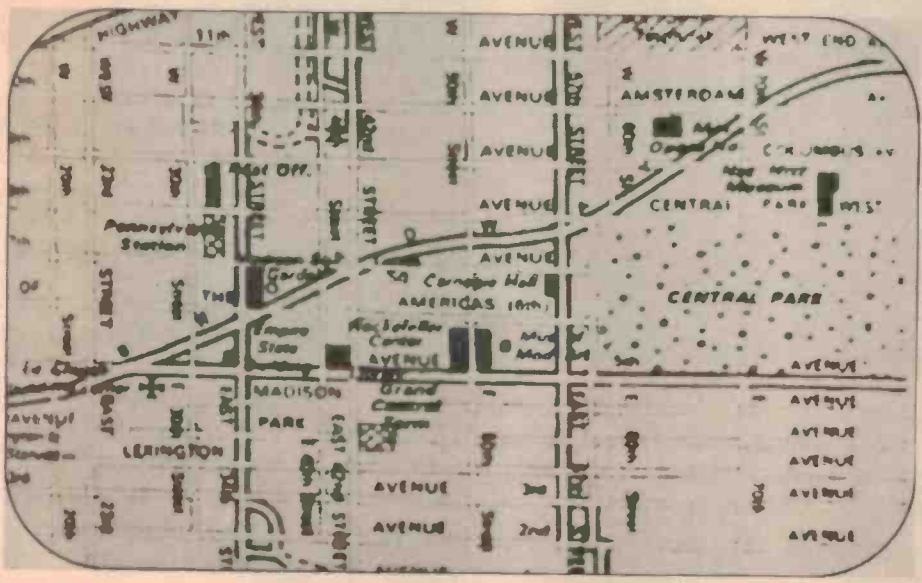
All material is optically scanned, digitized, edited if required, printed out, and recorded. The material may also be transmitted to other PIC terminals anywhere in the world.

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, instaneous 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



Zoom. Under software control you can enlarge any portion of an image. The right-centre sector of the map at top has been enlarged about six times and is shown at the bottom.



device which digitizes the information. Resolution is 1728 pixels horizontally, and 2200 lines vertically (equivalent to Group III fascimile 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 50 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 dot/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, edited, printed, transmitted and received. 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 US$1875 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."

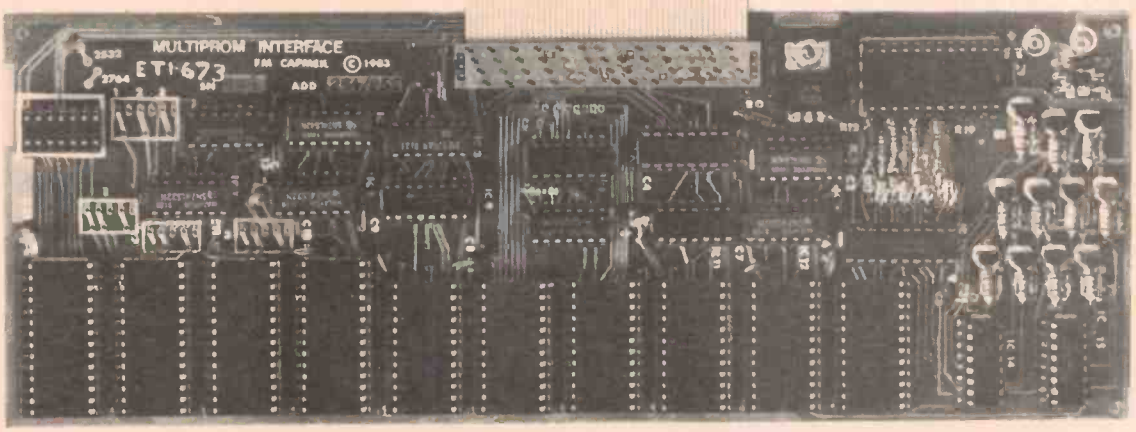
Your reporter flew from Sydney to Wang's headquarters near Boston specifically to see this unit. The return distance was over 20 000 kms. Not a single kilometre was felt to be wasted.

The Wang PIC system is a genuine breakthrough in computer technology. ●

Project 673

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.

THIS PROJECT gives you the ability to extend your Microbee's ROM software capacity. It is a board that just plugs into the 'Bee's 50-way expansion buss and can either be fitted inside the 'Bee or externally. Ten sockets accommodate the ROMs and either 2532s or 2764s can be used — mixed, too, if you like. The first four sockets are 28-pin types, while the last six are 24-pin types. The latter take only 2532s while the first three take either 2532s or 2764s. Socket no. 4 is arranged to take only a 2764. Address-wise, the first seven sockets are located at C000 to DFFF (i.e: where EDASM sits), while the last three are located at E000 to EFFF (NET location). Sockets 1, 2, 3 and 5, 6 7 are paired — 1:5, 2:6 and 3:7, when 2532s are in use. Only the first three are used when 2764s are in place. Link fields on the board permit ROM type selection.

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.

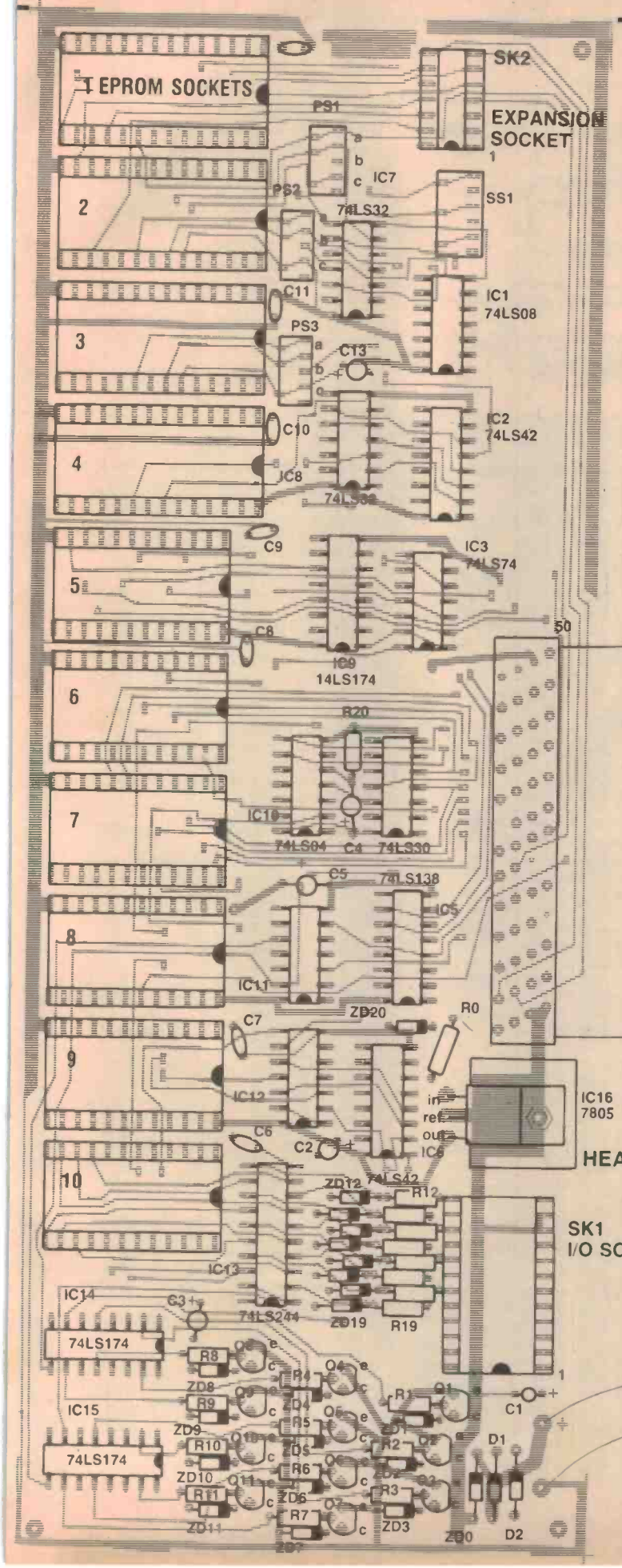
A casette of 'driving' software is provided with kits. This contains two 'monitor' programs, one in BASIC, the other in machine code. Using the monitor you can utilise the input and output lines and, as data for these needs to be in decimal form in programs, but it is in binary form when inputting or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

Copyright on the pc board is held by Avtek Electronics who are marketing the kit. Hence, we have not reproduced the artwork. In anycase, 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 ¼W, 5%
- R0, 12-19 ..... 100R
- R1-11 ..... 5k6
- R20 ..... 1k

Capacitors
- C1 ..... 1µ/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
- Q1-11 ..... BC548
- ZD0 ..... 15 V, 1 W zener
- ZD1-11 ..... 27 V, 400 mW zener
- ZD12-20 ..... 5V6, 400 mW zener

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

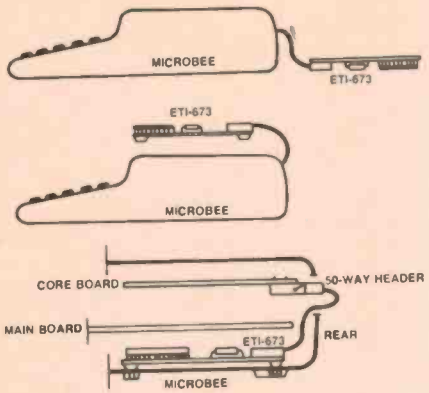
ETI-673 pc board; 50-way I.D. board header; approx. 80 mm of 50-way ribbon cable; IC sockets — 4 x 28-in, 6 x 24-pin, 1 x 20-pin, 6 x 16-pin; 8 x 14-pin; heatsink — Thermalloy #6073 or similar; 14-pin DIP I.D. plug or header; 24-pin DIP I.D. plug or header; ribbon cable to suit, etc.

Estimated price: $99-$110

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 1.

The 50-way header-cable-socket assembly is mounted last of all. Insulation-displacement (ID), connectors were used on the 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.



Installation

If your Microbee doesn't have an expansion socket fitted, then you'll need to obtain one and fit it. A male 50-way right-angle pc mount type is needed, the same as is used with disk drive interfaces. It mounts under the Microbee's core board. If your 'Bee is still under warranty, your supplier can probably fit one for you.

The MultiPROM board can be mounted in three ways, as shown in the accompanying diagram: on top of the Microbee case, upside down at the rear or inside of the Microbee under the main pc board. The choice is up to you. ▷

HOW IT WORKS — ETI-673

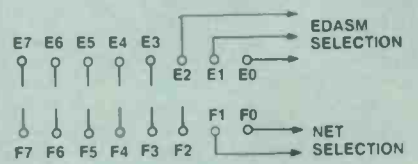
A total of ten EPROM sockets have been provided. Sockets 1, 2 and 3 can accept either type 2532 or 2764 EPROMs, while socket 4 only takes a 2764. Sockets 5 through 10 take only 2532s. Pin numbering on the 28-pin types (for 2764s) is shown in brackets. Sockets 1, 2 and 3 are paired with sockets 5, 6 and 7 respectively, but only sockets 1, 2 and 3 will accept 2764s (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 SS1, PS1, PS2 and PS3. 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 access it, selected by the address and data buss decoding scheme that is part of the output selection circuitry. Sockets 1 through 7 are located at C000 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 Z80 I/O ports for both EPROM selection and the input/output control. These ports are 254 (FE hex) and 255 (FFF 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 Z80 address buss 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 A0-A7 address lines will be high and IORQ low. The A0 line determines which Z80 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 buss 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 buss and IC6 decodes outputs F0 and F1.

The ROM selection signals are gated with the appropriate output from IC5 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.

F2	F1	F0		E1	E0	
0	0	1	EDASM 1	0	1	NET 1
0	1	0	EDASM 2	1	0	NET 2
0	1	1	EDASM 3	1	1	NET 3
1	0	0	EDASM 4			

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

ezample: 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.

F7	F6	F5	F4	F3	F2	F1	F0
0	0	0	0	0	0	1	0

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 one single output line it is necessary to know the decimal equivalent of the complete 8-digit 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 value in an 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 from D0 to D7 (not to be confused with the Z80 data buss). 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.

IC13 buffers the input lines which are protected against excess voltage or reverse polarity by the 100 ohm series resistors and 5V6 zeners across each line.

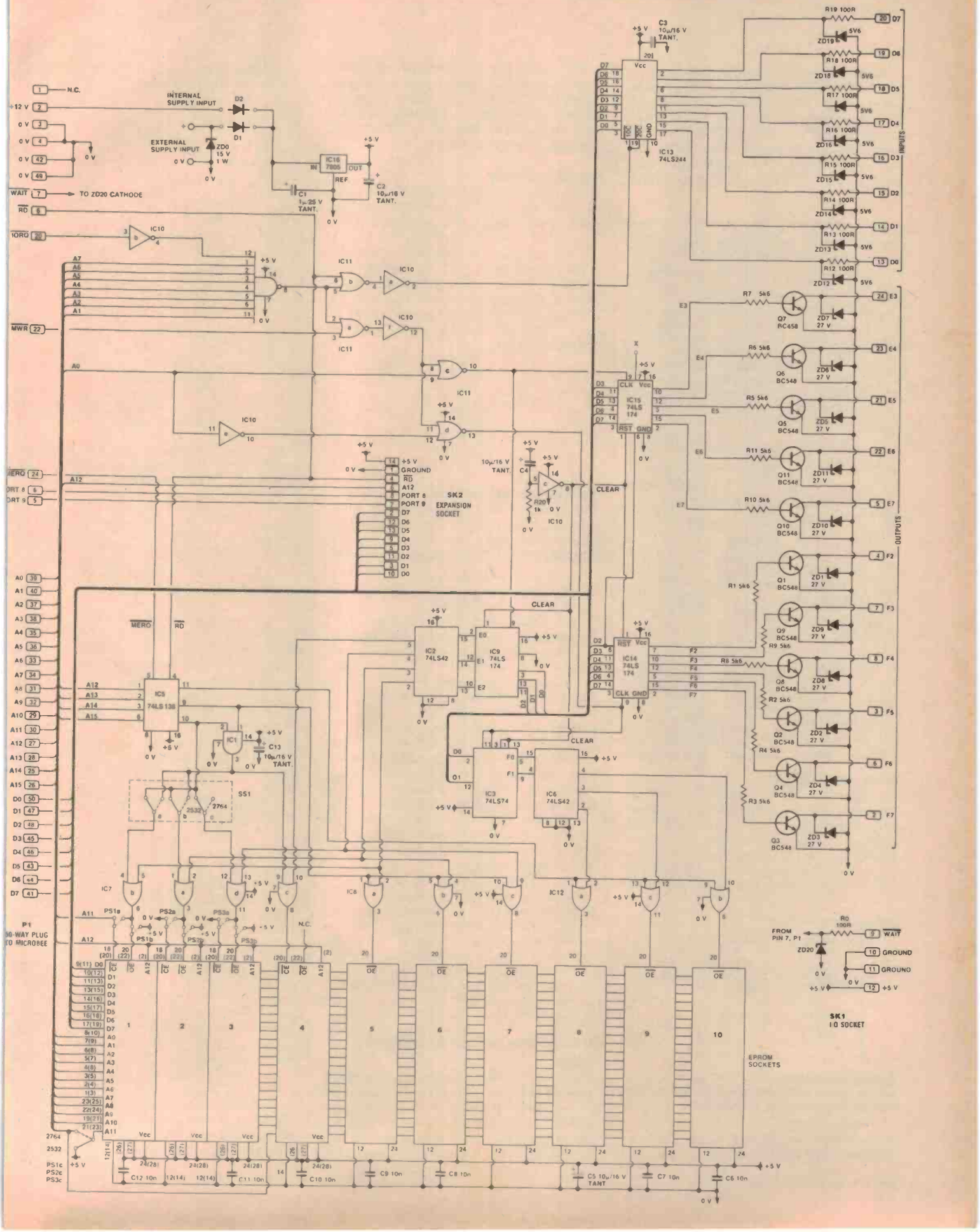
The user outputs, F2-F7 and E3-E7, comprise a series of open-collector BC548s, Q1 to Q11. Each transistor is protected against supply over-voltage and reverse polarity by 27 volt zeners. The E-series outputs are driven by IC15, the F-series by IC14. These two ICs latch the data value from the Z80 address buss, 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 ICs 14 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 input.

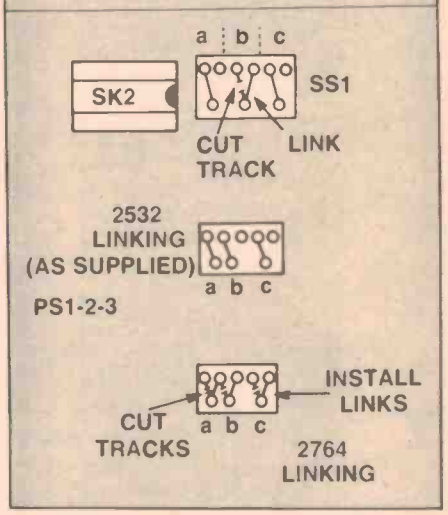
The expansion socket SK2 brings out the Z80 data buss plus 'Bee expansion connector signals RD, address line A12 and ports 8 and 9, along with +5 V and ground.

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


N.C.
+12 V
0 V
WAIT
TO ZD20 CATHODE
RD
IORQ
MWR
A0
A1
A2
A3
A4
A5
A6
A7
A12
A13
A14
A15
INTERNAL SUPPLY INPUT
EXTERNAL SUPPLY INPUT
D1
D2
ZD0 15 V 1 W
IC16 7805
IN
OUT
REF
C1 1µ/25 V TANT.
C2 10µ/16 V TANT.
+5 V
IC10
IC11
IC13 74LS244
IC15 74LS 174
IC14 74LS 174
IC2 74LS42
IC9 74LS 174
IC5 74LS 138
IC1
IC3 74LS74
IC6 74LS42
IC7
IC8
IC12
C3 10µ/16 V TANT.
C4 10µ/16 V TANT.
C13 10µ/16 V TANT.
R20 1k
CLEAR
MERO
RD
SK2 EXPANSION SOCKET
GROUND
PORT 8
PORT 9
D7
D6
D5
D4
D3
D2
D1
D0
INPUTS
OUTPUTS
R19 100R
R18 100R
R17 100R
R16 100R
R15 100R
R14 100R
R13 100R
R12 100R
ZD19 5V6
ZD18 5V6
ZD17 5V6
ZD16 5V6
ZD15 5V6
ZD14 5V6
ZD13 5V6
ZD12 5V6
R7 5k6
R6 5k6
R5 5k6
R11 5k6
R10 5k6
R1 5k6
R9 5k6
R8 5k6
R2 5k6
R4 5k6
R3 5k6
Q7 BC458
Q6 BC548
Q5 BC548
Q11 BC548
Q10 BC548
Q1 BC548
Q9 BC548
Q8 BC548
Q2 BC548
Q4 BC548
Q3 BC548
ZD7 27 V
ZD6 27 V
ZD5 27 V
ZD11 27 V
ZD10 27 V
ZD1 27 V
ZD9 27 V
ZD8 27 V
ZD2 27 V
ZD4 27 V
ZD3 27 V
SS1
2532
2764
PS1a
PS1b
PS2a
PS2b
PS3a
PS3b
N.C.
P1 50-WAY PLUG TO MICROBEE
EPROM SOCKETS
SK1 I/O SOCKET
R0 100R
ZD20
FROM PIN 7, P1
WAIT
GROUND
GROUND
+5 V
C12 10n
C11 10n
C10 10n
C9 10n
C8 10n
C5 10µ/16 V TANT
C7 10n
C6 10n

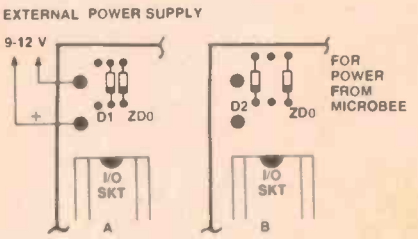
Before using the board you'll need to decide what EPROM types you'll be using and set up the linking on SS1, PS1, PS2 and PS3 accordingly. As it comes, the board is set up for 2532s with tracks linking the connection pads in the field areas on the top side of the board. The appropriate tracks must be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



Internal/external supply. Connections for using an external power supply (A); (B) shows arrangement for obtaining power from the Microbee.

The board can be powered externally from a small 9 Vdc 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 reselect the proper EPROM.

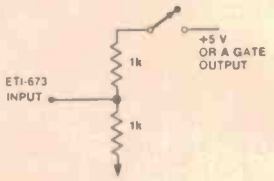
Example: OUT 254,1 (Wordbee), type EDASM. You are in Wordbee. Then enter text. Turn power OFF. Turn power on, the screen should display

OPTION NOT FITTED

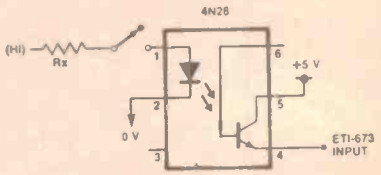
This is because the 'Bee does not see any EPROM until they are selected. So, enter OUT 254,1 (Wordbee), type EDASM. You should be back in Wordbee. If you're 'Bee appears to hang, then reset. It is a good idea to always leave the monitor when turning the power off as this leaves a return address in memory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

Using the input & output lines

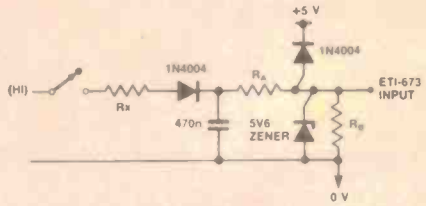
To use the input and output lines on-board, you will have to interface them to some sort of hardware. Take the inputs first. There are two forms the input can take: reading the 'status' of a switch, which can be open or closed; or the input can be driven from the output of a logic gate. To read the status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

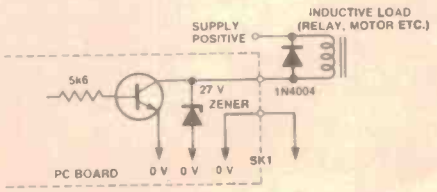


To drive an input direct from a logic gate output, no special interface is required.

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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The board takes the EDASM and NET eprom normally residing inside the Microbee, but allows several different sets to fit in: Editor-Assembler, Wordbee, Logo, MiniPascal, Networkrom, Bemon or your own program. It has room for 4 sets of eproms in the EDASM location and 3 sets of eproms in the NET location, a total of 44K of eprom. The board can be simply daisy chained with up to 6 slave boards (using an outside power supply in this case), allowing a maximum total of 308K in ROM. The EDASM locations accept either type 2532 or 2764 eproms and they can be mixed. Another powerful feature of the board is the input/output system. 11 outputs, open collector transistor driven. Each can turn ON or OFF a relay under program control. 8 inputs, buffered and protected can read 8 switch status. Ideal for computer controlling of model trains, alarm systems, tape recorders, machinery etc.
The Avtek kit includes a plated through board plus all components to make this exciting project. There is also provision on the board to change the address of the ports used for eprom selection and input/output.

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ETI-644 Modem —follow-up No. 2

Roger Harrison

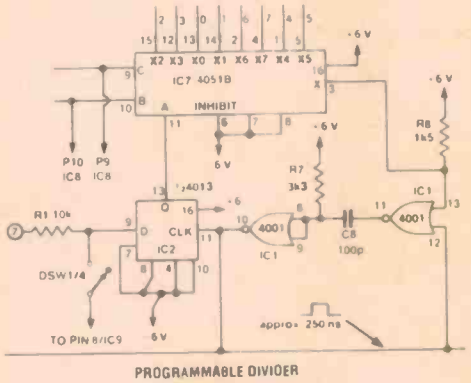
For those of you still struggling to get your recalcjtrant '644 modem up and running, the following pearls of wisdom and experience from Trevor Marshall (the designer) and Richard White (a successful constructor) should set you on a successful course.

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.

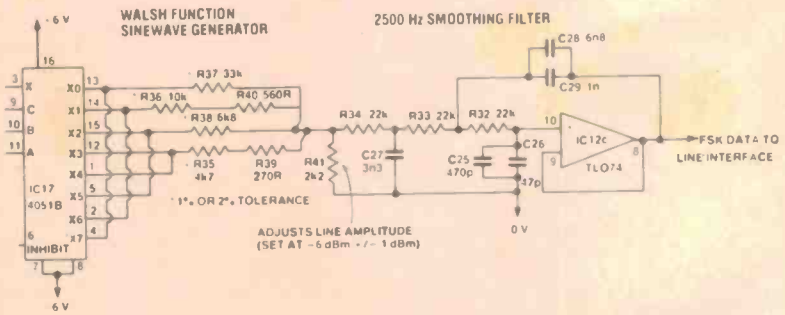
Since April 1982 the ETI modem (prototype) which I have adapted to the Bell 103 system frequencies, has been performing well at 300 and 600 baud across the USA.

In January 1983 I added an APPLE-CAT 212 add-on card to give my RCPM Bell 212 1200 baud PSK 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.



PROGRAMMABLE DIVIDER

Improve reset. You can improve the reset pulse here by changing R7 to 10k (see also, R6, top opposite page).



Set line level. The transmit line level has been found to be too high in practice at −6 dBm, swamping the reactive channel. Reduce it to −18 dBm or lower by lowering the value of R41. Richard White suggests 270R.

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 FC in answer mode (F = lowpass, C = Highpass) 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 4528B (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, and 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 TL081. 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 single 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).

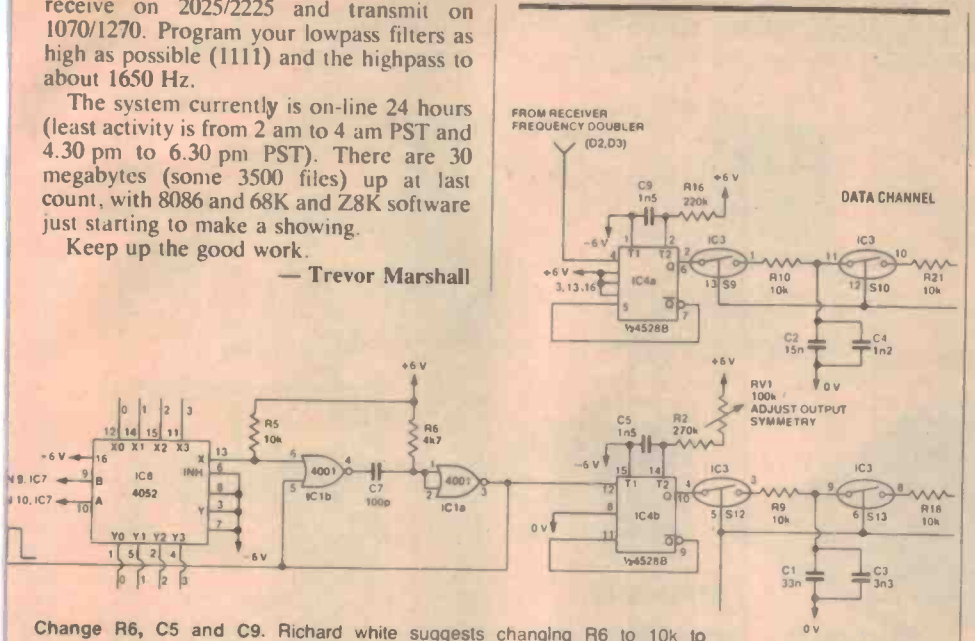
In closing, I often wonder why I have no callers from Australia. There are several who call my 'Thousand Oaks' RBBS system from Britain every week. Surely some of you who work for OTC (I didn't really say that . . .) could arrange to keep Bill more up to date with what's happening over here. Transfers at Bell 212 1200 Baud PSK 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



Change R6, C5 and C9. Richard white suggests changing R6 to 10k to improve the reset pulse here and changing C5 and C9 each to 1n (5% polystyrene) to shorten the monostable pulses.

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.

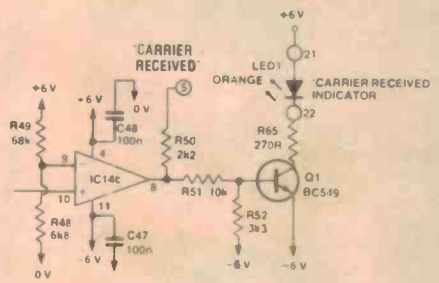
(2) DC offset at the output of IC20 (2 V) needed adjustment to allow the full operating range in this area. This fault may have been related only to my set of chips.

(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.

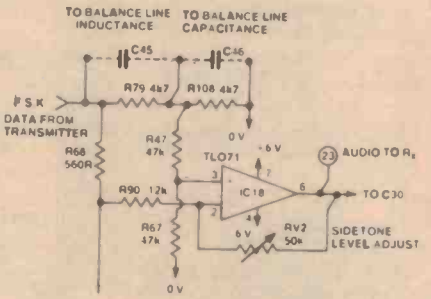
(4) Nulling the line is quite touchy (¼-turn on a ten-turn pot). This must be done with the optimal cap in C45-46 and takes quite a bit of fiddling to get right. It must be done with the line open, your modem in the transmit mode and preferably with nothing else on the line (dial tone or answer tone 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.



Line balance. Line balance requires fine adjustment. Make RV2 a 10-turn panel-mount pot. if you like. See (4) above.

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 ●

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 (½") 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-number 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 of the board 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 5¼" disk drives. The Little Big Board *will* drive 5¼" 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 5¼" 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 serial terminal. Read all about it! The B-ETI Serial Terminal, ideal as a low cost terminal for your little big board — just $275 on introductory offer (see page 71).

Note that 5¼" high density drives require "high density" media for reliable operation. Pulsar recommend Maxell MD2-HD, Memorex 2D-80-HD, Verbatim HDX and Dysan UHR-2.

Terminal hookup

It's a good idea to check the signals implemented on the RS232 connector on your terminal. If yours does not implement the 'Request to Send' signal, pin 4 of the D25 RS232 connector, then tie it high (+12 volts). If this is not done, nothing will happen. If you're using a Microbee as a terminal, tie pin 4 to pin 9. Best place to tie it high is at the *terminal* end, at the back of the D25 connector, *not* at the Little Big Board.

Note that the Microbee with Network emulates the ADM-3A terminal format, but communicates at 1200 baud. You can operate in half duplex or full duplex modes. The Little Big Board is set up for full duplex operation.

A low-cost terminal

Now here we have some *good* news for you! By special arrangement between ETI and Applied Technology a special 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 modes, all software selectable. It emulates the popular ADM-3A terminal format and most of the 'Televideo 912' format, making it simple to install in CP/M 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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UNCONDITIONALLY STABLE

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

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Has tapered low frequency response for articulate speech reproduction. Low impedance balance line. PTT switch with lock facility. Additional switch contacts for remote switching, muting etc. Gooseneck approx. 350mm.

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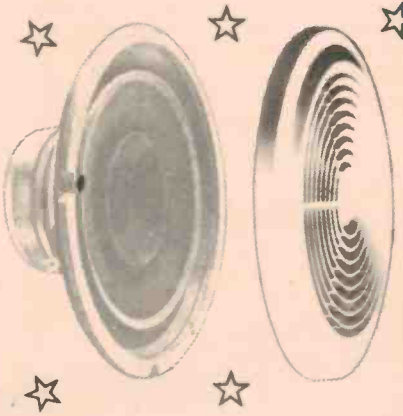

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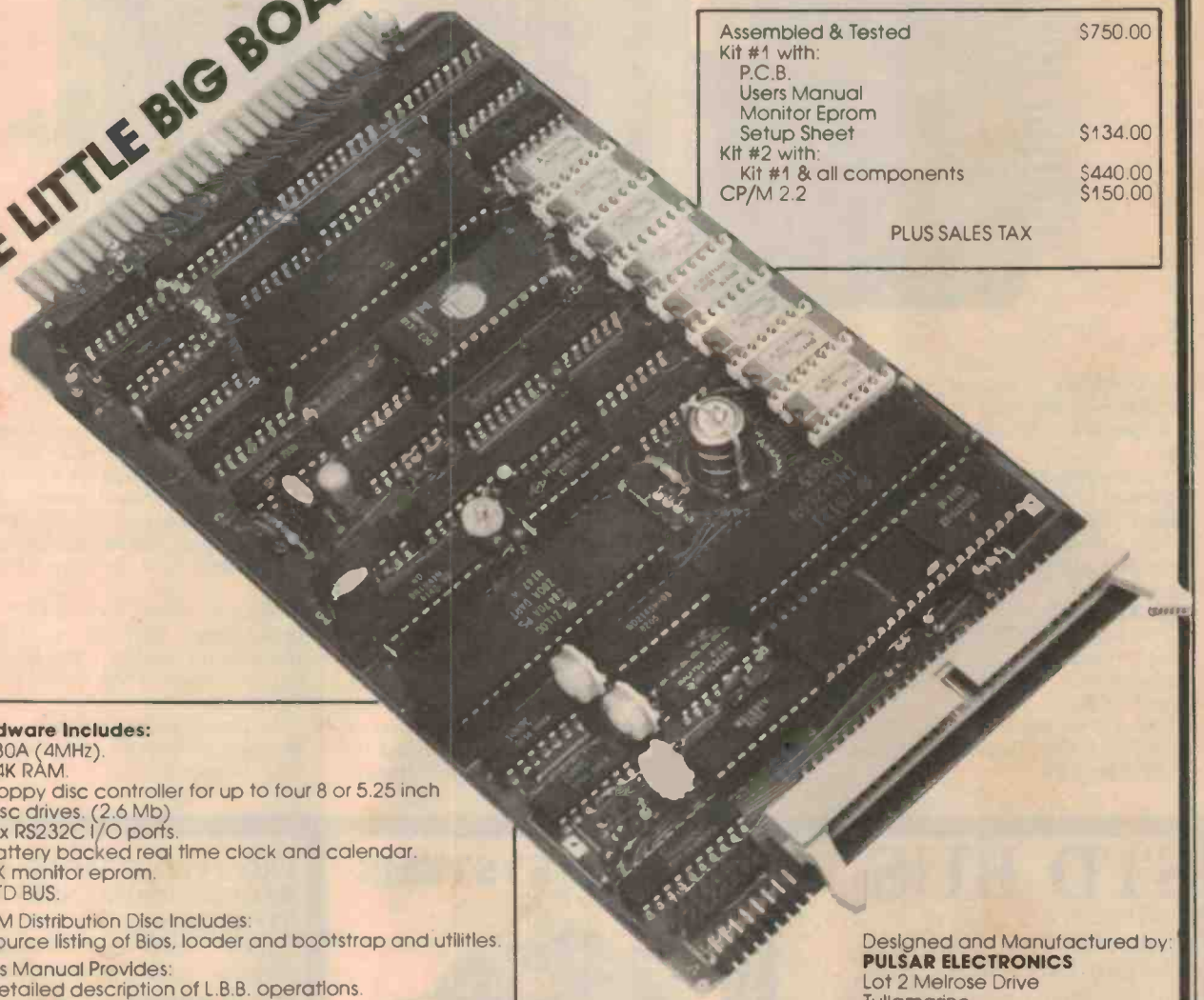
PULSAR

THE LITTLE BIG BOARD



Assembled & Tested	$750.00
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Hardware Includes:
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—2K monitor eprom.
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—Detailed description of L.B.B. operations.
—Circuit diagrams of L.B.B.
—Setup procedure for various disc drives.
—Functions of Monitor Eprom.
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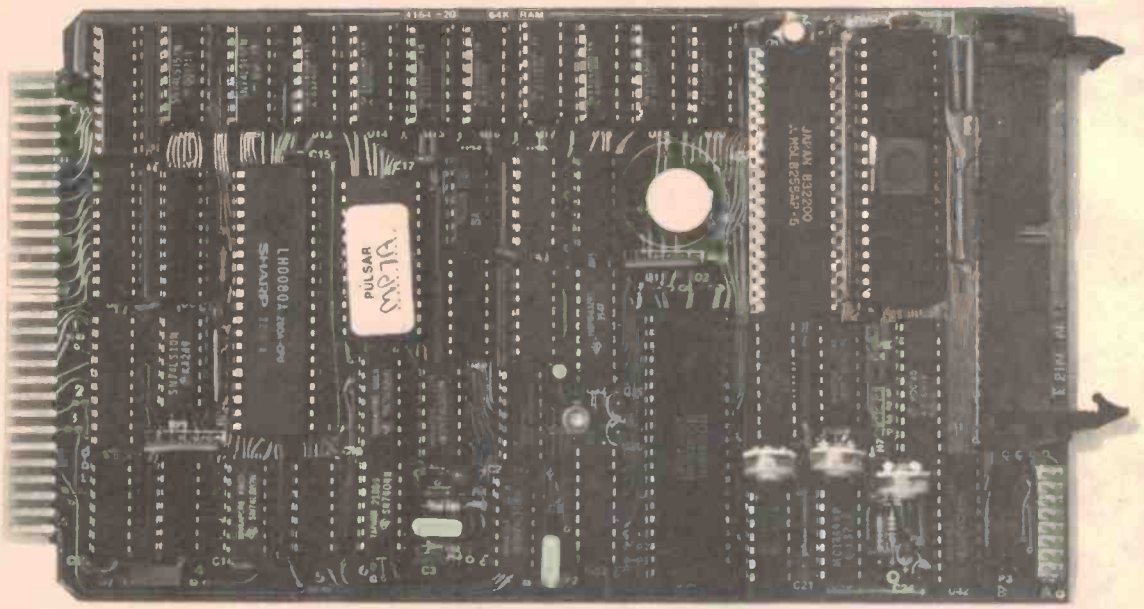

Commands are as follows:

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. ●

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 at 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.

FEATURES

- 300/1200 baud operation, software selectable.
- powered from 12Vdc supply.
- low cost — only $275.
- 80 characters x 24 lines screen format.
- auto-repeat on all character keys and space bar.

OFFER CLOSES 31 DECEMBER 1983

HOW TO ORDER YOUR B-ETI SERIAL TERMINAL

Fill out the coupon here, or a photostat of it, and enclose a cheque, bank cheque or money order for the amount required, made out to **APPLIED TECHNOLOGY PTY LTD.**

Cut out the coupon and send it to: **B-ETI TERMINAL OFFER** c/o ETI Magazine, P.O. Box 21, Waterloo, NSW, 2017.

Please rush me ..... B-ETI Serial Terminal(s) @ $275 each plus $10 freight. Offer closes 31 December 1983.

I enclose $..... total.

Cheque or Money Order No.....

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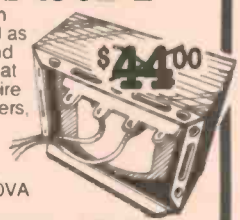
This transformer is used in the MOSFET amp, as well as a host of power supply and power amp circuits. Look at the massive saving. Enquire about our other transformers, always at the best prices around.



$44.00

Specifications

Nominal rating..... 200VA
Output Voltages:

70V @ 2.5V CT	or35V @ 5A plus 15V @ 1A	
or	or	
66V @ 2.5A CT	33V @ 5A	$32.00
or	or	
62V @ 2.5A CT	31V @ 5A	

Dimensions 95mm(H) x 79mm(W) x 95mm(L)

Z80A chips at prices that compute

Top quality Z80 chips at amazing savings:

Z80A CPU
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Z80A PIO
Don't pay $9.95!! All $5.00 each, 10+ $4.50

Z80A SIO Only $15.00 each

Brilliant LED special

	1-9	10-99	100+
5mm Red	12c	8c	6c
5mm Green/Yellow/	20c	16c	14c
3mm Red/Green/Yellow	15c	12c	10c
HP High Intensity			
5mm Red	60c	54c	
5mm Yellow/Green	65c	60c	
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Red	40c	35c	
Flashing Red LEDs	30c	25c	

Unbelievably low prices!!

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Huge saving on this popular delay IC.

Only $9.00 each, 10+ $8.00

Others are asking $22.00!!

NEW LEDs

Great new HP right angle mount LEDs with plastic holders. In red, green or yellow

Top quality!!

Only $1.40 each, $1.20 10+

Also available in 5V and 12V (red only) Perfect for on board mounting.

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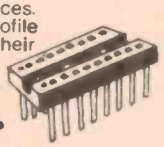
Only $4.40 each, 10+ $3.90

14 and 16 pin IC sockets

Never again at these prices. High quality AMP low profile sockets at a fraction of their usual price.



10 for $1
100 for $9

Electro Price Massacre

Selling at around 1/4 their normal price. We had a huge response to our half price electro sale. There are a few left and the have to be moved out, so the prices have been reduced to crazy levels. If you need top quality Philips or Sprague electros, get in for your chop – they'll never be cheaper!! They even include the mounting brackets!!

14,000/25V **were $5.50, now $4.50**
47,000/25V **were $17.00 now $12.00**
10,000/40V **were $6.50 now $5.00**
14,000/40V **were $9.00 now $7.00**
39,000/30V **were $13.00 now $10.00**
500/250V **were $5.00 now $3.00**
22,000/75V **were $19.00 now $15.00**
120,000/15V **were $18.00 now $12.00**

SN76489 Sound Generator $9.50

Get these very rare beasties at huge savings. Others are asking $15.00. Look out our mind blowing price!!

SN76488 Sound Generator $6.80

Normally selling for $10.50.
Save $4.00 at Sheridans

Price/performance Breakthrough

DON'T PAY ~~$699~~

$499 including tax.

Need RS232 serial interface? Just buy the RS232 serial card and plug it into your FAX-80. Others charge up to $300 extra for serial interface. Our price is a low: **$79.95**

The unbeatable FAX-80

Australia's best value printer – now at an unbeatable Sheridan price!!

If you've been looking for a high quality printer at a down to earth price, the FAX-80 is right for you. It offers features equal to printers costing over $1,000. We have made a huge purchase of these superb printers and reduced the price by a staggering $200. We believe this is Australia's best value dot matrix printer. Look at the features and specs. We don't think there's another printer near the price that even comes close.

- **Accepts 4" to 10" paper**
- **High resolution 9x9 matrix (including graphics)**
- **Adjustable tractor and friction feed**
- **80 characters per second with bidirectional printing**
- **User detachable print head**

Specifications

Printing Method	Serial Impact Dot Matrix
Printing Matrix	9x7 (8x8 Graphics)
Printhead	9 wires printhead
Print Rate	80 CPS
Line Spacing	1/6" x 1/8" Software selectable
Number of Columns	80, 142 (40, 71 Enlarged)
Printing	Bidirectional
Character Set	96 ASCII plus European
Switches	Power On/Off, Line Feed, Form Feed, On-Line
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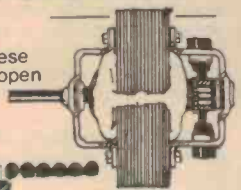

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MICROBEE SOFTWARE — MAKING IT DO ITS TRICKS

Tom Moffat, 39 Pillinger Drive, Fern Tree, Tas 7101

You didn't buy your Microbee to play games, did you? Of course not. You bought it for serious uses only. Home accounting, Education. Of course! Games are kids stuff, right? You're going to use your Microbee to learn programming.

Then again, a study of the structure and theory of games should teach you a lot about programming. And to learn how the games work, you're obviously going to play them.

This little article should help you select which games you'd like to study, for educational purposes only, of course.

I must admit I've spent many long hours studying games. When I was a youth we didn't have computer games, we only had mechanical pinball machines. But they provided the opportunity to study the action of a steel ball, rolling under the influence of gravity, its course interrupted from time to time by collision with some electromechanical device. That was really hard work, all that study.

Today's video games are much flashier, faster, and harder to master. But it's a shame they don't respond to a good hard belt on the side, the way the pinballs used to. A good well-placed knock could double the speed of the ball, providing much more educational action. Too hard a knock, of course, would result in a 'tilt' alarm and an instant end to the lesson.

When the first Microbees arrived they were supplied with some software that looked pretty good at the time, mostly written in BASIC. Remember the maths demos, the graph generators, the clock program, Tunes? And how about 'Four-in-a-row'? Anyone who hasn't bothered with this game, should. It's most clever, and quite addictive.

All 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 written 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!".

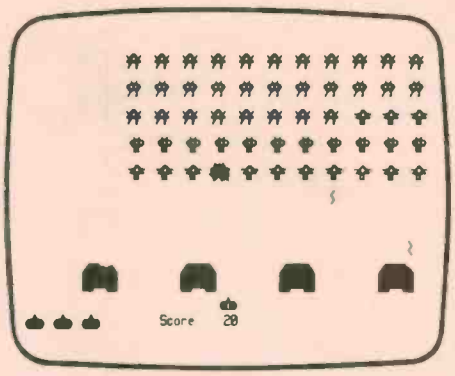

Figure 1. The Microspace Invaders screen; a Mytek cassette game.

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 copped a rocket and is 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 bleeps 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.

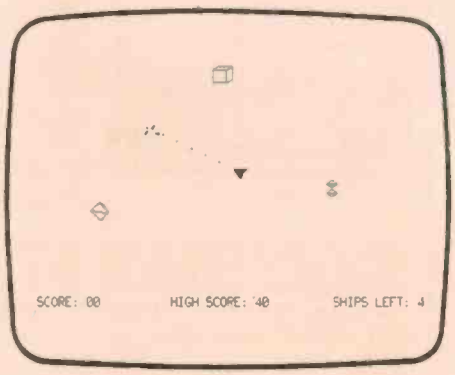

Figure 2. Asteroids Plus screen — dull here, exciting in the flesh. Another Mytek cassette game.

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 around your ship. 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.

Another notable 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 fizzy-whizzy will launch a 'football bomb' as it passes. You must then 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 loo 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 to a minimum. Avoid 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 up first).

Good play on your part, particularly among fizzy-whizzles and football bombs, sometimes results in extra spaceships being awarded. So you can keep racking 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 chomp 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 Microbee. It will be interesting to find out how it does it.

Winning strategy long hours of practise.

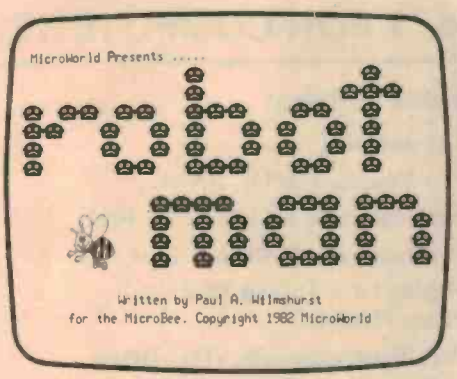

Figure 3. Robot Man — Microworld's version of the popular Pac Man.

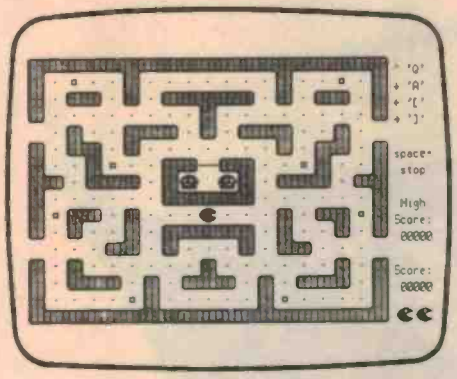

Figure 4. The Robot Man screen.

Chess

Not really an arcade game, but worth a mention because of its good graphics and excellent play. See Figure 5. You get a full chess board and the moves are listed down the left side in standard chess notation.

I must admit I had never played a game of chess in my life until this program fell into my hands. I had to get a book out of the library just to learn the rules. Needless to say the program found me an unworthy opponent, and kept calling everything I did an 'illegal move'.

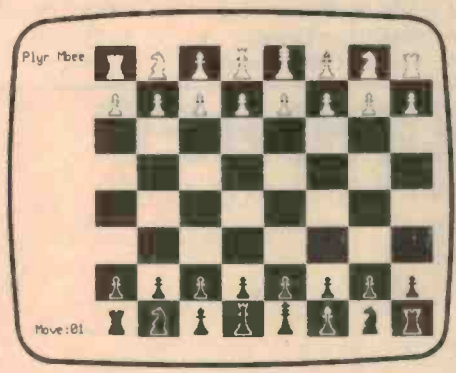

Figure 5. Microworld's Chess game. Keep your wits about you!

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 'materiallstic' 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 ask Boris Spassky.

Eliza

No picture, as there's nothing to see. No graphics. But this program is 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 $12 to the author for a post-paid cassette.

OPERATE OUTPUT AT 110 BAUD

Gary Hegedus, Greensborough, Vic.

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.

After entering and running your program type in 'OUT#40N'. This produces 110 baud at the output. Both LLIST AND LPRINT also operate at the same rate.

'New' and warm start do not reset the output so there is no need to keep reloading the program under normal conditions.

OPERATE OUTPUT AT 110 BAUD

```
00100 REM PROGRAM TO OPERATE OUTPUT AT 110 BAUD
00110 REM TYPE  OUT#40N  AFTER RUNNING PROGRAM
00120 REM PROGRAM BY GARY HEGEDUS & GEOFF TAURINS
00130 FOR X=416 TO 486
00140 READ D
00150 POKE X,D
00160 NEXT X
00170 USR(471)
00180 DATA 197,245,219,2,203,95,40,250,241,183,205,190,1,6
00190 DATA 8,15,205,190,1,16,250,55,205,190,1,205,190,1,193
00200 DATA 201,245,197,219,2,203,175,48,2,203,239,211,2,6,233
00210 DATA 197,193,197,193,197,193,16,248,193,241,201,33,160
00220 DATA 1,34,186,0,33,160,1,34,188,0,195,33,128,0
```

CALENDAR MODIFICATION

Jim Lawrence, Ravensthorpe, WA

This modification is to Noel Bailey's program 'Calendar' which appeared in ETI September 1983 on page 69.

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 recognise 2000 as a leap year.

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.

CALENDAR MODIFICATION

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

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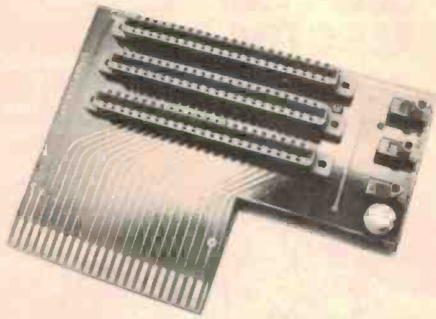

Ozi-Soft, in conjunction with Computer Technics, is offering to donate a VIC-20 expansion board for the best software item submitted to this column every month.

The board is Australian-designed and manufactured and simply plugs into the VIC-20's expansion slot. It features three sockets that can be independently switch-selected, plus an on-board reset switch. With it you can plug in up to three separate expansion units to your VIC-20 and avoid the hassle of plugging things in and out and turning the computer on and off each time.

It is distributed by **Computer Technics, 123 Clarence Street, Sydney (G.P.O. Box 4936) NSW 2000. (02)29-7244.** The board costs $59.95.

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

Send entries to: **The Editor, VIC-20 Column, ETI Magazine, P.O. Box 227, Waterloo NSW 2017.**

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.

GLADIATOR

Peter Kanizay, Bendigo, Vic.

This game, based on the Bally-Midway arcade game 'Wizard of Wor', is for two players. The left-hand player uses the joystick and the right-hand player uses the keypad.

The program runs on a VIC with the super expander cartridge, but it can be easily modified to run with an 8K cartridge.

The keyboard controls are: A-up; Z-down; VERTICAL CRSR-left; HORIZONTAL CRSR-right; SPACE BAR-fire.

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.

GLADIATOR

```
READY.
100 DIM RP(15),M(15),PP(15):POKE36878,15
110 L1=5:L2=5:O1=2:O2=4
120 POKE52,28:POKE56,28:RS=1
130 FORL=7552TO7631:POKEL,PEEK(L+25600):NEXTL:FORL=7424TO7431:POKEL,0:NEXTL
140 FORL=7168TO7168+(8*8)-1
150 READ A:POKEL,A
160 NEXTL:POKE36869,255
170 DATA255,153,153,255,255,153,153,255,24,44,126,255,189,165,38,96
180 DATA24,52,126,255,189,165,100,6,0,0,0,0,0,0,0,0,16,144,208,106,42,166,252,28
190 DATA48,96,88,70,120,40,69,106,56,63,101,84,86,91,9,8,12,6,26,226,30,20,34,10
2
200 REM*RND MAZE*
210 TI$="000000":P1=8100:P2=8118
215 SC=SC+1
216 IFSC=5ANDL1>0THENL1=L1+1
217 IFSC=5ANDL2>0THENL2=L2+1
220 PRINT"♥"
230 ON INT(5*RND(0))+1 GOTO 240,250,260,270,280
240 PRINT"@@@@@@@@@@@@@@@@@@@@@@CCCCCCCCCCCCCCCCCC@@@CCCCCCCCCCCCCCCCCCCC@";
241 PRINT"@@C@@C@@@@@C@@@@@C@@C@@@CCC@CCCCCCCCC@CCCC@@@C@@@@CCCCCCCCCC@@@@C$";
242 PRINT"@@CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC@@@CCCCCCCCCCCC@@@C@";
243 PRINT"@@CCC@CCCCCCCCCCCC@CCC@@@CCC@CCCCCCCCCCC@CCC@@@CCC@@C@@@@@@@C@@CCC@";
244 PRINT"@@C@CCCCCCCCCCCCCC@C@@@C@CCCCCC@@@CCCCC@C@@@C@CCCCCCCCCCCCCCCC@C@";
245 PRINT"@@CCC@CCC@CCC@CCC@CCC@@@CCC@CCC@CCC@CCC@CCC@@@CCC@CCC@CCC@CCC@CCC@";:G
OTO340
250 PRINT"@@@@@@@@@@@@@@@@@@@@@@@@CCCCCCCCCCCCCCCCCCCC@@@C@@@@@@@@C@@@@@@@@C@";
251 PRINT"@@C@CCCCCCCCCCCCCCC@C@@@C@C@@@@@C@@@@@@C@C@@@C@CCCCCCCCCCCCC@C@C@";
252 PRINT"@@C@C@C@@@CCC@@@C@C@CCCCCCCCCCCCCC@CCCCCCCCCCCCC@C@CC@CC@C@CC@C@C@";
253 PRINT"@@C@C@CC@CC@CC@CC@C@C@@@C@C@C@CCCC@CC@C@C@@@C@C@CC@@@C@@@CC@C@C@";
254 PRINT"@@C@C@CCCCCCCCCCCC@C@C@@@C@C@@@@@C@@@@@@C@C@@@C@CCCCCCCCCCCCCC@C@";
255 PRINT"@@C@C@C@@@@C@@@@C@C@C@@@CCC@CCCCCCCCCC@CCC@@@CCC@CCCCCC@CCCCC@CCC@";:G
OTO340
260 PRINT"@@@@@@@@@@@@@@@@@@@@@@@@CCCCCCCCCCCCCCCCCCCC@@@CCCCCCCCCCCCCCCCCCC@";
261 PRINT"@@C@C@C@CC@C@CC@C@C@C@@@C@C@C@CC@C@CC@C@C@C@@@C@C@C@CC@C@CC@C@C@C@";
262 PRINT"@@CCCCC@CC@C@CC@CCCCCCCCCCCCCC@CCCCCC@CCCCCCCCCCCCCC@@@CC@@@CCCCC@";
263 PRINT"@@@@C@CCCCCCCCCCC@C@@@@CCC@CCCCCCCCCCCC@CCC@@@CCC@@@CCCCCC@@@CCCC@";
264 PRINT"@@C@CCC@CC@C@CC@CCC@C@@@C@CCC@CC@C@CC@CCC@C@@@C@CCC@CC@C@CC@CC@C@";
265 PRINT"@@CCC@CCC@@C@@CCC@CCC@@@CCC@CCCCCCCCCCCC@CCC@@@CCC@CCCCCCCCCCC@CCC@";:G
OTO340
270 PRINT"@@@@@@@@@@@@@@@@@@@@@@@";:FOR L=1TO16:PRINT"@@CCCCCCCCCCCCCCCCCCC@";:NE
XTL
271 PRINT"@@CCCCCCCCC@CCCCCCCCC@";
272 GOTO340
280 PRINT"@@@@@@@@@@@@@@@@@@@@@@@@CCC@CCCCCCCC@CCC@@@CCCC@C@@C@@C@CCCCC@";
290 PRINT"@@C@@C@CCCCCCCCC@C@@C@@@CCCCCC@@@C@@@CCCCCC@@@C@@CCCCCCCCCCCCCC@@C@";
300 PRINT"@@CCCC@C@C@C@C@C@CCCCCCCCC@@C@C@C@C@C@C@@CCCCCCCCC@C@C@C@C@C@CCCC@";
310 PRINT"@@@C@@@C@CCCCC@C@@@C@@@@CC@CCC@C@CC@CCC@CC@@@CC@CCC@CCCCC@CCC@CC@";
320 PRINT"@@C@@C@@@C@C@C@@@C@@C@@@CCC@CCC@C@CCC@CCCC@@@CCC@CCC@C@CC@CCCCC@";
330 PRINT"@@C@@@@C@CCCCC@C@@@@C@@@CCCCC@C@@@C@CCCCC@@@CCCCCC@CCCCC@CCCCCCC@";
340 PRINT"@@@@@@@@@@@@@@@@@@@@@@@@C@C@CCCCCCCCCCCCCCCC@C@C@@@CCCCCCCCCCCCCCC@@@";:PR
INT"♥"
350 REM
360 REM PUT DROIDS
370 NR=INT(4*RND(0))*2+6:ON=NR
380 FORL=1TONR
390 IFL=INT(L/2)*2THENM(L)=1
400 IFL<>INT(L/2)*2THENM(L)=2
410 RP(L)=INT(395*RND(0))+7702
420 IF PEEK(RP(L))<>03THEN410
430 POKE RP(L),RS:POKERP(L)+30720,INT(8*RND(0))
440 NEXTL
450 POKEP1,O1+3:POKEP1+30720,0:POKEP2,O2+3:POKEP2+30720,6
460 POKE8142,3
470 REM PART2********
480 GOSUB 940
490 GOSUB 640:REMVMEN
500 REM WALK DROID
510 IF L1=0ANDL2=0 THEN 1680
520 IF ON=0THENPRINT"♥T4EFOACFEFOACFOIG":FORL=1TO1000:NEXTL:GOTO200
530 IF RS=1THENRS=2:GOTO550
540 RS=1
550 FOR L=1TONR:IF RP(L)=0THEN 620
560 POKERP(L)+30720,1
570 R=INT((RP(L)-7680)/22)
580 C=(RP(L)-(R*22+7680))
590 GOSUB 1180
600 POKE RP(L),RS:POKERP(L)+30720,INT(8*RND(0))
610 GOSUB1650
620 NEXT L
630 GOTO 480:REM*****
640 JJ=RJOY(0):IFTI$="000010"THENIFP1=8100THENJJ=1
650 IFL1=0THENRETURN
660 IF JJ=0THENRETURN
670 IF JJ=1THENO1=1:GOTO850
680 IF JJ=2THENO1=3:GOTO810
690 IF JJ=4THENO1=4:GOTO790
700 IF JJ=5THENRETURN
710 IF JJ=6THENRETURN
720 IF JJ=8THENO1=2:GOTO830
730 IF JJ=9THENRETURN
740 IF JJ=10THENRETURN
750 IF JJ>100THEN1360
760 REM PROGRAM SHOULDN'T GET TO HERE*******
770 RETURN
780 REM O1=4
790 IF PEEK(P1-1)=0THENRETURN
800 W1=-1:GOTO880
810 IF PEEK(P1+22)=0THENRETURN
820 W1=22:GOTO880
830 IF PEEK(P1+1)=0THENRETURN
840 W1=1:GOTO880
850 IF P1=8100THENW1=-44:GOTO880
860 IF PEEK(P1-22)=0THENRETURN
870 W1=-22:GOTO880
880 POKE36876,255:POKE P1,3:P1=P1+W1
890 POKE P1,O1+3
900 POKE P1+30720,0
910 R1=INT((P1-7680)/22)
920 C1=(P1-(R1*22+7680))
930 POKE36876,67:RETURN
940 JJ=PEEK(197):IFTI$="000011"THENIFP2=8118THENJJ=17
950 IFL2=0THENRETURN
960 IF JJ=64THENRETURN
970 IF JJ=17THENO2=1:GOTO1090
980 IF JJ=23THENO2=2:GOTO1070
990 IF JJ=33THENO2=3:GOTO1050
1000 IF JJ=31THENO2=4:GOTO1030
1010 IF JJ=32THEN1540
1020 RETURN
1030 IFPEEK(P2-1)=0THENRETURN
1040 W2=-1:GOTO1120
1050 IFPEEK(P2+22)=0THENRETURN
1060 W2=22:GOTO1120
1070 IFPEEK(P2+1)=0THENRETURN
1080 W2=1:GOTO1120
1090 IF P2=8118THENW2=-44:GOTO1120
1100 IFPEEK(P2-22)=0THENRETURN
1110 W2=-22:GOTO1120
1120 POKE36875,200:POKE P2,3:P2=P2+W2
1130 POKE P2,O2+3
1140 POKE P2+30720,6
1150 R2=INT((P2-7680)/22)
1160 C2=(P2-(R2*22+7680))
1170 POKE36875,77:RETURN
1180 V=0:H=0:IF M(L)=2THEN1260
1185 IF P1>8097THEN1250
1190 IF R>R1THENIFPEEK(RP(L)-22)<>0THENRP(L)=RP(L)-22
1200 IF R<R1THENIFPEEK(RP(L)+22)<>0THENRP(L)=RP(L)+22
1210 GOSUB1330
```

```
1220 IF C>C1THENIFPEEK(RP(L)-1)<>0THENH=-1
1230 IF C<C1THENIFPEEK(RP(L)+1)<>0THENH=1
1240 RP(L)=RP(L)+H
1245 IFRF(L)=8056THENRP(L)=7757
1250 RETURN
1260 IFP2>8097THEN1320
1261 IF R>R2THENIFPEEK(RP(L)-22)<>0THENRP(L)=RP(L)-22
1270 IF R<R2THENIFPEEK(RP(L)+22)<>0THENRP(L)=RP(L)+22
1280 GOSUB1330
1290 IF C>C2THENIFPEEK(RP(L)-1)<>0THENH=-1
1300 IF C<C2THENIFPEEK(RP(L)+1)<>0THENH=1
1310 RP(L)=RP(L)+H
1315 IFRP(L)=8074THENRP(L)=7757
1320 RETURN
1330 R=INT((RP(L)-7680)/22)
1340 C=(RP(L)-(R*22+7680))
1350 RETURN
1360 PP=P1:IF O1=1THENB1=-22
1370 IF O1=2THENB1=1
1380 IF D1=3THENB1=22
1390 IF O1=4THENB1=-1
1400 PP=PP+B1
1410 IF PEEK(PP)=0THENRETURN
1420 FOR K=1TONR
1430 IFPEEK(PP)>3THENGOSUB1470:P2=8118:S1=S1+30:L2=L2-1:RETURN
1440 IF PP=RP(K)THEN RP(K)=0:ON=ON-1:S1=S1+10:GOTO1470
1450 NEXT K
1460 GOTO 1400
1470 FORL=1TO10:POKE PP,4:POKEPP+30720,2:POKE 36877,255
1480 POKE PP,5:POKE36877,200
1490 POKE PP,6:POKE36877,222
1500 POKE PP,7:NEXTL
READY.
1500 POKE PP,7:NEXTL
1510 POKE PP,3:POKE36877,77
1520 PRINT"■";L1;S1;"          ";S2;L2;"■"
1530 RETURN
1540 PP=P2:IF O2=1THENB2=-22
1550 IF O2=2THENB2=1
1560 IF O2=3THENB2=22
1570 IF O2=4THENB2=-1
1580 PP=PP+B2
1590 IF PEEK(PP)=0THENRETURN
1600 FOR K=1TONR
1610 IFPEEK(PP)>3THENGOSUB1470:P1=8100:S2=S2+30:L1=L1-1:RETURN
1620 IF PP=RP(K)THEN RP(K)=0:S2=S2+10:ON=ON-1:GOTO1470
1630 NEXT K
1640 GOTO 1580
1650 IFRP(L)=P1THENL1=L1-1:PP=P1:GOSUB1470:P1=8100:TI$="000000"
1660 IFRP(L)=P2THENL2=L2-1:PP=P2:GOSUB1470:P2=8118:TI$="000000"
1670 RETURN
1680 FORL=1TO10000:NEXTL:PRINT"■":END
READY.
```

ALARM CLOCK

Mark Smith, Laverton Vic.

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

```
10 REM CLOCK:Q=0:A1$="000000":A2$="000000"
20 POKE36879,140
30 PRINT"■THE PROGRAM WILL RUN ":PRINT:PRINT"JUST LIKE A NORMA
:PRINT:PRINT"C LOCK"
40 PRINT:PRINT:PRINT"TO SET THE":PRINT:PRINT
45 PRINT"TIME PRESS (F1)":PRINT
50 PRINT"ALARM 1 PRESS (F3)":PRINT
55 PRINT"ALARM 2 PRESS (F5)":PRINT
60 PRINT"STOP ALARM PRESS F(7)"
70 PRINT"■HIT RETURN WHEN READY":INPUTA$
75 PRINT"■"
80 GETA$:IFA$=""THEN200
90 IFA$=CHR$(133)THEN400
100 IFA$=CHR$(134)THEN500
110 IFA$=CHR$(135)THEN600
120 IFA$=CHR$(136)THEN1020
125 IFQ=1THEN1010
130 GOTO80
200 PRINT"■"
210 FORL=0TO500:NEXT
220 PRINT"■";TI$
230 PRINT"■TIME■HHMMSS"
240 PRINT"■ALARM1■ALARM2"
250 PRINTA1$;"            ";A2$
260 IFA1$=TI$ORA2$=TI$THEN1000
270 GOTO80
400 INPUT"TIME SET";F$
410 PRINT"THE TIME YOU SET WAS";F$
420 TI$=F$:FORP=0TO1000:NEXTP
430 GOTO75
500 INPUT"ALARM #1";A1$
510 PRINT"ALARM #1 SET FOR";A1$
520 FORP=0TO1000:NEXTP
530 GOTO75
600 INPUT"ALARM #2";A2$
610 PRINT"ALARM #2 SET FOR";A2$
620 FORP=0TO1000:NEXTP
630 GOTO75
1000 POKE36878,15:POKE36876,230:Q=1
1010 FORP=0TO50:NEXTP
1015 GOTO80
1020 POKE36878,0:POKE36876,0:Q=0
1030 GOTO75

READY.
```

MAZE CHASE

Mark Smith, Laverton, Vic.

You must think and act quickly to score any points in this game.

MAZE CHASE

```
1 PRINT"■":POKE36879,91
2 PRINT"ANOTHER GAMES OF SKILLAND SPEED WHERE YOU   HAVE TO CONTROL A TINY'■'
  AND PLACE IT"
3 PRINT"OVER THE 'O'. WHEN     EVER YOU DO THIS, THE DOT DISSAPPEARS AND
  YOU HAVE TO"
4 PRINT"START AGAIN. DON'T RUN INTO THE '■',THEY ARE THERE TO BLOCK YOU."
5 PRINT"YOU HAVE SIX SECONDS  TO GET EACH 'O' SO     HURRY."
6 PRINT"CONTROLS....           Z-FOR UP                 X-FOR DOWN
  <-FOR LEFT"
7 PRINT">-FOR RIGHT":INPUT"ARE YOU READY";A$
8 PRINT"■"
9 SC=0:POKE7680+Y,90
10 Q=INT(RND(1)*30)+60:FORC=1TOQ
11 R=INT(RND(1)*507):IFPEEK(7680+R)=102THEN11
12 POKE7680+R,102:POKE38400+R,2:NEXTC
19 POKE7680+0,32
20 O=INT(RND(1)*507):IFPEEK(7680+O)=102ORPEEK(7680+O)=90THEN20
21 D=D+1:IFD=31THEN220
22 TI$="000000"
25 POKE38400+O,0:POKE7680+O,87
50 IFTI$="000006"THEN19
51 IFPEEK(197)=64THEN100
52 IFPEEK(197)=33THEN60
53 IFPEEK(197)=26THEN70
54 IFPEEK(197)=29THEN80
55 IFPEEK(197)=37THEN90
60 Y=Y-22:IFY<0THENY=Y+22
61 IFPEEK(7680+Y)=102THENY=Y+22
62 POKE7680+Y+22,32
63 IFY=OTHEN200
64 POKE38400+Y,1:POKE7680+Y,90
65 GOTO100
70 Y=Y+22:IFY>506THENY=Y-22
71 IFPEEK(7680+Y)=102THENY=Y-22
72 POKE7680+Y-22,32
73 IFY=OTHEN200
74 POKE38400+Y,1:POKE7680+Y,90
75 GOTO100
80 Y=Y-1:IFY<0THENY=0
81 IFPEEK(7680+Y)=102THENY=Y+1
82 POKE7680+Y+1,32
83 IFY=OTHEN200
84 POKE38400+Y,1:POKE7680+Y,90
85 GOTO100
90 Y=Y+1:IFY>506THENY=506
91 IFPEEK(7680+Y)=102THENY=Y-1
92 POKE7680+Y-1,32
93 IFY=OTHEN200
94 POKE38400+Y,1:POKE7680+Y,90
95 GOTO100
100 FORW=0TO40:NEXTW:GOTO50
200 POKE36878,15:FORL=0TO10:POKE36876,250:POKE7680+Y,86:FORLL=0TO30:NEXTLL:
    POKE36876,0
201 POKE7680+Y,32:FORLL=0TO10:NEXTLL:NEXTL
202 SC=SC+1:POKE38400+Y,1:POKE7680+Y,90:GOTO20
220 PRINT"■ YOU HAVE MANAGED TO  SCORE OUT OF 35        POSSIBLE SHOTS A SCOREOF"
;SC:PRINT
221 PRINT"IF YOU SCORED         15 YOU NEED A LOT OF    HELP"
222 PRINT"20 YOU ARE NOT TOO BAD":PRINT"30 YOU ARE A SMART ALLEC."

READY.
```

VIC-20 PROGRAM POTPOURRI

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 is 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.

AIR BATTLE

```
8 POKE650,255:SD=36876:N=36877:V=36878:POKEV,15:POKE36869,240:POKE56,28:POKE52,2
8
9 I=0:POKE37139,0:DD=37154:PA=37137:PB=37152
10 READA:IFA<>-1THENPOKE7168+I,A:I=I+1:GOTO10
11 FORI=0TO7:POKE7168+32*8+I,0:NEXT:FORI=1TO4:READCH(I),D(I):NEXT
13 PRINT"■■■■■■■■■AIR BATTLE■■■■■■■■■■■■■■■BY■■■■■■■GORDON MAXIM":POKE36879,109
16 PRINT"■■LAST SCORE "SC"■■■HIGH SCORE "HS"■■■■F1 FOR INSTRUCTIONS"
19 PRINT"■■■■F7 TO CONTINUE":SC=0:P=7933:POKE198,0
20 GETO$:IFO$<>"■"ANDO$<>"■"THEN20
21 IFO$="■"THENGOSUB3000
22 PRINT"■":POKE36869,255:POKEN,220
23 FORI=0TO21:POKE7680+I,5:POKE38400+I,0:POKE8164+I,5:POKE38884+I,0:NEXT
24 FORI=1TO22:POKE7680+22*I,5:POKE38400+22*I,0:POKE7701+22*I,5:POKE38421+22*I,0:NEXT
25 POKEN,0
26 FORI=128TO254:POKEV,INT((300-I)/12):POKESD,I:POKEN,I:NEXT:POKEV,15:POKESD,0:POKEN,0
27 TI$="000000"
28 POKEDD,127:W3=((PEEK(PB)AND128)=0):POKEDD,255:Z=PEEK(PA):W1=((ZAND8)=0):OP=P
29 W2=((ZAND16)=0):W0=((ZAND4)=0):P=P+(W0-W1)*22+W2-W3:IF(ZAND32)=0ANDGM=0THENGM=2
30 O=PEEK(197)
31 P=P+((O=9)-(O=33))*22+(O=17)-(O=41):IFGM=0ANDO=32THENGM=2
33 PRINT"■■■SCORE ",SC" HI "HS:POKEN,128:IFVAL(TI$)>=200THEN4000
34 IFPEEK(P)=5THENP=OP
35 IFABS(P-OP)<>0ANDABS(P-OP)<>22THENSP=SP+P-OP
36 POKEOP,32:POKEP,0:POKEP+30720,2
37 IFE=0THENE=2:P1=INT(RND(1)*4)+1:S=7702+INT(RND(1)*18+1)*22+1:IFD(P1)=-1THENS=S+19
38 IFE=2THENE=1:P2=INT(RND(1)*4)+1:S1=7702+INT(RND(1)*18+1)*22+1:IFD(P2)=-1THENS1=S1+19
39 O1=S:O2=S1:IFD(P1)=D(P2)THENE=0:GOTO37
40 S=S+D(P1):S1=S1+D(P2)
41 POKEO1,32:POKES,CH(P1):POKES+30720,5:C=C+1
42 POKEO2,32:POKES1,CH(P2):POKES1+30720,5:IFC=19THENE=0:C=0:POKES,32:POKES1,32
43 O1=S:O2=S1
44 IFGM=0THEN28
45 IFGM=1THEN300
46 GM=1:SP=P
260 SP=SP+22:IFPEEK(SP)<>5THEN260
300 POKE36875,250:FORI=1TO10:NEXT:POKE36875,0
305 SP=SP-22:IFSP<PTHENPOKESP,32:GM=0:GOTO28
310 IFSP<>PTHENPOKESP,4:POKESP+30720,0:FORI=1TO50:NEXT:POKESP,32:GOTO28
320 IFSP<>SANDSP<>S1THENPOKESP,32:GM=0:GOTO28
330 ZZ=PEEK(36879):POKE36879,8:POKE36877,254:FORI=1TO300:NEXT:POKE36877,0
340 POKE36879,ZZ:POKES,32:E=0:GM=0:POKES1,32
350 SC=SC+10:C=0:GOTO30
999 DATA255,129,129,129,129,129,129,255,0,128,192,254,255,28,56,0,0,1,3,127,255,56,28,0
1002 DATA254,16,120,249,255,126,40,124,0,0,0,24,24,0,0,0,255,255,255,255,255,255,255,255
1005 DATA127,8,30,159,255,126,20,62,-1,1,1,2,-1,3,-1,6,1
3000 PRINT"■■■■■■INSTRUCTIONS■■■■■■■■■■■■■■■                    ■■"
3010 PRINT" A JOYSTICK IS■RECOMMENDED FOR THIS■GAME, BECAUSE OF THE■SPEED INVOLVED."
3020 PRINT"■■KEYBOARD CONTROLS ARE  W-UP■ Z-DOWN■ A-LEFT■ S-RIGHT■ SPACE-FIRE"
3030 PRINT"■■■PLEASE PRESS F7"
3040 GETO$:IFO$<>"■"THEN3040
3050 PRINT"■■■SIMPLY KEEP YOUR■SIGHTS FIRMLY ON THE■ENEMY UNTIL YOUR■MISSILE CAN REACH ";
3060 PRINT"HIM.■"
3065 PRINT" THIS GAME REQUIRES■FAST REFLEXES.■■"
3070 PRINT" NOT THE GAME FOR■WEAKLINGS !"
3080 PRINT"■■■■■■PLEASE PRESS F1"
3090 GETO$:IFO$<>"■"THEN3090
3100 PRINT"■":RETURN
4000 POKE36869,240:POKEN,0:POKESD,0
4010 PRINT"■■■SORRY, YOUR TIME IS  UP. PLEASE PLAY AGAIN."
4020 PRINT"■■YOUR SCORE "SC
4030 IFSC>=HSANDSC>0THENHS=SC:PRINT"■■( THE HIGHEST SO FAR)"
4040 IFSC<HSTHENPRINT"■■( NOT TODAY'S BEST !)"
4050 FORI=1TO9999:NEXT:GOTO13

READY.
```

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BS0399

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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 b5. Then you're ready to dodge the torpedoes and depth charges.

POLARIS II

```
0600  08b2 08c1 6001 6100 6200 6308 6404 2890
0610  6204 6408 6005 2890 620c 6401 6006 2890
0620  620d 640e 6005 2890 6217 6401 6004 2890
0630  6118 6000 a836 d011 7008 3040 1636 6200
0640  682c a710 d282 612f 6000 a830 d011 7008
0650  3040 164c 6300 6101 a82e 6b20 6c20 dbc2
0660  a82c 6d00 6e02 dde2 6700 6500 6a00 6900
0670  80b0 80d5 4009 167c 3008 1688 3a00 1688
0680  6200 a65d 6a04 dda1 a82c dde2 7d01 3d3e
0690  1694 6d00 dde2 80d0 3200 8024 3a18 16a4
06a0  8900 79ff 4a00 171a a65d 3900 16ba 70ff
06b0  d0a1 7001 7a02 d0a1 171a d9a1 9ac0 16ca
06c0  7a01 9ac0 16ca d9a1 171a a831 8ae5 d9a5
06d0  8090 7002 80b5 3f01 1714 6e06 8e05 6e02
06e0  4f00 1714 6060 f000 7001 f118 3000 16e6
06f0  6318 640a a838 f533 f265 f029 d345 f129
0700  7305 d345 f229 7305 d345 6008 e09e 170a
0710  00e0 1602 d9a5 6a00 89a0 a837 3300 1724
0720  84c0 d341 d341 7301 d341 8030 80b5 3f01
0730  1748 6e06 8e05 6e02 3f01 1748 94c0 1824
0740  80c0 7001 9400 1824 333e 1750 d341 6300
0750  80d0 6f03 80f2 3000 179a a82e dbc2 6005
0760  e0a1 1778 6007 e0a1 177e 6006 e0a1 1784
0770  600e e0a1 178a 1798 3b01 7bff 1798 3b38
0780  7b01 1798 3c19 7cff 1798 8080 9c00 1798
0790  70ff 9c00 1798 7c01 dbc2 a65d 6000 e09e
07a0  17c0 3700 17c0 6008 f000 7004 f118 3090
07b0  17a8 86b0 87c0 80c0 8012 3000 77ff d671
07c0  4700 1670 d671 87e5 3702 1820 a831 d675
07d0  80d0 7003 8065 3f01 1818 6e06 8e05 6e02
07e0  4f00 1818 6e00 6030 f000 70fe f118 3010
07f0  17e8 7e01 3e04 17e6 6e02 a82c dde2 82d0
0800  6d00 dde2 6001 8052 3000 1816 a710 d082
0810  381f 78ff d082 7505 a831 d675 6700 1670
0820  d671 1670 84e5 a831 d345 16e4 80f0 08fe
0830  ff50 a850 a850 aac0 ---- --

0880                                  -- ---- ----
0890  a88b f455 8e10 8d30 81e0 28b8 7dff 7101
08a0  3d00 189a 74ff 7201 3400 1896 a88b f465
08b0  00ee e961 d4-- ---- a8b5 f255 08d1 00ee

N.B.
'----' indicates memory used by the program.
```

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 ship 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; 8 — move up; 2 — move down.

LUNAR BLITZ

```
0600 2908 6524 6900 6E0A 6010 6210 6100 2908
0610 8310 A800 D366 7307 A806 D36A 7308 A80F
0620 D36C 7307 A81B D36F 7307 A82A D369 7308
0630 A833 D369 7308 A83C D369 7308 A845 D366
0640 7308 A854 D363 CB01 7002 4B01 7201 4B00
0650 72FF 421F 621D 42FF 62Q5 A850 D023 A84C
0660 D454 C60F 460A 2720 6605 E6A1 26D8 6608
0670 E6A1 75FF 6602 36A1 7501 3435 7401 6604
0680 E6A1 74FD 87F0 8D10 8A10 7D1D 7A2D 8B40
0690 8DB5 3F00 16C0 8B40 6F01 8BA5 3F00 16C0
06A0 3524 16C0 6E0A 6A40 FA00 6C05 FA18 7AFF
06B0 3A30 16B6 16C0 FC15 FC07 3C00 16B8 16A8
06C0 8F70 4F01 177E 6606 E6A1 273A 28FC 00E0
06D0 31D0 160E 6100 160E 8740 8850 7703 7804
06E0 4E00 00EE 7EFF A8D6 D784 4F01 1700 D784
06F0 7801 382F 16FA 6F00 00EE F800 F618 16E8
0700 F800 F618 482B 18F0 6F00 00EE 2A78 6B20
0710 FB00 F018 7BFF 4B10 171C 1710 6F00 00EE
0720 6B1F CA3C A84A DAB1 4F01 1770 00FF 7BFF
0730 3B01 1726 A84C 6F00 00EE 8740 8850 7709
0740 7802 A84A D781 F700 F618 4F01 1756 7701
0750 3740 1744 00EE F800 F818 8320 9820 2A70
0760 7201 9820 2A70 7201 9820 2A70 8230 00EE
0770 8320 7202 9B20 177A 177E 8230 1736 27E4
0780 00E0 6A00 61C8 6264 8390 8490 8590 8C90
0790 8925 4F00 17A8 6264 8325 3F01 0000 8415
07A0 4F00 17AC 6850 17B0 6800 17B0 6828 00FF
07B0 A860 F81E F765 A480 FA1E F755 7808 7A08
07C0 3A28 17B0 6A10 6B10 AAF0 FC33 F265 F029
07D0 DAB5 7A04 F129 DAB5 7A04 F229 DAB5 F80A
07E0 00E0 1600 A858 74FF 75FF 610A C32F 7380
07F0 F300 F118 F115 F207 3200 17F6 71FF 18E0
0800 0000 00F8 0402 0000 0000 E010 0804 0300
0810 0000 0000 0000 00F8 0402 0100 0000 0000
0820 0000 0000 0102 3CA0 A0E0 0000 0000 0010
0830 2824 E300 0000 0000 0000 00FF 0000 0000
0840 0004 0B10 E001 1E20 4080 8070 3870 FF7C
0850 2810 2800 0080 6000 AA55 AA55 AA55 BD06
0860 0EFB BBAB 8100 0000 0AAA 922A 8100 0000
0870 0EAB 93AB 8100 0000 0AAA 922B 0000 0000
0880 0AAA 93BA 8100 0000 0AEE A0EE EC04 0000
0890 0A8A A08A AA04 0000 0AEE E0AA AA04 0000
08A0 0A8C 40AA AA00 0000 04EA 40EE EC04 0000
08B0 0EAE FBBB B810 0000 08AA AA92 A810 0000
08C0 08EE AB92 A810 0000 08AA AA12 A800 0000
08D0 0EAA AA3B A810 0000 A040 4040 F139 35FE
08E0 D456 3100 17EC 00EE 110A 2094 4122 0420
08F0 A8E8 8710 6822 7713 D788 170C 67E0 6AFF
0900 F700 FA18 71FF 00EE 6620 6700 6AFF F700
0910 FA18 00EE 9044 576B BD8B 9215 D1B0 3C60
0920 8080 8080 8080 F800 8888 8888 8888 7000
0930 8888 C8A8 9888 8800 F880 80F0 8080 F800
0940 F088 88F0 A090 8800 20A8 7020 70A8 2000
0950 F088 88F0 8888 F000 7020 2020 2020 7000
0960 F820 2020 2020 2000 F808 1020 4080 F800
0970 2040 8080 8040 2000 2050 8888 F888 8800
0980 0008 1020 4080 0000 F880 80F0 8080 8000
0990 8040 2020 2040 8000 0000 A040 A000 0000
09A0 0000 00C0 0000 0000 F880 F008 0888 7000
09B0 0102 3CA0 A0E0 0000 40C0 4040 4040 E000
09C0 7088 98A8 C888 7000 600F 6105 A920 D018
09D0 7007 A928 D018 7007 A930 D018 7007 A978
09E0 D018 7007 A940 D018 6008 610E A948 D018
09F0 7007 A950 D018 7007 A920 D018 7007 A958
0A00 D018 7007 A960 D018 7007 A968 D018 7007
0A10 A948 D018 600F 6119 A970 D018 7007 A978
0A20 D018 7007 A980 D018 7007 A988 D018 7009
0A30 A990 D018 6007 6125 A998 D018 7006 A9A0
0A40 D018 7005 A9A8 D018 700E A9B0 D018 7009
0A50 A9A0 D018 7004 A9B8 D018 7006 A9C0 D018
0A60 FF0A 4F0F 0000 3F0A 1A60 6424 00E0 00EE
0A70 7905 39C8 00EE 1780 790A 39C8 00EE 1780
0A80 ---- ---- ---- ---- ---- ---- ---- ----
```

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!!!

BOMBS AWAY

```
0600  63 00   69 00   6E 00   7E 01
0608  C0 3F   61 16   A6 F4   D0 11
0610  3E 0A   16 06   6D 35   6E 15
0618  FD 00   FE 15   FE 18   FC 07
0620  3C 00   16 1E   6D 45   6E 07
0628  FD 00   FE 15   FE 18   FC 07
0630  3C 00   16 2E   6D 26   6E 25
0638  FD 00   FE 18   C4 3C   65 2B
0640  A6 F6   D4 55   C6 3C   67 03
0648  A6 FC   D6 72   68 05   E8 A1
0650  16 54   16 4E   A6 FC   D6 72
0658  68 04   E8 A1   16 72   68 06
0660  E8 A1   16 80   6A 01   77 01
0668  A6 FC   A6 72   4F 01   16 92
0670  16 8C   86 A5   77 01   A6 FC
0678  D6 72   4F 01   16 92   16 8C
0680  76 01   77 01   A6 FC   D6 72
0688  4F 01   16 92   47 2E   16 D2
0690  16 54   47 15   16 CC   47 16
0698  16 CC   73 05   A7 30   F3 33
06A0  6B 02   6C 18   F2 65   A7 20
06A8  F0 29   DB C5   7B 04   F1 29
06B0  DB C5   7B 04   F2 29   DB C5
06B8  6D 40   FD 00   FD 18   6D 80
06C0  FD 15   FC 07   3C 00   16 C2
06C8  00 E0   16 04   79 01   39 03
06D0  16 9C   6D 50   FD 00   FD 18
0608  A7 50   F3 33   F2 65   6B 02
06E0  6C 18   F0 29   DB C5   7B 04
06E8  F1 29   DB C5   7B 04   F2 29
06F0  DB C5   00 00   80 00   20 70
06F8  70 F8   88 00   A0 40
```

660 SOFTWARE

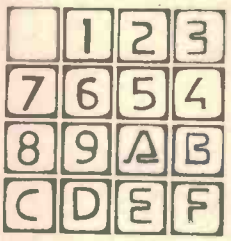
ALTERNATIVE BLOCK PUZZLE D.P. Edwards, Lower Hutt, New Zealand

This is an alternative version of the 14-15, or moving block puzzle, published in ETI November 1982 in the Chip 8 potpourri on page 92.

The puzzle was originally designed by Sam Lloyd early last century and he offered a $1000 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  7108  7A08  3130  1624  6110  7208
0620  6A12  7B08  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  85B0  86C0  3002
0660  166A  4501  166A  75F8  76FC  3008  1676  4519
0670  1676  7508  7604  3006  1682  4412  1682  74F8
0680  76FF  3004  168E  442A  168E  7408  7601  A700
0690  F61E  F065  8100  6000  A700  F61E  F055  A700
06A0  FC1E  8010  F055  F129  D455  DAB5  8A40  8B50
06B0  8C60  00EE  FEFE  FEFE  FEFE  FEFE
```

IAGO FOR TWO UPDATED W. F. Kreykes, St Albans Vic

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 all makes it that much more interesting to play.

Key 0 concede a move/change position.

Keys 1-8 board co-ordinates.

Keys 9-F confirm move.

Game ends if either player's score reaches zero, or when the board is full.

To replay the game, reset 8.

IAGO FOR TWO UPDATED

```
0600  6302 a86e 6c0f 6d01 dcd7 6d29 dcd7 7c07
0610  3c32 1606 6d07 6c09 dcd7 6c31 dcd7 7d07
0620  3d2a 1616 6402 6b2d a875 dcd5 6c09 a87d
0630  dcd5 6d02 a881 dcd5 6c31 a879 dcd5 6001
0640  6c10 6d02 f029 dcd5 6d2a dcd5 4001 7c01
0650  7c04 7001 3009 1642 6001 6c09 6d08 6e34
0660  f029 dcd5 4001 7c01 a886 dcd3 7d04 7001
0670  dbd3 f029 ded5 7001 7d04 3009 1660 a85a
0680  6c10 dc02 7c04 3c30 1682 7004 3029 1680
0690  6902 d902 6a3a da02 a862 da04 6b1c 6c15
06A0  6d19 6e20 dbd4 dec4 a85e dbc4 ded4 d904
06B0  2728 ce01 ff18 6040 f000 2804 6508 8a60
06C0  460f 1764 8652 3600 1770 2804 8b60 8652
06D0  3600 1770 178e 68f8 69fc 27ca 4700 176c
06E0  8ca0 8db0 280c 460f 176e 2728 68f8 69fc
06F0  27ca 4908 1708 3e00 1700 8374 8475 1704

0700  8375 8474 2834 16f0 4e00 7301 4e01 7401
0710  2728 8230 8244 3240 1764 2734 f500 6610
0720  f618 6218 275a 171a 4300 171a 4400 171a
0730  6008 f000 6600 8230 6501 2740 8240 6538
0740  a404 f233 f265 f129 d565 7505 f229 d565
0750  00ee a85e 3e00 a862 00ee f215 f007 3000
0760  175c 00ee 6501 7e01 8e52 16b4 2752 284e
0770  6280 f200 188a a86a 177c a85a 6f00 2782
0780  82f0 7c10 7d09 dcd4 7df7 7cf0 00ee 8aa4
0790  8aa4 8bb4 8bb4 8ca0 8db0 277a 3201 1770
07A0  2752 284e 16d6 6f01 ff18 6200 8c84 8d94
07B0  65e0 86c0 8652 3600 620f 86d0 8652 3600
07C0  620f 00ee 3700 00ee 6700 27d6 3908 17e6
07D0  00ee 5890 00ee 7804 4800 17d2 3808 00ee
07E0  68fc 7904 00ee 6700 8ca0 8db0 27a6 420f
07F0  17c8 277a 4201 17c8 2776 82e5 4200 17c4

0800  7701 17ec 6d20 6cf2 4e01 6c2a 2752 600f
0810  610f 2782 6600 e6a1 1824 7601 3630 1816
0820  8103 1812 f018 3100 2782 e6a1 182a 76ff
0830  8602 00ee 2752 8ca0 8db0 27a6 6204 f21e
0840  2782 2752 2782 77ff 3700 183a 00ee 7a10
0850  7b09 dab4 7af0 7bf7 00ee 0020 0000 2070
0860  2000 7070 7000 2070 2000 5000 5000 fefe
0870  fefe fefe fe7c 7870 6040 6070 787c 3c1c
0880  0c04 0c1c 3c7c 0000 0c00 f218 621a 275a
0890  16b4 .
```

PAKMAN 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 '660 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.

If the game 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 06D2 to 2B00.

```
0B00 6A00 6988 A900 3A00 AA00 F91E F765 A400
0B10 3A00 A500 F91E F755 7908 3900 1B04 7A01
0B20 3A02 1B04 00EE
```

The MCSR gets the high of register 3 and register 6 (09 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 designed the program could default after the screen comes up and a Pakman is placed in the home.

If 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 Utility program. The last line of 0F80 should be 70A0 AF4A F055 00EE. 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 00EE; D36 00EE; E50 1E20.

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Y 1012	4.0000 mHz	Parallel	5.00	4.50
Y 1015	4.1940 mHz	Parallel	5.00	4.50
Y 1017	5.0000 mHz	Parallel	5.00	4.50
Y 1018	6.0000 mHz	Series	5.00	4.50
Y 1019	8.0000 mHz	Series	5.00	4.50
Y 1020	10.0000 mHz	Series	5.00	4.50
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Y 1030	16.0000 mHz	Series	5.00	4.50

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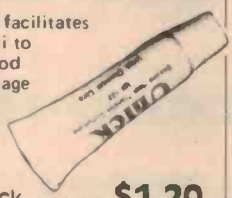

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• Vertical deflection	
Sensitivity	5mV/div to 5V/div ±5% 10 calibrated steps 1mV div to 1V div ±6% (When using ×5 amplifier) Uncalibrated continous control between steps 1 - 2.5 (provided with click-positioning function)
Bandwidth	DC to 15MHz, -3dB (at 4div) DC to 7MHz, -3dB (at 4div) (When using ×5 amplifier) 24ns (for ×5) 70ns typ
Rise time Signal delay line	
Max. input voltage	600Vp-p or 300V (DC + AC peak at 1kHz)
Input Coupling	AC, GND, DC
Input impedence	Direct 1M ohm, approx. 30pF
Operating modes	CH1, CH2, DUAL, ADD, DIFF
X Y operation	CH1 X axis, CH2 Y axis
Sensitivity	5mV/div to 5V/div (when using ×5 amplifier, 1mV/div)
Phase difference	DC to 10kHz within 3°
X bandwidth	DC to 500kHz, -3dB
Dynamic range	4div or more
CH1 output	
Output voltage	20mV/div or more (terminated into 50Ω)
Band width	50Hz to 5MHz, -3dB
Output impedence	Approx. 50Ω

• Horizontal deflection	
Trigger modes	AUTO, NORM, TV (-), TV (+)
Trigger source	CH1, CH2, LINE, EXT
Trigger coupling	AC
TV sync	TV sync separation circuit
Internal	1div or more (V sync signal)
External	1Vp-p or more (V sync signal)
Trigger sensitivity	Frequency / Internal / External 20Hz to 2MHz / 0.5div / 200mV 2 to 15MHz / 1.5div / 800mV
AUTO low bandwidth	30Hz
Trigger slope	
External trigger input	Input impedence approx. 1M ohm, 30pF or less Max. input voltage 100V (DC + AC peak, at 1kHz)
Sweep time	0.2us/div to 0.2s/div ±5% 19 calibrated steps Uncalibrated continuous control between steps 1 - 2.5 (provided with click-positioning function)
Sweep time magnifier	10 times (±7%)
Max. sweep time	100ns/div (20ns/div and 50ns/div, not calibrated)
• Amplitude calibrator	
Waveform	Approx. 1kHz ±10% (typ), square wave
Voltage	0.5V ±5%
• Power requirements	100/120/220/240V ±10% 50 to 60 Hz, approx. 40W
• Dimensions	Approx. 275(W) x 190(H) x 400(D)mm
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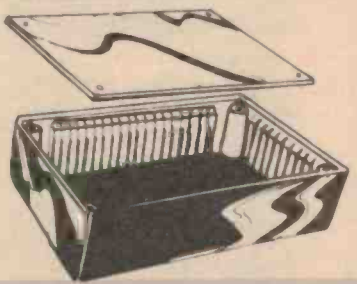

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Vertex Peripherals gave Australia a vote of confidence when they recently shipped us their top-of-the-line high performance V-170 Winchester. Boasting an average access time of 30 millisecs the V-170 offers an excellent, compact central data storage for multi-user systems. Vertex are also shipping 30 and 50 Mbyte product.

MPI LEAPS TO US No 2 IN FLOPPY DRIVES.

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.

IBM dealers will cheer at the Model 52-SLI, a perfect match for the PC at considerable savings over the OEM installed product.

MINISCRIBE WINCHESTERS SWITCH REPS.

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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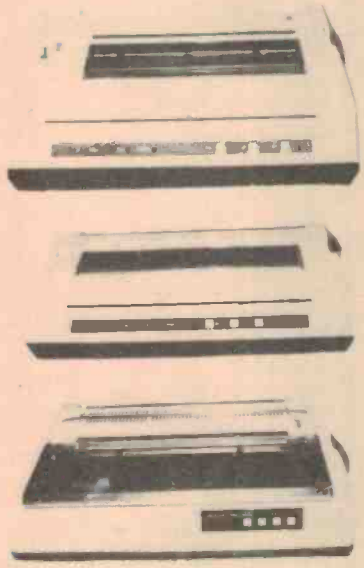

Pro/Writer Printer 8510

Print Features: Number of columns—136 col. max. Print Speed—120 CPS. Print Direction—Single-directional and Bidirectional, Switch Selectable. Throughput Speed—From 44 to 152 ipm. Character spacing (max. number of columns per line)—Pica 10 CPI (80), Double Width 5 CPI (40), Compressed Font 17 CPI (136), Double Width 8.5 CPI (68), Elite 12 CPI (96), Double Width 6 CPI (48), Proportional Double Width Proportional Line Spacing—Variable to 1/144". Print Width—203 mm (8") max.
Forms Type: Fan Fold Roll or Cut Sheet: Width—113 mm to 254 mm (4.5" to 10.0"). Total Thickness—0.05 to 0.28 mm (0.002" to 0.011"). Number of Copies—Original + 3 copies nominal.
Form Feed: Method—Tractor or Friction. Form Loading—Either rear or top.
Interface—Serial: Method—EIA RS232-C and 20mA (40 & 60mA switchable option) Current Loop Serial Interface. Baud Rate (BPS)—110, 300, 600, 1200, 2400, 4800, 9600. Transmitting Method—Half Duplex, Synchronization—Asynchronous.
Interface—Parallel: Method—TTL compatible, 7-bit, parallel interface. Control Signals—ACK, BUSY, SELECT, DATA STB, INPUT PRIME FAULT, INPUT BUSY, PAPER EMPTY. Instruction Codes—(ASCII): CR, LF, VT, FF, CAN, SO, SI, DEL, DC1, DC2, DC3, DC4, GS, RS, US, FS, EM. GRAPHIC SYMBOLS: BIT GRAPHICS.
Error Detection: (1) Parity (VRC)—Odd, Even, No-parity, Switch selectable. (2) Framing Error—Stop bit check. (3) Overrun Error—Error is detected when data are received before the previous data have been processed.
Physical dimensions: 398 mm W x 120 mm H x 285 mm D (18.7" W x 4.7" H x 11.2" D).
Weight: 8.5 kg (18 lbs., 12 oz.)

Model 1550

The Model 1550 is a compact desk-top dot matrix serial impact printer used for data communication terminals, hardcopy of CRT displays, peripheral terminals for minicomputers and microcomputers, and small-sized business systems.
The character format is a dot matrix of 7(H) x 9(V), or 8(H) x 8(V).
Print speed is 120 characters/second. Up to 136 characters can be printed per line at 10 CPI.
Its main features are: ● Compact desk-top dot matrix printer ● 136-column print ● Light-weight ● Low power-consumption ● High-quality print ● Bit image graphics ● Graphic Symbols ● Prints in six different languages ● High reliability ● Low cost.

F-10 Printmaster Daisy Wheel Printer

Print Speed: 40 CPS. **Print Method:** Static Print Impact. **Number of Printable Columns:** 136, 163. Variable. **Character Spacing:** 1/120 inch (minimum). **Line Spacing:** 1/48. **Return Time:** 900 msec. **Line Feed Time** 40 msec. **Paper Width:** 406 mm (maximum). **Print Characters: 96 Printwheels** Industry Standard 96 Character Wheel. **Interface:** Industry Standard 8-bit Parallel, RS232-C Compatible, X-ON, X-OFF, 12-bit Qume and Diablo Compatible. **Dimensions:** 574 mm W x 405 mm d x 153.5 mm H (22.5" W x 15.9" D x 6" H). **Weight:** 14 kg (30.8 lbs.) with cover and power supply. **Noise:** Less than 65 Db (1M from Platen, A Scale).

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SPECIFICATIONS

Functional Specifications

Printing method — Serial impact dot matrix
Printing format — Alpha numeric — 7 x 8 in 8 x 9 dot matrix field. Semi-graphic (character graphics) — 8 x 8 dot matrix. Bit image graphic — Vertical 8 dots parallel horizontal 640 dots serial line.
Character size — 2.1mm (0.083")-W x 2.4mm (0.09") H. 7 x 8 dot matrix.
Character set — 228 ASCII characters. Normal and italic alpha-numeric fonts, symbols and semi-graphics.
Printing speed — 80 CPS. 640 dots/line per second.
Line feed time — Approximately 200 msec at 4.23mm (1/6") line feed.
Printing direction — Normal — Bidirectional logic seeking. Superscript and bit image graphics — Unidirectional left to right.
Dot graphics intensity — Normal — 640 dots 190.5mm (7.5") line horizontal. Compressed characters — 1,280 dots/190mm (7.5") line horizontal.
Line spacing — Normal — 4.23mm (1/6"). Programmable in increments of 0.35mm (1/72") and 0.118mm (1/216").
Columns/line — Normal size — 80 columns. Double width — 40 columns. Compressed print — 142 columns. Compressed/double width — 71 columns. The aboves can be mixed in a line.
Paper feed — Adjustable sprocket feed and friction feed.
Paper type — Fanfold. Single sheet. Thickness — 0.05mm (0.002") to 0.25mm (0.01"). Paper width — 101.6mm (4") to 254mm (10").
Number of copies — Original plus 3 copies by normal thickness paper.

Mechanical Specifications

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

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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 or 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 plots 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 A$ (good example of using the slicing of strings in the ZX81 for data) and after conversion, uses this to plot points and spaces. Note use of compact screen data, not every point on the screen has to be separately accounted for.

Looking at the A$ you will see that not only numbers, but also letters are used. What I have done is represented 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 XZ81 basic programming.)

This range of numbers could be expanded if required, ie: 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).
A$ used as data.
B$ string slicing to get space data.
P required spaces.
C$ string splicing to get plot data.
K required plots.

Line 15 A$ set up with data to be used.
Line 20 FOR — NEXT loop to count down Y.
Line 30 slicing A$ to obtain data.
Line 40 conversion of character to numerical value.
Line 55 checking to see if line is finished i.e. A$=Z.

A way to make your own 'computer pictures' is to take a black and white picture with high contrast. Rule a grid over the top of the picture, keeping as close as possible to the same number of X and Y points on the screen.

You then go along the grid (as in Figure 2) and mark plots and spaces. Convert these numbers into the correct code, then enter into the program. Changes are required in the program for different picture heights, i.e: Y co-ordinate.)

Note that the choice and size of the original picture will dictate the quality of the computer picture.

One final comment on this program; when running and entering the program it is advisable that you use the fast mode of the ZX81 to save time. However, sometimes it is interesting to watch the picture slowly form when running it in the slow mode.

```
1 REM
5 LET X=0
10 LET T=0
  15 LET A$="BDZ91Z6MZ5NZ5NZ50Z5
OZ5PZ5PZ5PZ5WZ5XZ5WZ5VZ5D4BZ5R5B
Z597AZ588721Z48A621Z2711318417Z
8532111Z0C138231Z0163311116131Z
7342C111Z8242E1Z9152D2Z91K3Z91K2
11ZF1E22111ZD121C324ZA1133511ZB2
G346ZC1519365ZC4316113B3ZC321213
1323253ZD4521113222142ZC45332232
331ZB6333232252BB4152232BC224225
ZBC125126112BC116127ZAD7119"
20 FOR Y=43 TO 2 STEP -1
25 LET T=T+1
30 LET B$=A$(T)
35 LET T=T+1
40 LET P=CODE B$-28
45 LET C$=A$(T)
50 LET K=CODE C$-28
55 IF P=35 THEN GOTO 85
60 LET P=P+X
65 FOR X=P TO P+K-1
70 PLOT X,Y
75 NEXT X
80 GOTO 25
85 LET X=0
90 LET T=T-1
95 NEXT Y
100 PRINT
105 PRINT "HERES LOOKING AT YOU
KID."
110 GOTO 110
```

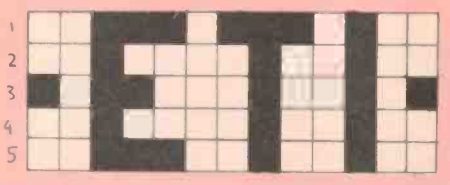
BOGART △

Matthew Rees, Boort, Vic.

This program draws a picture of Humphrey Bogart.

COMPUTER PICTURES

Screen



Plotting table

	S	P	S	P	S	P	S	P	S	P	S
1	2	3	1	3	1	1	2	Z			
2	2	1	4	1	2	2	Z				
3	Ø	1	1	2	3	1	2	1	1	1	Z
4	2	1	4	1	2	2	Z				
5	2	3	1	2	1	2	Z				

SPEED COMPARISON PROGRAM FOR ZX 80 (OLD ROM) ▷

J. L. Elkhorne, 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.

ZX81 USER'S HANDBOOK — REVIEWED ▷

P. Moxom

ZX81 User's Handbook by Trevor J. Terrell and Robert J. Simpson; a Newnes Technical Book published in 1982 by Butterworth and Co, 271 Lane Cove Rd, North Ryde NSW 2113.

The Sinclair ZX81 has been at the centre of much software and hardware development since its release in the UK. One of the by-products has been the sale of ZX81-related books.

One friend (?) commented on the ZX81, "Those smaller, plastic-cased computers are great for lifting tacks off drawing boards — you can use the lip of the pop-apart 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 hassles. The handbook 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 doing so 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.

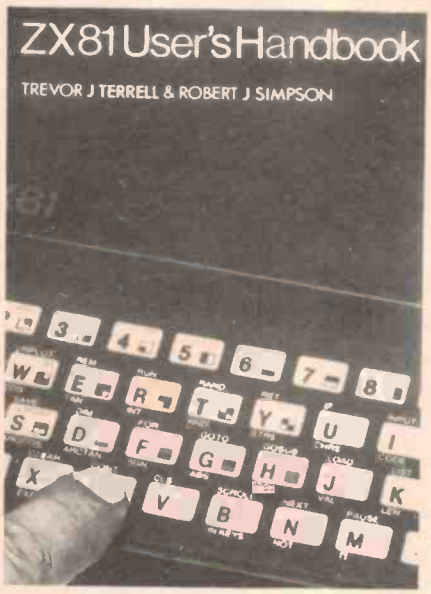
There are programs such as binary-to-hex conversions and back again. Most programs have a section at the end giving hints on how to make the program run faster.

The best part of the book is its indepth explanation of machine code programming.

The book also explains how to make your own programmable I/O card and has some imaginative backup software.

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 experiementers and '81 fanatics.



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 M$ = "FDE5DD2A0A40017F03D
        D7E00FE762004DD2318F53A1E40E6BFD
        D77000BDD2378FE0020E5FDE1C9"
130     LET H = CODE (M$)
140     LET M$ = TL$ (M$)
150     LET L = CODE (M$)
160     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 M$ = TL$ (M$)
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 1000

2000    CLS
2005    LET B$ = CHR$ (RND (64))
2010    FOR I = 1 TO 20
2020    FOR L = 1 TO 32
2030    PRINT B$;
2040    NEXT L
2050    PRINT
2060    NEXT I
2070    PRINT
2080    GO SUB 3000
2090    GO TO 1020

3000    REM PROMPT
3010    PRINT "ENTER B FOR BASIC GENERATION"
3020    PRINT "N/L FOR MACHINE CODE GENERATION"
3030    RETURN
```

Assembly listing

```
RANDLD  FDE5        PUSH IY         SAVE IT
        DD2A 0A40   LD IX, (NN)
        01 7F03     LD BC, NN

LOOKY   DD7E 00     LD A, (IX + 0)
        FE 76       CP, 118         LOOK FOR NEWLINE
        20 04       JR NZ           TO PUT
        DD23        INC IX          BUMP IT
        18 F5       JR, LOOKY       GO AGAIN

PUT     3A 1E40     LD A, (NN)      GET CHARACTER
        E6 BF       AND A, 191      MASK FOR VALID
        DD77 00     LD (IX + 0), A  TO SCREEN
        0B          DEC BC          COUNTDOWN
        DD23        INC IX          NEXT SCREEN POSITION
        78          LD A, B
        FE 00       CP, 0           FINISHED?
        20 E5       JR NZ, LOOKY    DO MORE
        FDE1        POP IY          RESTORE IT
        C9          RET             BACK TO BASIC
```

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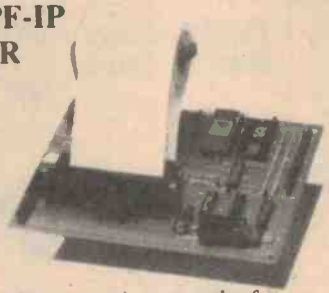

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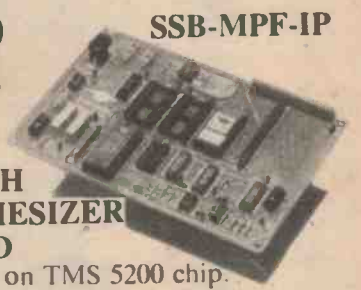

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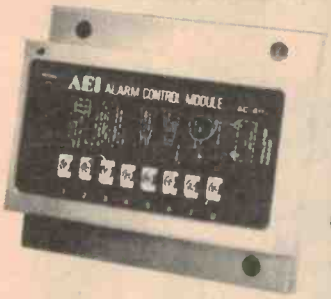

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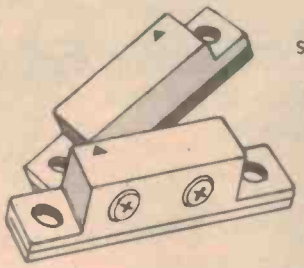

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NEW LOW-COST DMMs FROM FLUKE FEATURE BARGRAPH

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 milliamps, 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, Mortlake NSW 2137. (02)736-2888.**

EIGHT CHANNEL CRO MULTIPLEXER

Vicom International has announced a multiplexing device which converts a general-purpose single or dual-channel oscilloscope into an eight-channel instrument.

Developed by Global Specialities, the new model 8001 multiplexer, which functions in the same way as a simple logic analyser minus its memory, allows simultaneous inputs on different channels to be compared and directly displayed.

The instrument allows users to view events occurring synchronously or asynchronously, or to observe all eight channels at once or one of two 4-channel combinations.

Input to the multiplexer is via eight BNC connectors, and the instrument will accept signals of ±5 V (10 V peak-to-peak) with a frequency response which is flat to 12 MHz and 3dB down at 20 MHz; input impedance is 1M, G.S.C. claim.

The 8001 is ideally suited to applications such as field service, development and monitoring work. The price is around $419 plus tax.

For further information, contact **Vicom International, 57 City Road, South Melbourne Vic. 3205. (03)62-6931, or 6th Floor, 118 Alfred Street, Milsons Point NSW 2061.**

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, bourban 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 45-1035 kPa.

For further details, contact **Mayer Krieg and Company, 246-248 Angas Street, Adelaide SA 5000. (08)223-6766.**

EPROM-BASED ENERGY RECORDERS

The Measuring and Control Equipment Company has released two new solid-state wind and solar energy recorders.

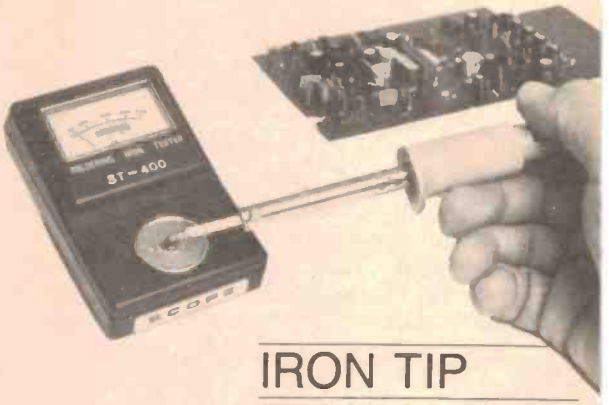
The Mace DFR78-WND wind recorder and the Mace DFR78-SOL solar recorder use EPROM as the data-recording medium. Both are designed to operate in remote areas under harsh conditions and are capable of operating for several months without attention.

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)86-4060.**



IRON TIP TEMP. METER

Scope Laboratories has released the new Model ST400 temperature meter, which requires no batteries and gives an instant analogue readout from 0°-500° C.

Scope claims the Model ST400 costs less than the average professional soldering iron, and says production and service technicians will find it invaluable for monitoring hand soldering's most vital variable.

For further information, contact **Scope Laboratories, (03)338-1566.**

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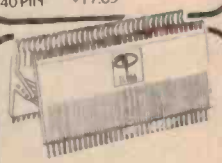

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LIQUID CRYSTAL DISPLAY FEATURES 80x16 FORMAT

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 128 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 pc board 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, Bayswater 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.

The required function is determined by selecting the appropriate switch terminals with the pc board tracking. The two switch versions are colour-coded to avoid mistakes in production.

The Unimec switch is low-profile (10 mm high) and is designed for 2.54 mm (0.1") grid pc mounting. It has a minimum life of one million cycles.

The switch can be positioned on the board 'straight' or with a 180 degree twist. Unimec can be illuminated with up to four LEDs on any one switch.

For further information, contact **Associated Controls Pty Ltd, 55 Fairford Road, Padstow NSW 2211. (02)709-5700.**

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 uA 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.

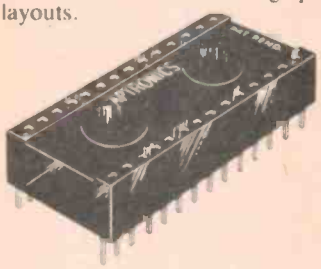
The 7126 can be used as a plug-in replacement for the 7106, changing only the values of the seven passive components.

For further information, contact **Promark Electronics, Suite 102, 6-8 Clarke Street, Crow's Nest NSW 2065. (02)439-6477.** ▶

Component NEWS

PROGRAMMED SOCKET AIDS PC LAYOUTS

The new Aptronics 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 pin-out 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

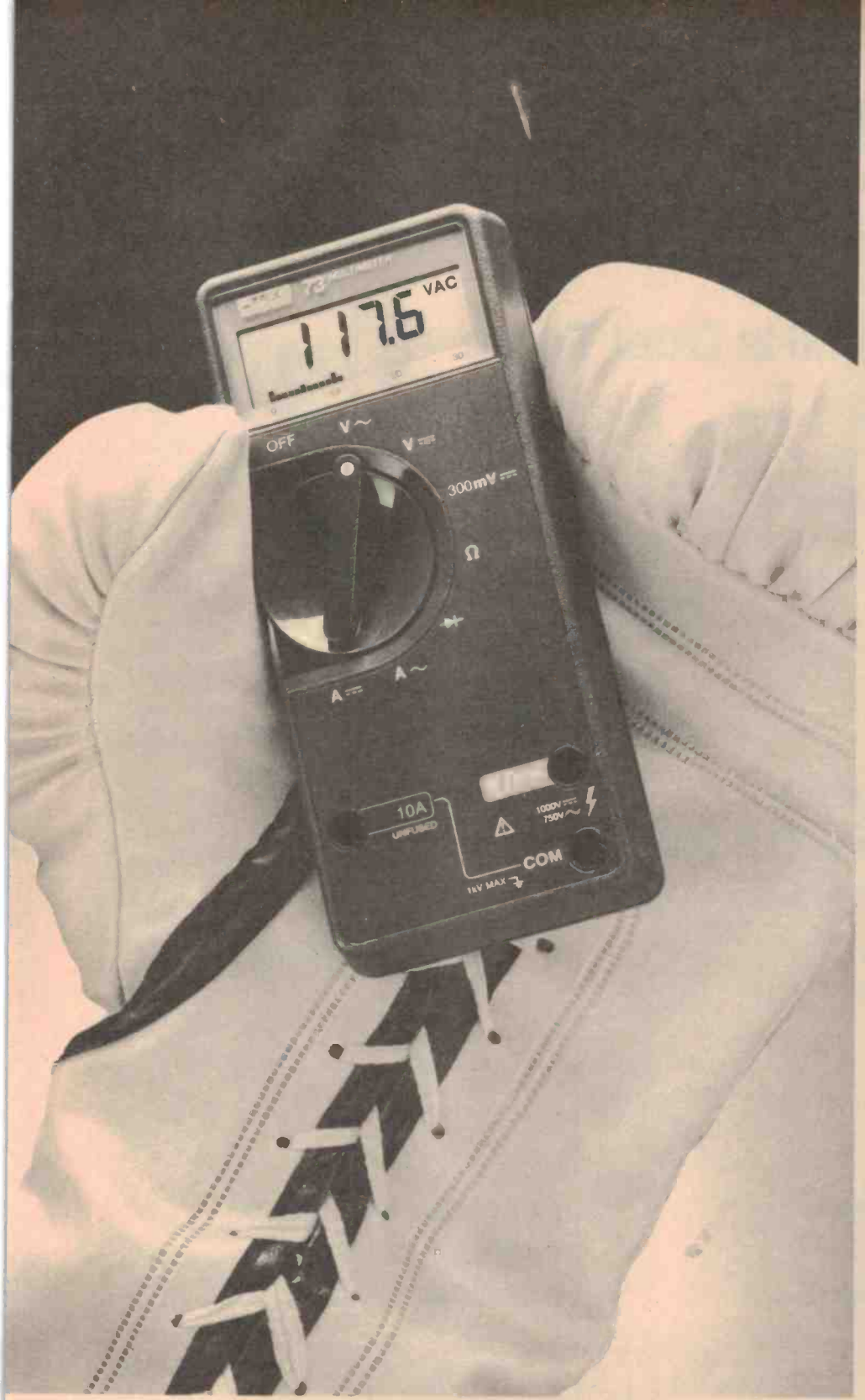
Now available from Hewlett-Packard is a series of industry-standard, right-angle LED indicators. They are T-1 ¾ LED lamps assembled in black plastic housings that orientate the LED at a right angle to the printed-circuit board.

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.**



The Digital vs. Analog battle is over.

From $110 buys you the new champion. **The new Fluke 70 Series.**

They combine digital and analog displays for an unbeatable two-punch combination.

Now, digital users get the extra resolution of a 3200-count LCD display.

While analog users get an analog bar graph for quick visual checks of continuity, peaking, nulling and trends.

Plus unparalleled operating ease, instant autoranging, 2,000+ hour battery life and a 3-year warranty.

All in one meter.

Choose from three new models. The Fluke 73, the ultimate in simplicity. The feature-packed Fluke 75. Or the deluxe Fluke 77, with its own multipurpose protective holster and unique "Touch Hold" function (patent pending) that captures and holds readings, then beeps to alert you.

Each is Fluke-tough to take a beating. American-made, to boot. And priced to be, quite simply, a knockout.

So call or write for more information.

Fluke 73	Fluke 75	Fluke 77
$110*	$129*	$165*
Analog/digital display	Analog/digital display	Analog/digital display
Volts, ohms, 10A diode test	Volts, ohms, 10A, mA, diode test	Volts, ohms, 10A, mA, diode test
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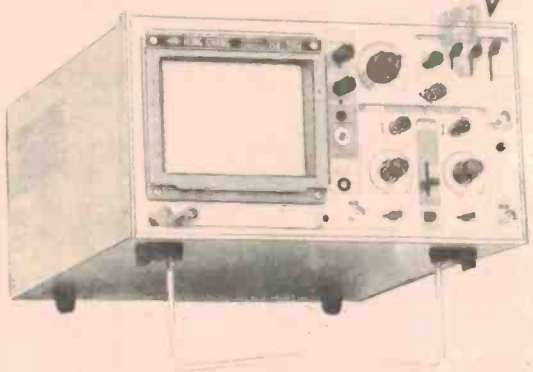

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Surface acoustic wave devices — fundamentals and applications

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.

P. J. Hall
Physics Department, University of Tasmania

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.

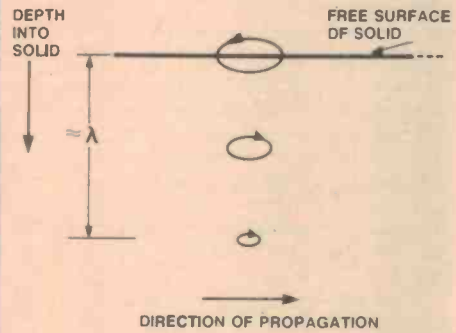
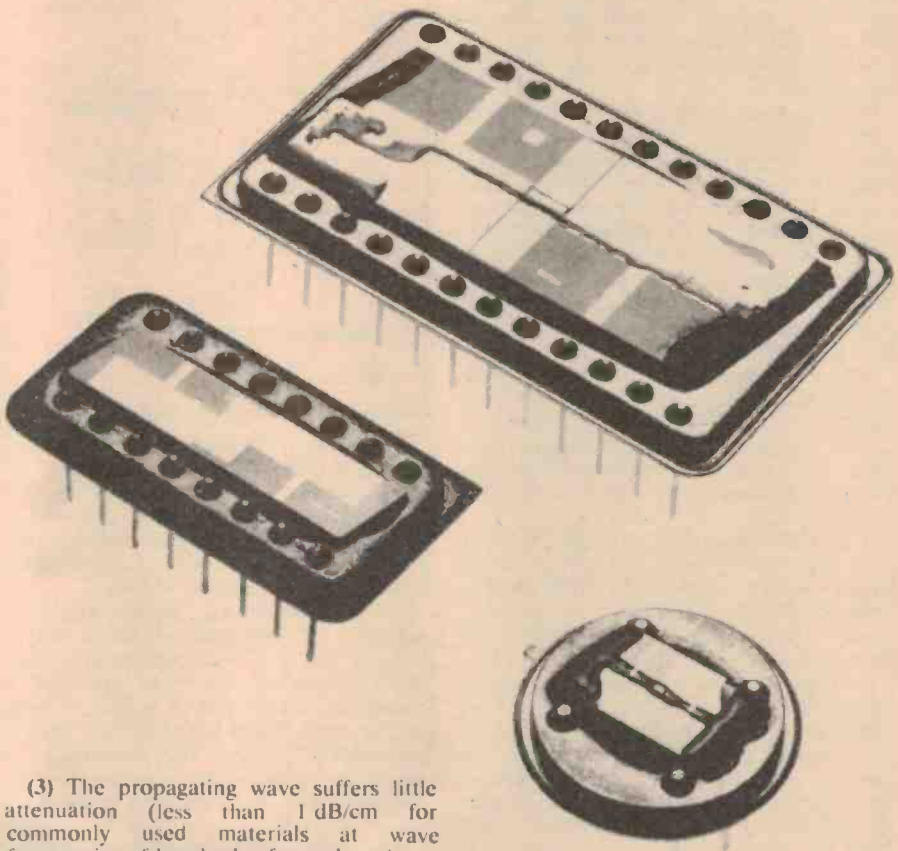


Figure 1(a). Motion of solid elements in an isotropic solid due to the propagation of a surface wave. Similar disturbances occur along axes of high symmetry in the anisotropic crystalline solids used for SAW device substrates.

(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).

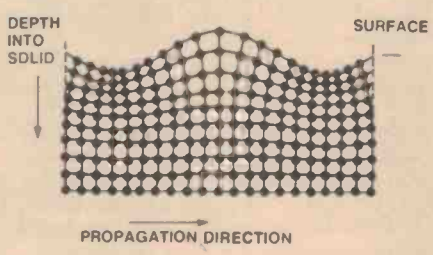


Figure 1(b). Oscillations in a vertical plane through a solid. Note the surface oscillations.

(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. ▶

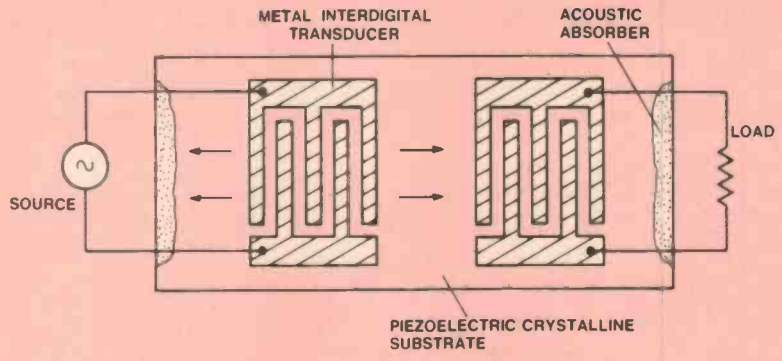


Figure 2. Basic SAW device configuration.

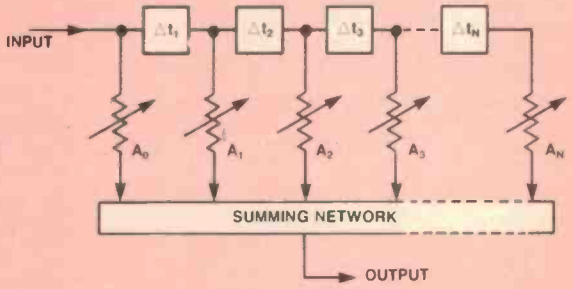
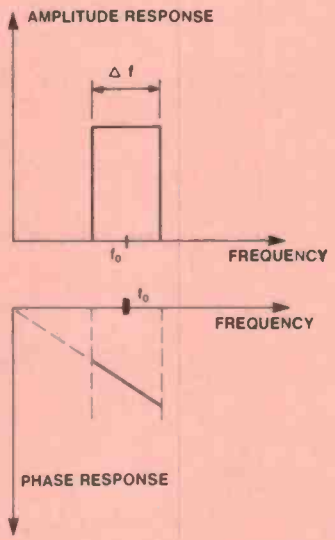


Figure 3. A transversal filter. In the SAW realisation the tap amplitudes A_0-A_N are set by the length of the IDT fingers and the time delay between taps is controlled by the relative positions of the fingers.



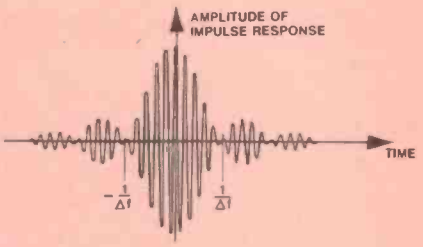


Figure 4. Responses of an ideal bandpass filter. The amplitude and phase responses are 'single-sided' (no negative frequencies) representations and the impulse response is derived by considering a psuedo-impulse (a very short pulse) modulated onto a carrier at the filter centre frequency. The impulse response is infinite in extent in time.

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 neighbouring 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.

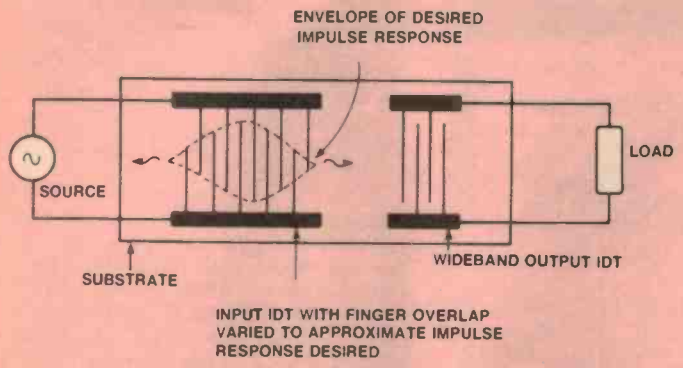


Figure 5. SAW transversal filter.

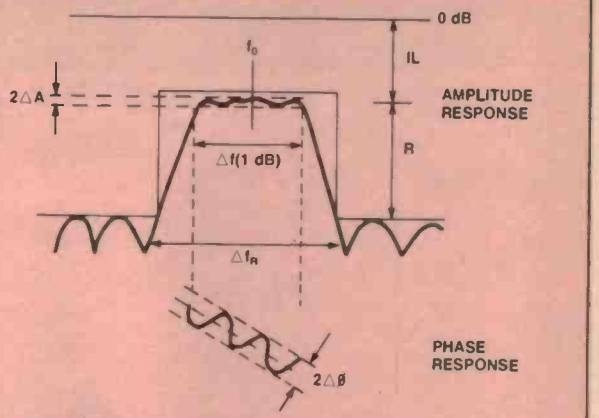


Figure 6. Major parameters of a bandpass filter.

Sampling in this way produces a pass band displaced from baseband i.e: a bandpass filter.

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.
(4) Small size and weight. Mechanically rugged.
(5) Passive.
(6) Wide frequency range of operation (10 MHz to 1 GHz).
(7) Good temperature stability.
(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, $\triangle f$. 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 $(\triangle f/f_0)x100$.

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.

Table 1. Typical Parameters of SAW transversal bandpass filters

Substrate material	Lithium niobate or quartz
Centre frequency (f_0)	10-1000 MHz
1 dB bandwidth ($\triangle f$)	60 kHz to 50% fractional bandwidth
Insertion loss (IL)	10-30 dB
Amplitude ripple ($\triangle A$)	± 0.2 dB
Phase ripple ($\triangle \varnothing$)	± 1°
Ultimate rejection (R)	50-70 dB
Shape factor ($\triangle f_R/\triangle f$)	1.1
Size	10-30 mm

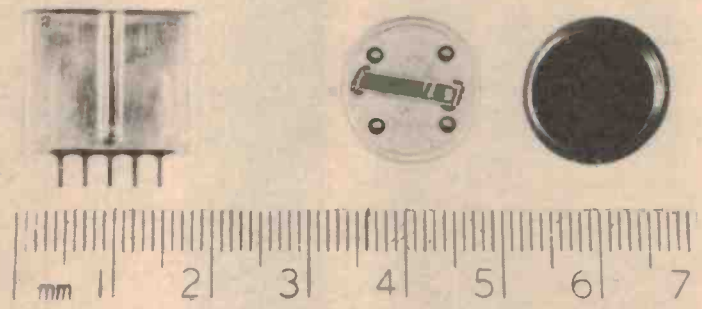


Figure 7(a). Two versions of a SAW TV IF filter. The filter on the right has the top removed to reveal the substrate and IDTs (devices courtesy of Signal Technology Ltd).

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 analogy 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. ▶

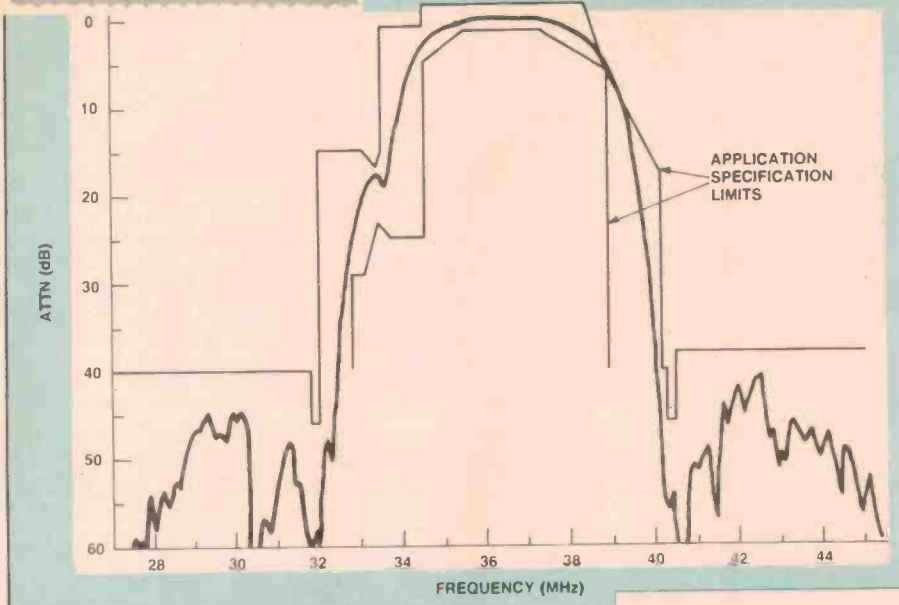


Figure 7(b). Response of TV IF filter (courtesy of Signal Technology Ltd).

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.

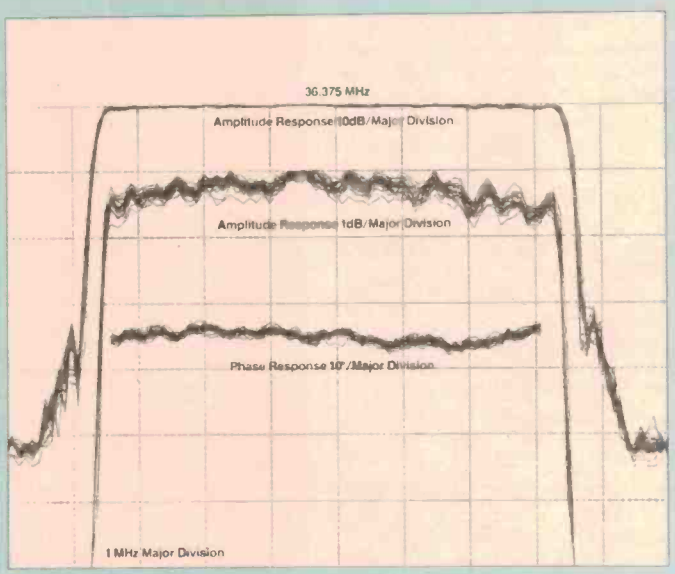


Figure 8. Overlay of the responses of 20 SAW filters (courtesy of Anderson Laboratories Inc).

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 f_0 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.

In real radars the peak transmitter output cannot be increased indefinitely and once the limit is reached the only way to increase the energy output of a normal pulsed radar is to lengthen the pulse. Unfortunately, the bandwidth of the pulse is then decreased and the time, and therefore the range, resolution is reduced accordingly.

In a chirp radar the transmitted pulse bandwidth is artificially increased by the superimposed frequency modulation. A pulse long enough to ensure adequate detection sensitivity can be used while at the same time retaining sufficient bandwidth for good time resolution.

It is found that the time resolution of a chirp radar is the actual pulse length, T, divided by the time-bandwidth product, N=BT. Since N can be large (>1000 in many cases), the advantage is real. Note

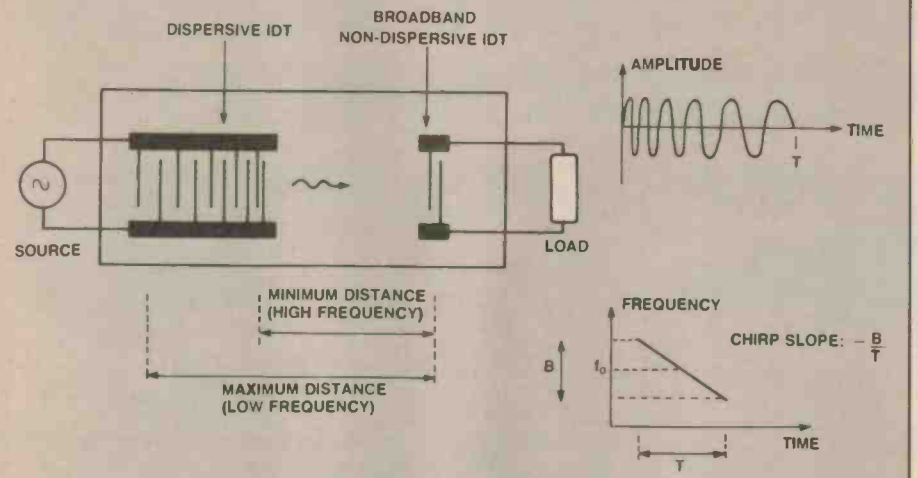


Figure 9. A dispersive delay line with two representations of its impulse response. When an impulse excites the dispersive IDT, the high frequency components arrive at the output before the low frequency components. The resultant output is a 'chirp' sweeping down in frequency. The complementary 'un-chirp' can be generated by reversing the high and low frequency ends of the dispersive IDT.

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 impuse 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.

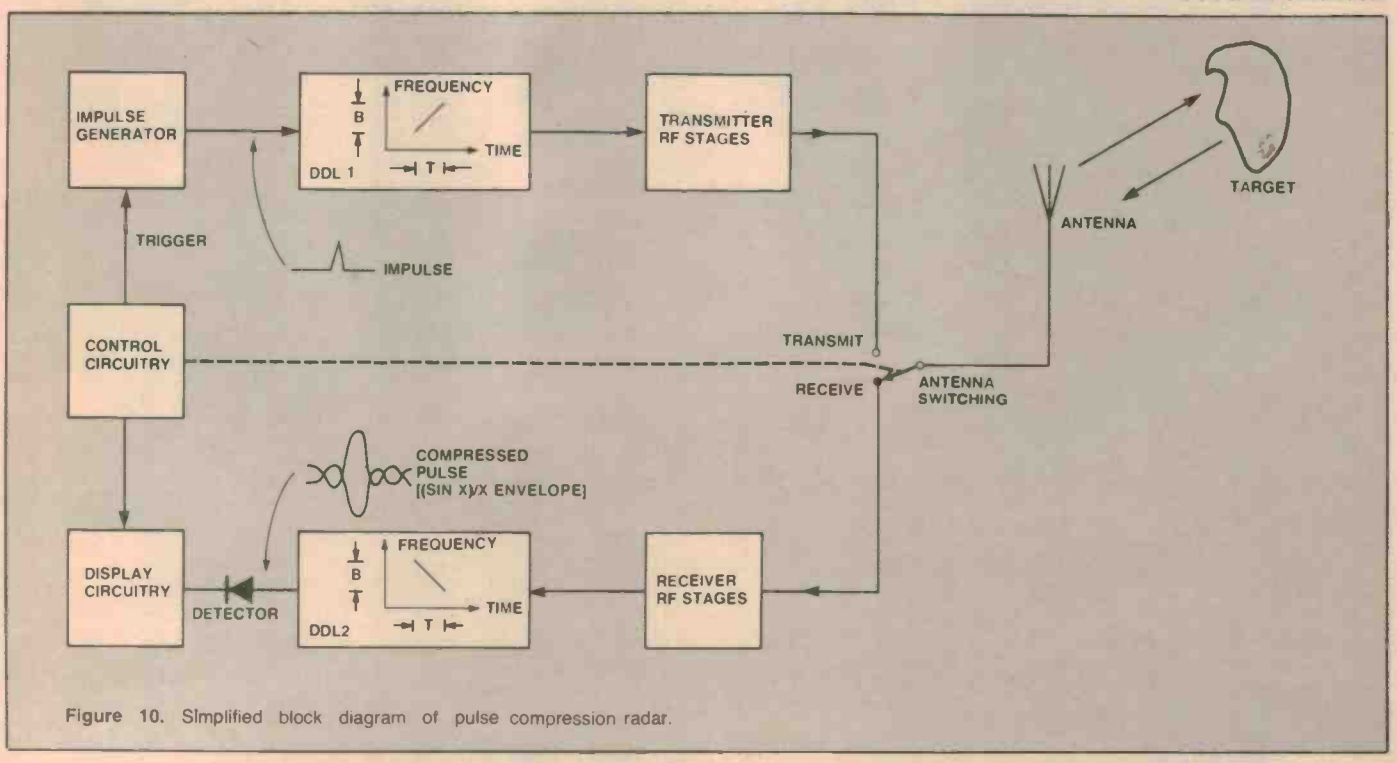


Figure 10. Simplified block diagram of pulse compression radar.

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	200V	100mV	1%±1 digit	
	500V	1V	1%±1 digit	
Current (d.c.)	2mA	1uA	1%±1 digit	1A/250V
	20mA	10uA	1%±1 digit	
	200mA	100uA	3%±1 digit	
	2000mA	1mA	5%±1 digit	
Volts (a.c.)	2V	1mV	2%±5 digit	500V for
	20V	10mV	2%±5 digit	one minute
	200V	100mV	2%±5 digit	
	500V	1V	2%±5 digit	
Current (a.c.)	2mA	1uA	2%±5 digit	1A/250V
	20mA	10uA	2%±5 digit	
	200mA	100uA	4%±5 digit	
	2000mA	1mA	7%±5 digit	
Resistance	2K	1	1%±3 digit	260V
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	200K	100	1%±1 digit	
	2000K	1K	1%±1 digit	
Diode Test	2V	1mV	1%±1 digit	260V r.m.s.

AC VOLTAGE AND CURRENT RANGES
When S3a selects d.c. functions the output from either the voltage attenuator or current shunts is fed through C1 to remove any d.c. component.

AMAZING VALUE

$39.95

syntom

KJ-6502

Original design from the UK magazine "Electronics and Music Maker" April 1981. Self-contained unit produces a variety of fixed and falling pitch effects. Trigger by tapping the unit itself or by striking a drum to which the unit is attached. The Jaycar "SYNTOM" comes complete with high quality pre-drilled moulded all ABS box 152 x 80 x 47mm with professional silk-screened front panel.
FEATURES: Decay from less than 0.1 second to several seconds, pitch control, sweep control and volume on/off.

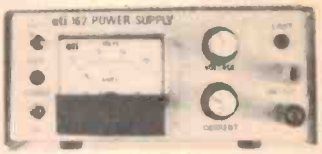
$36.50

0-30V 1amp power supply

Ref: ETI December 1982

ETI 162

Cat. KE4570



- Fully protected
- Output variable from 0-30V DC
- Selectable current limit
- Both voltage and current metering
- After a multimeter & soldering iron an absolute must for the enthusiast.

You will never own a more useful piece of gear.

$49.50

Digital Delay Line

The Digital Delay Line is designed to produce a huge variety of electronic effects. It works very well but the amazing thing is the low low price! The effects depend on the time delay selected and some of those included are: Phasing, Flanging, Chorous, ADT (Automatic Double Tracking), Echo, and Vibrato. The delay time can be varied from 0.32ms to 1.6 seconds! Because the signal is stored in digital form there is, unlike analog systems, no degeneration of the signal with time and unlimited repetition is provided by use of the freeze control.
All the controls mount directly upon PCB's to eliminate wiring and to further simplify construction the main board is 'plated-through' i.e. there are no wire links or link-through pins. The whole of the memory whether for the basic 400ms machine or the fully expanded 1.6 second model all fits on the main board. The cabinet which is free standing but also suitable for 19" rack mounting, is fully finished to a very high standard. The panel is deep blue whilst the cover is psrayed with a durable black enamel. The kit is available for only $449 - compare that with inferior units that can cost over $2,000!!
Cat. KJ6621

ONLY

$449

COMPLETE **KIT**

400ms VERSION

NOW IN STOCK!!

BBD EFFECTS BOX

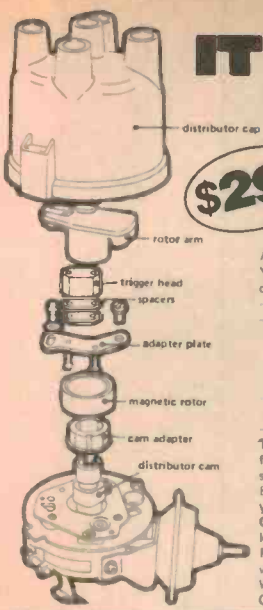
Fantastic low-cost instrument using the versatile MN3001 Bucket-Brigade Delay Line to achieve brilliant sonic effects. Now you can emulate the commercial rock groups with Phasing, Flanging' Reverb and Echo. The Jaycar kit includes all components INCLUDING IC sockets and the TU-04 box. (Not cut down but this is easily done). Jaycar has a specially built cabinet for this kit with all holes pre-punched etc., at only $10 extra but only if you buy the original kit from us. Available as a separate item for $29.50. WHEN THE KIT IS PURCHASED WITH THE DE-LUXE CASE THE TU-04 CASE WILL NOT BE SUPPLIED.

Special cabinet to suit $10.00 Cat. HB6445

COMPLETE KIT

Cat. KE1522 $79.00

IT HAD TO HAPPEN



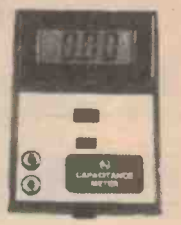
$29.95

PLEASE NOTE
this system must be used in conjunction with an electronic ignition. The Hall Effect device will not switch enough current to replace the contact breaker points on their own!

JAYCAR
125 YORK ST. HAS CLOSED – WE ARE NOW TRADING AT 117 YORK ST.
OUR TELEPHONE NUMBER REMAINS UNCHANGED
(02) 264 6688

A professionally engineered electronic ("breakerless") contact breaker system.
Yes, only Jaycar has a complete Hall effect triggerhead assembly designed to adapt to an extensive number of cars. Each kit contains the following:
– HALL EFFECT TRIGGER HEAD
– MAGNETIC ROTORS FOR BOTH 4 & 6 CYLINDER CARS
OVER 6 CAM LOBE ADAPTORS
OVER A DOZEN DIFFERENT ADAPTOR PLATES FOR YOUR PARTICULAR DISTRIBUTOR
OTHER HARDWARE (i.e. SCREWS etc.)
YOU CAN REMOVE THIS SYSTEM AND RE-EQUIP YOUR CAR WITH THE ORIGINAL
– BREAKER POINTS WHEN YOU SELL THE CAR!
AS EASY TO INSTALL AS A SET OF POINTS!
– INSTRUCTIONS (SIMPLE-TO-FOLLOW) INCLUDED!
This set is designed to fit most European and Japanese cars. In fact it will also fit many Australian cars fitted with Lucas, Bosch, Motorcraft, AC Delco or Autolite electrics. If you wish to check first, please send SAE for car/distributor list.
Because we have no way of knowing, you get the fitting set for ALL of the distributors available. Basically you end up with a jar full of parts that you don't need to use! (Perhaps for your next car?)
Quite frankly, we are amazed that we can supply such a comprehensive kit for this price. To produce a kit that will adapt to the dozens of different distributors around is amazing!
Remember, once you have installed a breakerless system it will never wear out and that part of your system will remain in tune FOR EVER.
We expect this kit to sell well. To ensure that you receive one, check with us early!
Cat. KJ6655

DIGITAL CAPACITANCE METER $74.50



Ref: EA March 1982
Accurately measure capacitance from 1pF to 19.99uF. A must for the serious enthusiast.
Cat. KA-1420

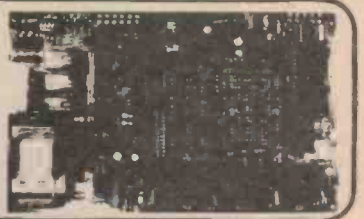
Digital Thermometer

Ref: EA Feb 1982
0 - 100 degrees with 0.1 degree resolution. Bright, easy to read display. Kit includes two sensors.
Cat. KA-1404

VALUE $74.50

ETI 644 direct connect modem

Ref: ETI
October 1982



Two models (i) Short form which contains ALL PCB components as specified by ETI (BEWARE!!). The genuine ETI PCB with plated-thru holes, solder mask and component overlay is supplied. We also supply at NO EXTRA CHARGE a full set of quality IC sockets. A must with plated-thru PCB's – Remember this when making comparisons (ii) Full kit. Includes: all of the above plus 12V plug-pack, case, front panel, switch and LED bezel and Cannon DB-25 RS-232 connector. Makes a complete stand alone modem. *Capable of a range of Answer/Originate operating modes * Selectable Baud rate * Software controlled. * Uses new patented technique * More reliable and faster than most acoustic modems. Arlec transformer as used in this project only $22.00

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SHORTFORM KIT Cat. KE-4600 $169

VIDEO ENHANCER NEW

Ref: EA Oct 1983
Get improved performance from your VCR.
Cat. KE-7016 $35.00

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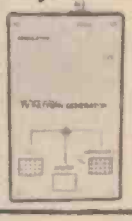
TV Crosshatch/Dot Hatch Generator

Ref: EA Nov. 1983
Great new version of this handy piece of test gear. Now you can generate Crosshatch, Dots and Blank (white) video signals. This is handy for TV/Video alignment.
Cat. KA-1530 Basic (short form) kit inc. Jiffy box ONLY $24.95
Cat. LT-3800 Video Modulator to suit $8.95
Power Supply to suit $9.95

ONLY $24.95



STEREO SYNTHESIZER

NEW ECONOMY SHORT FORM KIT

$11.95

All parts necessary to construct this project to PCB stage. (Please note that plug pack and case are extra).
A great project for the Stereo Hi Fi lovers. Turns mono sound into realistic "stereo"
Cat. KA-1510

Function Generator

Ref: EA April 1982

$99

"Pigeon Pair" companion to the new 500MHz DFM. Low distortion generator of sine, square and triangular waveforms. From below 20Hz to over 160kHz. Inbuilt 4 digit frequency counter in de-luxe case.

JAYCAR EXCLUSIVE – 1% 50ppm metal film resistors used for stability

Cat. KA-1428

500MHz Digital Frequency Period Meter

REF: EA Dec '81 – Feb '82

NOW BACK IN STOCK! The best version of this kit in Australia is now back in stock. Why settle for an inferior kit at the same price as ours? Cat. KA-1390

500MHz option only $26 extra
50MHz Version $119

ONLY $119

Tilting Bail to suit ONLY $4.95

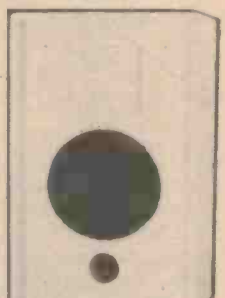
Other people may appear to be selling this kit for less. But you GET less!!! Exclusive Jaycar features:
* Heavy gauge front panel. Pre-punched, and silkscreened. (NOT Scotchcal). * Low aging rate 10.000 MHz crystal * Quality IC sockets provided (A MUST) * All metal film resistors used (1% 50ppm) *Therm alloy heatsink for +5V regulator
Beware of advertised units that do not conform to the original design. They may have inferior performance.

THE BEST QUALITY KIT VERSION OF THIS PROJECT IN AUSTRALIA

SUBWOOFER SYSTEM SPECIAL SAVE

NOVEMBER ONLY
BUY THE FANTASTIC EA DESIGNED SUBWOOFER ENCLOSURE AND SPEAKER AND SAVE A FORTUNE! (Ref: EA Aug '82)

NB. The photo shows the prototype which was finished in white. The production units are only available in black



SPEAKER (Cat. AS-3250) NORMALLY $79.00
CABINET (Cat. KA-1454) NORMALLY $79.00
TOTAL $158.00
SAVE $28 IN NOVEMBER PAY ONLY $130.00 (freight $12 extra)

Jaycar

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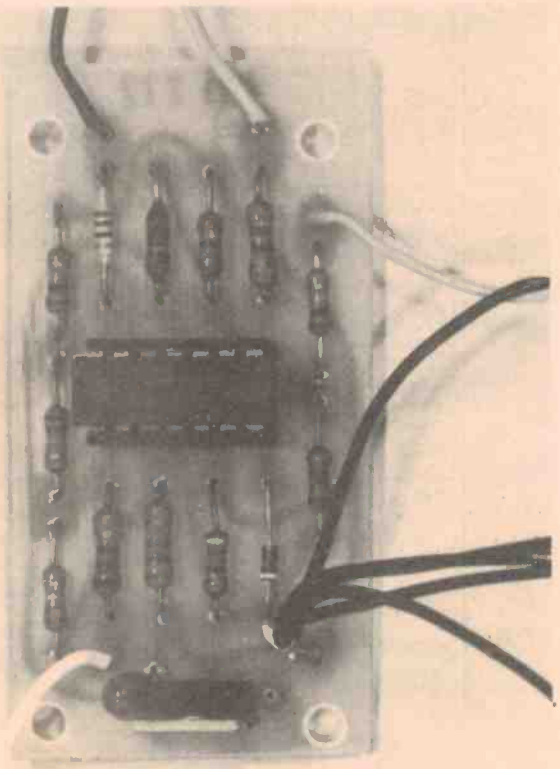
Project 272

A three-LED power level indicator for audio amps

This simple project provides indication of when your power amp output reaches three pre-determined levels. It's more useful than a simple clipping indicator (your ear is better at that!) and is cheaper and easier to install than bargraph level displays or moving coil meters.

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.

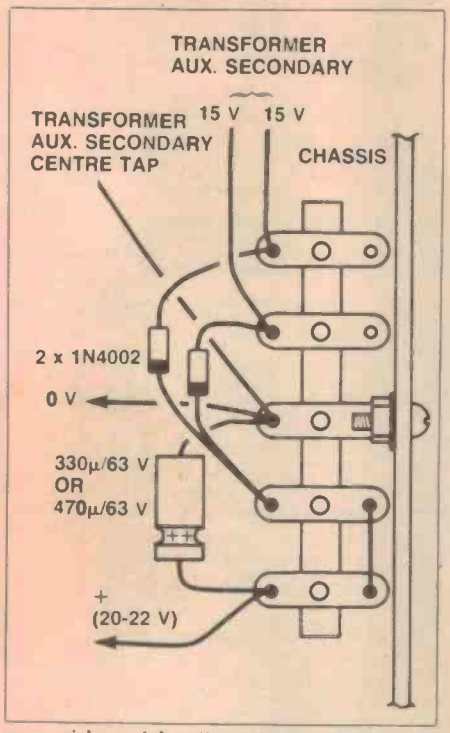
Boards can also be cascaded to give six-level readout if desired, simply by running two in parallel and selecting the appropriate resistors to get the desired levels. While I did design it as a retro-fittable addition for my 5000 amplifier, you can install it inside almost any amplifier, even a commercial 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 six LEDs mount 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 circlup is 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 0.27, 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 inverting input at zero volts; this arrangement produces a gain of −R2/R1, or −0.27. When the input goes 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 the 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 required to turn on LED 1.

Similar formulae 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 values of 1k2 and 15k for R5 and R4 give V_{on} = 4.12 and this is within 3% of the value of V_{peak} for 1 watt into 8 Ohms.

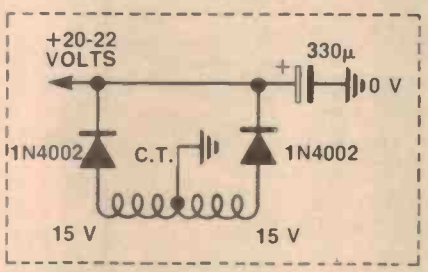
To select resistors to give a reading of ½ watt into 4 Ohms

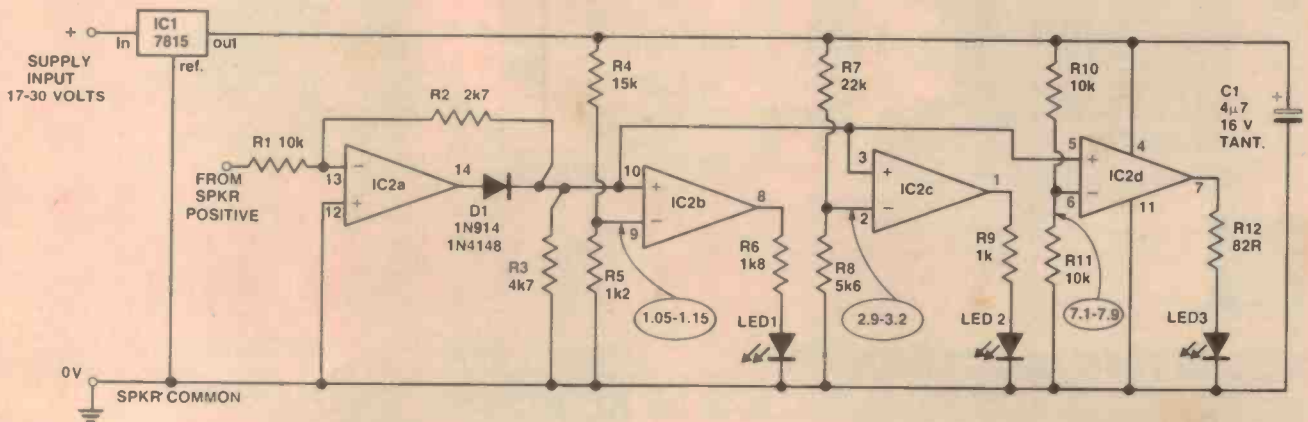
$$V_{peak} = \sqrt{2} \times ½ \times 4 = 2$$

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 resistors the same, in which case any resistors of 82-220 Ohms may be used, and the op-amps will define the intensity possible.





RE WALL

Board No	PCB Price	Description		Kit price
EA6800	$15.50	6800 Micro computer		$119.00
EA6802	$15.50	6802 Micro computer		$119.00
		Power supply to suit		$35.00
		Hex keypad 19 keys		$39.50
75L11	$2.50			
78UP10	$9.50	2650 extra ram	OCT 78	
79FE11	$3.50	Photo flash exposure mtr.	NOV 79	$24.50
79PC9	$3.90	Pulse generator	SEP 79	
79SE3	$4.90	Train model sound	MAR 79	
79TI11	$3.90	Transistor assisted ign.	NOV 79	$34.50
79PS11	$2.90	Experimenters power sup.	NOV 79	
79PC12	$2.90	Fan speed control	DEC 79	
79SF10	$2.50	Photo slave flash	OCT 79	
79SF9	$2.90	Photo sound trigger	SEP 79	
79UPS6	$3.90	Universal power supply	JUN 79	$34.50
80ST10A	$3.90	Stylus timer	OCT 80	
80ST10B	$3.50		OCT 80	
80TC12	$3.90	Bipolar train controller	DEC 80	$34.50
80CM3A	$4.90	Digital capacitance mtr.	MAR 80	$49.50
80CM3B	$3.90		MAR 80	
80PG6	$7.90	TV pattern generator	JUN 80	$67.50
80TV8	$4.50	TV CRO adapter inc. p/pack	AUG 80	$39.90
80F3	$3.20	Audio prescaler	MAR 80	
80PP3	$2.50		MAR 80	
80LL7	$3.90	Leds & ladders	JUL 80	$19.50
80B7	$2.50	Beat frequency oscillator	JUL 80	
80BM10	$3.90	Car battery monitor	OCT 80	$11.50
80DC10	$6.50	Digital storage CRO ad.	NOV 80	$89.90
80HLA5	$2.90	Car headlight alarm	MAY 80	
80LS12	$3.50	Selectalott	DEC 80	$22.00
80LBR12	$2.90	Light beam relay	NOV 80	$13.00
80PC4	$2.90	Power heat controller	APR 80	
80PC7	$3.50	Power saver induc mtr	JUL 80	
80G6	$5.90	Musical tone gen.	JUN 80	
80GPS3	$2.90	Voltage regulator multi	MAR 80	
80AU3	$3.50	Hifi auto turn off	MAR 80	
80AW4	$4.50	Receiver all wave	APR 80	
80TM8A	$6.90	Digital engine analyser	AUG 80	$49.50
80TM8B	$2.90		AUG 80	
80PP7A	$8.50	Eprom programmer	JUL 80	$79.50
80PP7B	$3.90		JUL 80	
80RF5	$2.90	Rumble filter	MAY 80	
80SA3	$5.90	Playmaster stereo amp.	MAR 80	
80CH7	$8.50	240V ac light chaser	JUL 80	
80RAM12	$5.90	Ram expansion for dream	DEC 80	$39.00
80PA6	$7.50	Playmaster 300W amp module		$63.00
			JUN 80	
80CL4	$3.50	Timer controller	APR 80	
80TRS11	$2.90	TRS 80 printer serial in.	NOV 80	$17.50
80SA10	$9.90	Playmaster mosfet stereo amp.		
			JAN 81	
80AD12	$3.00	Autodim light dimmer	JAN 81	$32.00
80RM12	$3.90	Cylon voice simulator	JAN 81	$19.95
80FB12	$3.90	Guitar fuzz box	FEB 81	$19.90
81SW1	$3.90	Osc. switch dual trace	FEB 81	$60.00
81SP1	$2.90	TRS 80/SYS 80Serial interf.	FEB 81	
81GA3	$11.50	Color graphic analyser	MAR 81	$109.00
80GA12	$6.50	25W guitar amplifier	MAR 81	
81DC2	$3.50	Le Gong doorbell	MAR 81	$14.95
81DC3B	$8.50	Digital and	MAR 81	$189.00
81DC3A	$9.50	Analogue storage CRO	MAR 81	
81IR4	$4.50	Infra-red relay receiver	APR 81	$39.00
81RC4C	$2.90	Infra-red relay transmitter	APR 81	
81HB4A	$7.50	Heart rate monitor	APR 81	$82.00
81HB4B	$3.50		APR 81	
81MA4	$4.50	Touch sensitive alarm	APR 81	
81VM2	$2.90	High impedance DC voltmeter		
			APR 81	
81SI3	$7.90	TRS 80/SYS serial interf.	APR 81	
81RC4A	$4.90	2 channel (receiver)	MAY 81	$72.00
81RC4B	$2.50	Infra-red remote (preamp)	MAY 81	
81RC4C	$2.75	Control (transmitter)	MAY 81	
81SP5	$2.90	Sound pressure meter	MAY 81	$37.00
81CC5	$2.90	PC birdies	MAY 81	$14.50
81SS4	$4.90	Speed sentry	MAY 81	
81DT5	$3.00	Dream tape controller	MAY 81	
81MP6	$3.90	Microprocessor power supply		
			MAY 81	
81AO6	$4.90	Audio oscillator	JUN 81	$59.00

Board No	PCB Price	Description		Kit price
81UA6		Benchmate power supply	JUN 81	
81MC7	$2.90	Moving coil preamp	JUL 81	
81OR7	$9.50	Electrochume (electr. organ)	JUL 81	$59.00
81P6	$2.90	Pools/lotto selector	JUL 81	$22.50
81SW7	$4.90	Electronic steam whistle	JUL 81	$17.50
81MC8	$10.90	Musicolor IV	AUG 81	$84.00
81SM7	$3.90	Bagatelle	AUG 81	
81CL9	$4.00	Digital clock/thermometer	SEP 81	$80.00
81GA9	$4.90	Photon torpedo game	SEP 81	$24.50
81UC8	$4.50	Universal timer & stpwatch	SEP 81	
81WS10	$4.90	Wind universal indicator	OCT 81	$52.50
81AO10	$3.50	Audio test unit cass. deck	OCT 81	$47.50
81SS11	$8.90	Slide cross fader	NOV 81	$99.50
81SG9	$4.20	Led sandglass	NOV 81	$22.50
81AU11	$3.90	Audible turn indicator	NOV 81	
81FM10A	$5.90	500MHZ digital freq. mtr.	DEC 81	$135.00
81FM10B	$3.90		DEC 81	
81CH12	$3.50	Christmas decoration	DEC 81	
81LD12	$4.50	Led bar graph display	DEC 81	
81MI11	$3.90	Metronome (low current)	JAN 82	
81WD12A	$3.50	Wind direction indicator	JAN 82	$24.50
81WD12B	$3.50		JAN 82	
81P19	$6.90			
82EP1	$12.50	Free standing eprom prog	JAN 82	$45.00
		with 24 pin' textool socket		$55.00
		and AC plugpack		$69.50
82TH2	$3.90	Digital thermometer	FEB 82	$79.00
82CR1	$13.50	Lge. scrn. storage CRO Adapt		$119.00
			FEB 82	
82EG2	$3.90	Cudlip	FEB 82	$12.95
82PS2	$4.90	Dual tracking power supply	MAR 82	$87.50
82LF2	$3.90	Low fuel indicator	MAR 82	$16.50
82CM3	$3.90	LCD capacitance meter	MAR 82	$79.00
82AO3A	$7.90	Function generator	APR 82	$79.50
82AO3B	$3.90		APR 82	
82VC3	$3.50	Voice canceller	APR 82	$22.50
82VX4	$3.50	Vox	APR 82	$15.00
82VS10				
82PT4	$3.90	Photographic timer	APR 82	$48.00
82IV5	$5.40	12-240V inverter 40 watt	MAY 82	$49.50
82P5	$5.90	Universal preamp MM/MC	MAY 82	$35.00
82TO5	$3.90	Tacho/dwell meter	MAY 82	$72.50
82TS3	$3.90	Low cost touch switch	MAY 82	$12.00
82GA5	$9.90	Guitar booster	JUN 82	$17.50
82EM6A	$4.90	Theremin	JUN 82	$34.50
82EM6B	$3.90			
82IV6	$8.90	12-240V inverter 300 watt	JUN 82	$195.00
		Power monitor	JUL 82	$18.00
82HB6	$3.90	LDC heart rate monitor	JUL 82	$79.00
82CC7A	$15.50	Car computer	JUL 82	$109.00
82CC7B	$4.00	Car computer	to SEP 82	
82DP6	$4.90	Decimal point for D.G. meter	JUL 82	$70.00
82PA7	$9.50	Sub woofer amp	JUL 82	$85.00
82UR8	$4.90	Ultrasonic rule	AUG 82	$49.00
82MS8	$6.50	Stereo synthesizer	SEP 82	$55.00
82EF9	$4.90	Electric fence	SEP 82	$19.50
82PC8	$2.00	Fluorescent starter	OCT 82	$5.00
82FC8A	$6.50	Digital readout	OCT 82	$72.00
82FC8B	$3.90	For short wave	OCT 82	
82FC8C	$2.50	Receivers	OCT 82	
82TA10	$3.90	Freezer alarm	OCT 82	$21.00
82VS10	$7.90	Speech Synthesizer	OCT 82	
82PC10	$3.90	Power up	NOV 82	$36.00
82AL11	$3.90	Super siren	NOV 82	$23.50
82PC11	$3.90	Driveway sentry	DEC 82	$32.00
82QR12A	$9.95	Playmaster AM tuner	DEC 82	$239.00
82QR12B	$9.95		DEC 82	
82PH12	$4.90	Digital PH meter	DEC 82	$135.00
82EG12	$2.90	Boggle goggles (short form)	DEC 82	$9.60
82FD5	$4.90			
82DP6	$3.90			
83TV1A	$4.90	Remote Infrared TV	JAN 83	$39.50
83TV1B	$2.90	Sound control	JAN 83	
83TV1C	$2.90		JAN 83	
83PS1	$3.90	Plugpack regulator	JAN 83	$14.00
		with plugpack		$29.50
83EG1	$3.50	Led head light chaser	JAN 83	$12.00
82WB1	$2.90	Wheatstone bridge	FEB 83	$45.00
82AO2	$2.90	AM tuner alignment kit	FEB 83	$8.00
		Molsture alarm	FEB 83	

Board No	PCB Price	Description		Kit price
79TI11	$3.90	Trans.ass. ignition updated	FEB 83	$34.50
83FC2		Fuel consumption meter	MAR 83	$50.00
83BP3	$3.90	Brown out protector	MAR 83	$25.00
83MS4	$3.90	Stereo simulator PCB version		$12.00
			APR 83	
		Self contained unit	AUG 83	$20.00
83PC3A	$3.90	Touch lamp dimmer	APR 83	$20.00
83PC3B	$3.50	Touch lamp timer	AUG 83	$21.00
83PS5	$4.90			
83SC7	$3.90	LCD event counter	JUL 83	$32.00
83SC8	$3.50	2MHZ digital freq. meter	AUG 83	$60.00
83VA8	$5.90	Video amplifier	AUG 83	$15.00
83EG5	$4.90	Electronic roulette wheel	MAY 83	$24.00
		Electronic breath tester	MAY 83	$25.00
83PS5	$5.90	50V/5A power supply	JUNE 83	$140.00
83GA6	$7.90	Effects unit	JUNE 83	$75.00
83PP5	$5.90	Overload indicator	JUNE 83	$20.00
83PS7	$3.50	±12V for lab power supply	JULY 83	$13.00
83AL6	$2.90	Fridge door alarm	JULY 83	$9.00
83MS4	$3.90	Compumuse	AUG 83	$20.00
83WM8	$6.95	Electronic watt meter	SEPT 83	$65.00
83TT8	$3.95	Transistor tester	SEPT 83	$15.00
83MS8	$4.90	Soil heating unit	SEPT 83	$70.00
83VE10	$4.90	Video enhancer	OCT 83	$35.00
83MD9	$3.50	Nail finder	OCT 83	$10.00
83SS9	$3.90	Speed sentry	OCT 83	$11.00
ET014	$4.90	Dual voltage power supply	DEC 71	
ET043	$2.50	Heads or tails	OCT 76	$3.90
ET044	$2.50	Two tone doorbell	OCT 76	$4.90
ET047	$2.50	Morse practice set	DEC 76	$3.90
ET048	$2.50	Buzz boards	DEC 76	$4.50
ET061	$2.50	Simple audio amp	OCT 76	$5.90
ET062	$2.90	Simple AM tuner	MAR 77	$6.90
ET063	$2.90	Electronic bongos	NOV 79	$5.90
ET064	$2.50	Simple intercom	OCT 83	
ET065	$2.90	Electronic siren	DEC 79	$5.90
ET066	$2.50	Temp alarm	DEC 79	$5.50
ET067	$2.90	Singin moisture		$7.95
ET068	$2.90	Led dice	OCT 76	$6.90
ET071	$2.50	Tape noise limiter	JUN 79	
ET072	$2.50	Two octave organ	JUN 78	$9.50
ET081	$2.90	Tachometer	OCT 83	
ET083	$2.50	Train controller	DEC 79	
ET084	$2.90	Car alarm	JAN 77	$13.50
ET085	$2.50	Car over rev. alarm	OCT 79	
ET130	$2.50	Temp/volts converter	FEB 76	
ET132	$3.90	Experimenters power supply	FEB 77	
ET134	$2.90	R.M.S. voltmeter	AUG 77	
ET135	$3.50	Digital panel meter	OCT 77	
ET136	$2.90	Linear scale cap. meter	MAR 78	
ET137A	$4.90	Frequency meter LCD	MAY 78	
ET137B	$3.90	Audio oscillator	MAY 78	
ET139	$2.50	Power meter	MAY 78	
ET147	$4.90	Electronic dummy load	OCT 80	$99.00
ET149	$3.50	Two tone generator	JUL 80	$34.90
ET152	$2.90	Capacitance meter	FEB 80	
ET153	$3.50	Temperature adaptor	MAY 83	$19.95
ET157	$4.90	Crystal marker	OCT 81	$37.50
ET158	$3.50	Low Ohms meter	NOV 81	$36.50
ET159	$2.90	10-15V exp. scale voltmeter	DEC 81	$26.50
ET160		13.8V 10 amp power supply	JUL 82	
ET161	$4.90	Evaluation meter		
ET162	$4.50	0-30V var. power supply	DEC 82	$47.50
ET163	$6.50	0-40V/5A alb power supply	MAY 83	$169.00
ET164	$8.00	Zener diode tester	MAY 83	$9.00
ET166		Frequency counter	AUG 83	$16.00
ET166B	$4.90			
ET166C	$4.90			
ET166D	$4.90	Power supply	AUG 83	$24.00
ET165	$7.50	Tacho calibrator	NOV 82	$39.50
ET245	$2.90	White line follower	NOV 77	
ET255	$2.90	Thermometer	NOV 80	
ET256	$3.50	Humidity meter	OCT 83	$29.50
		Humidity sensor	OCT 83	$19.95
ET257	$2.90	Universal relay board	MAY 81	$13.50
ET258	$2.50	Mini drill speed controller	JUL 81	$9.50
ET259A	$3.90	Versatile 'incremental' timer	JAN 82	$39.00
ET259B	$3.90			
ET260	$2.60	Photo lamp flasher	DEC 79	

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1st floor 425 High St. Northcote 3070 (03) 489 7099 (03) 481 1923
Telex AA 38897

CHART

Board No	PCB Price	Description		Kit price
ET261	$2.90	Fog horn	DEC 79	
ET263	$2.90	Simple egg timer	DEC 79	
ET264	$2.90	Simple siren	MAR 80	
ET265	$3.90	Power down	JUL 83	$37.00
ET268	$2.50	Nicad float charger	MAR 83	$9.50
ET316	$3.50	Transistor assisted ignition	MAY 77	$34.00
ET317	$3.90	Car rev monitor	JUL 77	
ET324	$4.90	Led tacho	AUG 80	$34.00
ET323	$3.90	Headlight delay	MAY 83	$17.50
ET325	$2.50	Car auto electric probe		
ET326	$2.50	Exp. scale led voltmeter	SEP 80	$12.50
ET327	$3.50	Turn/Hazard indicator	OCT 80	$22.00
ET328	$2.90	Led oil temp meter	JAN 81	$19.00
ET329	$2.50	Exp. scale vehicle ammeter	FEB 81	$19.00
ET330	$3.90	Car alarm	JUL 81	$29.00
ET332	$3.90	Electronic stethoscope	AUG 81	$34.00
ET333	$3.90	Reversing alarm	JAN 82	$10.00
ET334	$3.90	Auto tester	JAN 83	
ET335	$4.50	Windscreen wiper controller	MAR 83	
ET336	$3.90	Low cost tacho dwell	AUG 83	$24.00
ET363	$3.50			
ET417	$2.90	Overload indicator	AUG 73	
ET421		Three way (Dick Smith)	SEPT 83	
ET438	$3.90	Led level meter		$12.95
ET440	$8.50	25 Watt stereo amp	MAR 75	
ET445	$2.90	General purpose preamp	JUL 76	$8.25
ET446	$3.90	Stereo limiter	JUL 76	
ET449	$3.90	Mike preamp	MAY 77	
ET450A	$4.90	Bucket brigade	DEC 77	
ET450B	$4.90			
ET452		Guitar practice amplifier	JAN 80	
ET453	$2.90	Amp class B gen purpose	APR 80	
ET454	$3.90	Fuzz box	APR 80	
ET455	$4.50	Loud speaker protector	MAR 80	$32.50
ET457	$3.90	Scratch & rumble filter	SEP 80	$49.50
ET458	$4.90	Led level meter	JUN 81	$27.00
ET459A	$16.50	Series 5000 1/3 oct graph equ	NOV 82	$189.00
ET459B	$16.50			
		Graphic equ. front panel		
		Graphic equ. metal work		
ET461	$3.90	Balanced input preamp	DEC 82	$20.00
ET464	$2.90	IC audio amplifier	JUL 83	$8.00
ET465	$4.50	Loud Hailer	JUL 83	$50.00
ET466	$8.50	300W amp module	FEB 80	$67.50
ET467	$6.90	4 input mike preamp	JUL 80	$29.50
ET470	$4.50	60 watt amp module series 4000	TPV 6	$26.00
ET471	$9.90	Audio preamp series 4000	TPV 6	$49.50
		Series 4000 front panel		$14.90
		Series 4000 metal work		
ET472	$4.50	Power supply for series 4000	TPV 6	$24.00
ET473	$5.90	Moving coil preamp series 4000	TPV 6	$54.00
ET474	$2.90	Interface 60W amp	JAN 80	
ET475	$6.90	AM tuner	SEP 80	$99.00
		Set of three pot cores		$29.50
ET476	$7.90	Series 3000 amp 25W stereo	NOV 80	$84.00
ET477	$7.90	Series 5000 pwr. amp mod 150W	JAN 81	$63.50
		Series 5000 power amp complete kit		$299.00
		Series 5000 pwr amp front panel		
		Series 5000 pwr amp metal work		
ET478MB	$3.90	Series 5000 preamp main brd	OCT 81	
ET478MC	$4.90	Moving coil preamp (5000)	SEP 81	$24.50
ET478MM	$4.90	Moving magnet preamp (5000)	SEP 81	$18.50
ET478SA	$2.90	Series 5000 preamp switch brd	OCT 81	
ET478SB	$1.90	Series 5000 preamp switch brd	OCT 81	
ET478SC	$1.90	Series 5000 preamp switch brd	OCT 81	
ET478SD	$1.90	Series 5000 preamp switch brd.	OCT 81	
ET479	$3.50	Series 5000 bridging adaptor	MAR 82	$12.90

Board No	PCB Price	Description		Kit price
		Series 5000 preamp complete kit		$259.00
		Series 5000 preamp front panel		
		Series 5000 preamp metal work		
ET480	$4.50	100 watt amp module	30 AP	$25.50
ET480PS	$4.50	50-100W amp module pwr supply	30 AP	$22.50
ET481M	$3.95	Hi-power p.a./guitar amp mod.	30 AP	
ET481PS	$4.90	12V/100 p.a. inverter	30 AP	
ET483	$4.50	Sound level meter	FEB 78	
ET484	$5.90	Expander compressor 30 AP	JUL 77	
ET485	$5.25	Graphic equaliser	JUN 77	
ET486	$4.90	Howl round stabilizer	NOV 77	$59.00
ET488	$7.90	60W amp module	JAN 83	
ET489A	$3.50	Audio spectrum analyser no2	APR 78	
ET489B	$3.50			
ET492	$3.90	Sound bender	FEB 82	$29.00
ET494	$3.90	Loud speaker protector	OCT 82	$24.50
ET496	$8.90	Series 4000-1 speaker kit	FEB 80	$749.00
		Speakers & crossovers		$499.00
		Crossover kits		$199.00
		Speaker boxes (prices per pair)		$269.00
ET499	$4.95	50W mosfet amp 75-85	MAR 82	$79.00
		Transformer		$43.50
		Anodised heatsink		$42.50
ET525	$4.90			
ET527	$5.90			
ET528	$2.90	Intruder alarm	JAN 75	
ET539	$3.90	Touch switch	MAR 76	
ET541	$3.90	Train controller	MAY 76	
ET547	$3.50	Telephone bell extension	JUN 77	
ET549A	$3.90	Metal detector	MAY 77	
ET560	$2.50	240V mains locator	MAY 80	
ET561	$3.90	Metal Detector	MAR 80	$34.00
ET562	$3.90	Geiger counter	APR 80	
ET563	$4.50	Nicad fast charger	JUL 80	$59.95
ET566A	$2.90	Pipe & cable locator	APR 80	
ET566B	$4.90			
ET567	$4.50	Core balance relay	APR 81	$44.50
ET568	$2.90	Photo flash trigger	OCT 80	$26.50
ET570A	$2.90	Infrared 'trip' relay TX	JAN 82	$24.50
ET570B	$3.20	Infrared 'trip' relay RX	JAN 82	
ET572	$4.90	Digital pH meter with probe	DEC 80	$109.00
ET573	$4.50	Universal timer	OCT 79	
ET575	$2.90			
ET576	$8.90	Electromygram	TPV 6	$95.00
ET577	$3.50	General purpose power supply	TPV 6	$39.50
ET578	$3.90	Simple nicad charger	JUN 80	
ET581	$3.25	15V dual power supply	JUN 76	$17.50
ET583	$2.90	Marine gas alarm	AUG 77	
ET585R	$2.90	Ultrasonic receiver	TPV 6	$17.95
ET585T	$2.90	Ultrasonic transmitter	TPV 6	$10.95
ET586				
ET596	$2.90	White noise generator	NOV 81	$8.00
ET598A	$3.90	Touch switch	FEB 81	$10.00
ET598B	$3.50			
ET599A	$3.50	Infra red remote control	MAY 80	$76.00
ET599B	$3.50			
ET599C	$4.90			
ET599D	$3.20	I.R. remote cntrl power supply	MAY 80	
ET603	$4.90	Music synthesizer sequencer	AUG 77	
ET604	$4.50	Metronome	SEP 77	
ET606	$3.90	Electronic tuning fork	NOV 79	
ET607A	$2.90	Sound Effects generator	AUG 81	$12.50
ET607nf	$2.90		AUG 81	
ET631-2	$7.50	Keyboard encoder	APR 77	
ET635	$4.90	Computer power supply	APR 81	
ET636	$19.90	7 slott s100 mother board	MAY 80	$89.50
ET638A	$5.90	Eprom programmer	JUL 78	
ET640	$69.00	Memory mapped VDU		$129.00
ET644	$69.00	Direct connect modem	OCT 82	$169.00
ET646A	$3.75			
ET646B	$3.75			
ET647		Speech synthesizer	OCT 82	
ET649		Microbee light pen	AUG 83	$19.95

Board No	PCB Price	Description		Kit price
ET650A	$4.90	Stac timer	NOV 78	
ET650B	$4.50			
ET650C	$4.50			
ET653	$6.50	16 Channel comp output driver	NOV 82	$45.00
ET654	$69.00	Gen. purp. interface. for Apple	MAR 83	$169.00
ET660	$19.00	Learners microcomputer	OCT 81	$99.00
		Key set (18) to suit ET660		$30.00
		Colour option kit to suit 660		$16.50
ET668	$5.90	Microbee eprom programmer	FEB 83	$38.00
		With textool socket		$47.50
ET670	$11.00	Low cost micro keyboard	MAY 82	
ET682	$79.00	Versatile eprom card	MAY 81	$115.00
ET686	$9.50	ppi-based eprom programmer	OCT 82	$48.00
ET688A	$3.50	Bipolar prom programmer	JUL 83	$48.50
ET688B	$3.50			
ET708	$2.90	Aerial amp	MAR 76	
ET713	$4.90	FM tuner add on	SEP 77	
ET717	$4.90	Crosshatch generator	MAY 78	
ET724	$3.90	Microwave leak detector		$16.50
ET726	$3.50	R.F. amp 70W 6/10 meter	FEB 80	
ET729	$3.90	UHF TV masthead amp	APR 81	$36.00
ET730		UHF TV converter	MAY 81	$37.50
ET731	$4.50	Teletype modulator	OCT 79	
ET733	$4.90	RTTY computer decoder	APR 83	$20.00
ET734	$7.90	Phoney patch	MAY 83	$65.00
ET735	$4.90	UHF to VHF convertor	MAY 81	
ET736	$3.90	Radio facs pict-comp decoder	SEPT 83	$25.00
ET760	$3.90	Video mod. to suit 660 micro	OCT 81	$15.50
ET824	$3.90	Slot car power supply	DEC 81	$19.50
ET825	$5.90	Slot car contr. (no case)	DEC 81	$59.00
ET905	$16.00	Polyphonic organ	JAN 83	
ET918	$3.90			
ET1501A	$2.90	Negative ion generator	APR 81	$39.00
ET1501B	$2.90			
ET1501C	$2.00			
ET1503	$3.90	Battery charger	AUG 81	
ET1505	$5.90	12V fluoro. inverter	AUG 82	$49.50
ET1506	$2.90			
ET1509	$4.90	D.C.-D.C. inverter	SEP 82	$39.50
ET1510A	$3.90	Model railway points	JAN 83	
ET1510B	$2.90	Controller and indicators		
ET1511	$3.90	Immersible temp. controller	FEB 83	$19.50
ET1512	$4.25	Electric fence tester	FEB 83	$24.50
ET1515	$3.95	Motor speed controller	APR 83	$27.50
ET1516	$3.90	Model engine ignition system		$41.50
ET1517	$3.75	Video distribution amp	SEP 83	$45.00
ET1520	$3.90	Wideboard amp	JUL 83	$37.00
Hobby Electronics				
HE102	$4.50	Guitar phaser	JUN 81	$25.00
HE103		Transistor tester		$9.40
HE104	$3.90	A.M. tuner	MAY 81	$7.50
HE105	$3.90	Basic amplifier	MAY 81	$9.50
HE106	$3.90	F.M. radio microphone	MAY 81	$8.50
HE107	$3.90	Electronic dice	JUN 81	$5.95
HE108	$3.90	Power supply		$11.95
HE110		Unmistakabell		$6.90
HE111		Ohmeter		$19.90
HE112	$3.20	Micromixer		$11.90
HE113	$3.50	Water alarm		$9.45
HE114	$3.90	Digital counter	OCT 81	$14.50
HE115	$2.90	Reaction timer		
HE116	$3.90			
HE117	$3.90	House and car alarm		$16.90
HE121	$2.90	Scratch and hiss filter		$9.00
HE122				
HE123	$4.50	Alien invaders		
HE126	$3.50	Nicad charger (P/Pack ex $9.95)		
HE127		Siren		$3.90
HE128		Fog horn		
HE129	$3.50	Simple tuner		

ELECTRONICS

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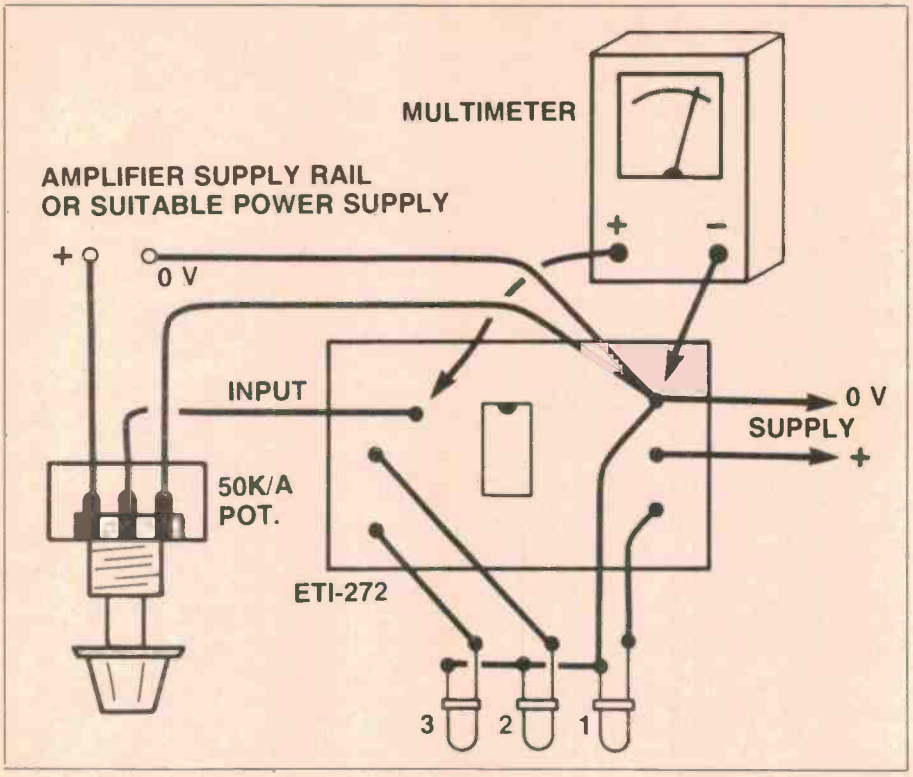
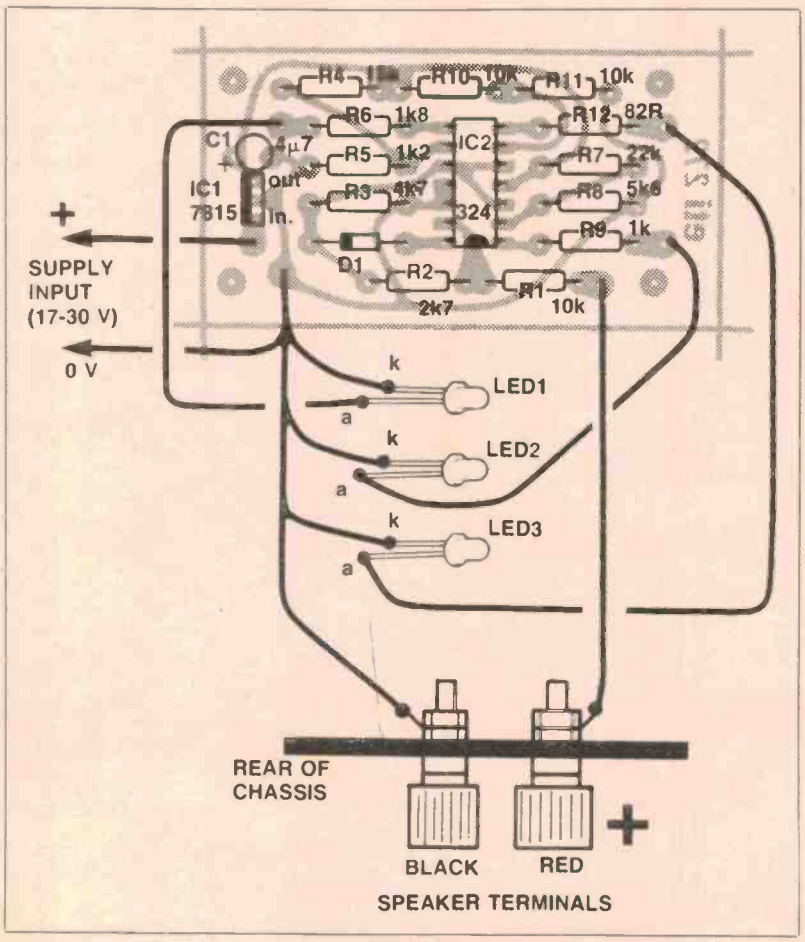




Power up

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 whose end 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 28 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 ..... all ½W, 5%
- R1, 10, 11 ..... 10k
- R2 ..... 2k7
- R3 ..... 4k7
- R4 ..... 15k
- R5 ..... 1k2
- R6 ..... 1k8
- R7 ..... 22k
- R8 ..... 5k6
- R9 ..... 1k
- R12 ..... 82R

Capacitor
- C1 ..... 4µ7/16 V tant.

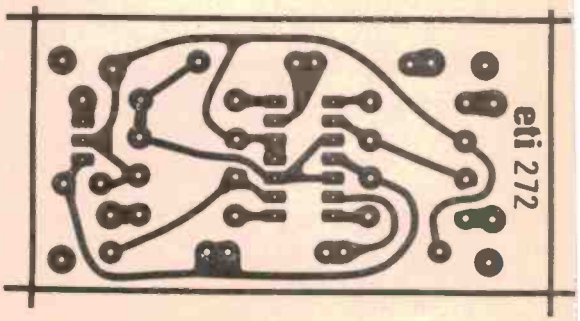
Semiconductors
- D1 ..... 1N914, 1N4148
- IC1 7815
- IC2 ..... µA324, LM324
- LED1, 2, 3 ..... TIL220 5 mm LEDs

Miscellaneous
EIT-272 pc board; hookup wire; nuts, bolts, etc.

Estimated price: $7-$9

Table 1. Alternate resistor values for LEDs 1, 2 and 3 to light at different power levels.

	LED1		LED2		LED3	
Power level	R4	R5	R7	R8	R10	R11
¼W	15k	560R	—	—	—	—
½W	22k	1k5	—	—	—	—
2.5W	12k	1k5	12k	1k5	—	—
4W	—	—	18k	1k5	—	—
10W	—	—	27k	8k2	27k	8k2
15W	—	—	1k	3k9	10k	3k9
20W	—	—	10k	4k7	10k	4k7
75W	—	—	—	—	10k	15k
100W	—	—	—	—	12k	27k



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.

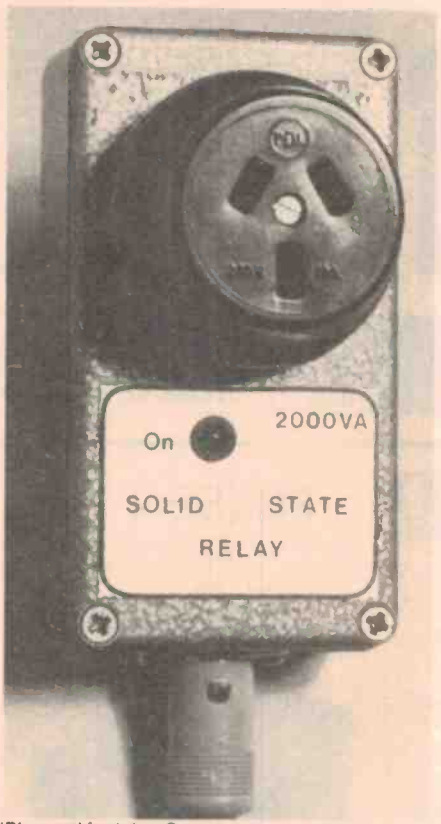
Graeme Teesdale

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 dumps messages on a printer is pretty well a self-sufficient machine, only interacting with the real world via its benevolent operator.

'Ports', that is, a connection into or out 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 circuitry in a computer which 'drives' an output port is generally not capable of switching substantial currents or voltages, 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 buss 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.



'Plugpack' style. One prototype, built plugpack-style into a diecast box (see opposite page).

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 lamps), 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 in-rush 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.

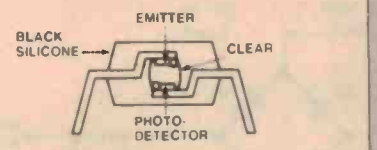
OPTOCOUPLERS

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 two parts. They are sometimes known as *photon-coupled devices* or as *opto-isolators*. They may be employed to replace conventional relays when a fast response is required or when sparking at relay contacts must be avoided.

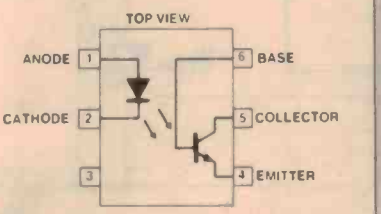
An optocoupling device consists of an infrared emitting device or other photon emitter on its input side and some form of detector for the radiation on the output side, both the emitter and detector being in a light-tight enclosure.

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 photon emitter device emits with its maximum intensity. In other words, the devices are spectrally well matched so that a small emitter device current can produce a reasonably large response in the detecting device.



Cross-section through an optocoupler.



Pinout for the 4N26 – 4N28 and MCT2 devices.

Although some optocoupled devices are fabricated in circular metal packages, the most common types are produced in dual-in-line (DIL) packages with a typical construction like that shown in the diagram. The emitter and detector are placed fairly close together with a clear insulating material between them. The black silicone body of the device prevents stray radiation from falling on the detector.

In most DIL devices the radiating emitter is connected to pins on one side of the device while the detector is connected to pins on the other side. This arrangement provides the maximum possible electrical isolation between the input and output circuits. Many of the simpler optocoupled devices differ from most other dual-in-line devices in that they have a total of only six connecting pins.

The basic internal circuitry of the 4N26, 4N27, 4N28 and MCT2, with a single phototransistor output, all have the connections shown in the pinout diagram here.

Two designs

As there are applications where a zero crossing switch is unnecessary or unusable (e.g: switching dc-operated devices) I have designed electronic switches of each type. Both designs make use of opto-isolators (or optocouplers) to isolate the microcomputer from the power source being switched — which will generally be the 240 Vac mains. The optocoupler's transparent dielectric provides an isolation between input and output terminals of up to several thousand volts, depending on the type used. The other advantage offered by an optocoupler is that the use of a LED for the photon emitter creates a 20 mA loop. The driver for the LED input of the photocoupler is located at the computer rather than the solid-state switch and the effects of noise induced into the cable will be considerably less for a 20 mA low impedance circuit than the relatively high impedance loop of a logic device or transistor base. A lot of interference noise comes from external leads running back inside the computer's case and re-radiating noise into the data, address and control lines. A low impedence 20 mA loop substantially reduces or eliminates this problem.

The non-zero crossing switch is designated ETI-1514a, the zero crossing switch being ETI-1514b. Each has the same basic mechanical design so that either can be used interchangeably in a case or chassis drilled accordingly.

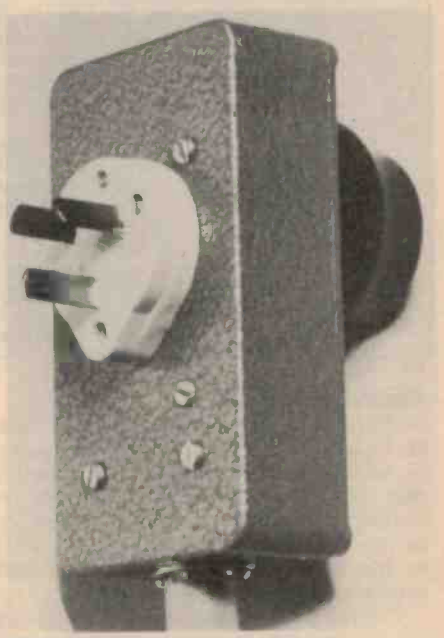
If your computer has an eight-bit parallel port, then up to eight switches can be controlled from it. The ETI-673 Microbee MultiPROM Interface board features 11 output lines and these electronic switches are ideal for controlling mains-operated devices via this board.

I have designed each switch so that 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.

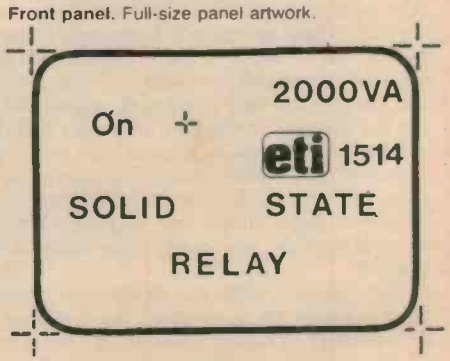
For the zero crossing switch, I chose an IC specially made for this application — the TDA1024. It is cheap (around $3) and generally readily avaialble. It will happily drive the T6000 triac. RCA make the T6006 triac specifically for zero crossing switch applications, but I found it not so easy to get 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.

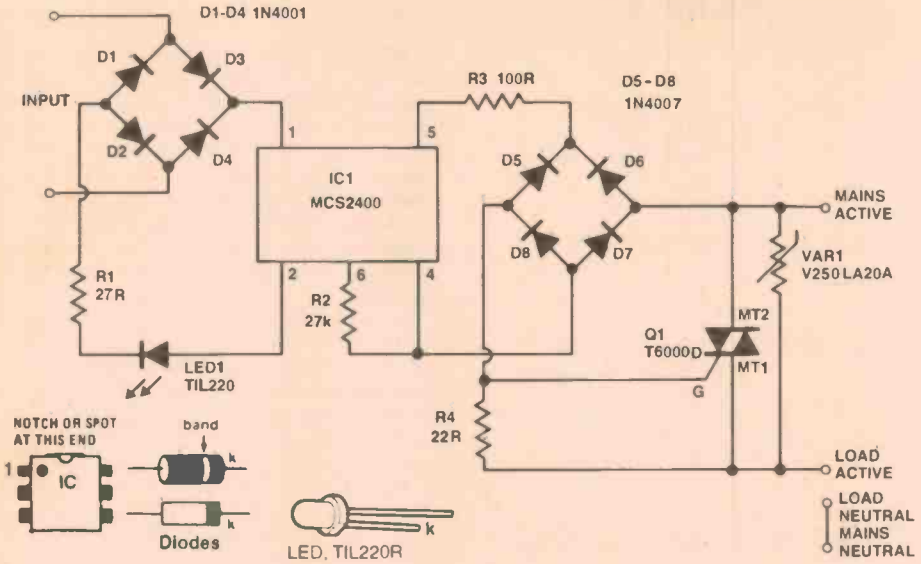
The TDA1024 provides a positive-going mains-synchronised trigger pulse for the triac whenever its control input is activated. Since the current and voltage in the load must be in phase for mains-synchronised switching, only resistive (or substantially resistive) loads can be attached to the ETI-1514b zero crossing switch. Incandescent lamps and heater elements are substantially resistive and the ETI-1514b can be used on these loads, but not on reactive loads such as a motor — that's why the non-zero crossing switch, ETI-1514a, is used. ▶



Rear view. Showing plug mounting.

Front panel. Full-size panel artwork.





PARTS LIST ETI-1514A
non-zero crossing type

Résistors ..... all ½W, 5% unless noted
R1 ..... 27R
R2 ..... 27k
R3 ..... 100R
R4 ..... 22R

Semiconductors
D1-D8 ..... 1N4007, EM410
LED1 ..... TIL220R red LED
Q1 ..... T6000D triac
IC1 ..... MCS2400 optocoupler

Miscellaneous
SK1 ..... 5-pin DIN socket
PL1 ..... 5-pin DIN plug
VAR1 ..... Varistor, G.E. type V250LA20A

ETI-1514A pc board; diecast box to suit (see text); 240 Vac 3-pin surface socket; 240 Vac 3-pin plug (see text); aluminium angle bracket (see text); wire, nuts, bolts etc.

Price estimate: $22-$26

HOW IT WORKS — ETI 1514a

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 D5-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 dI/dt currents passing through the D5-D8 bridge diode capacitances from the triac gate.

Voltage transients that might destroy the triac are 'snubbed' by a metal oxide varistor, VAR1 — a V250LA20A 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.

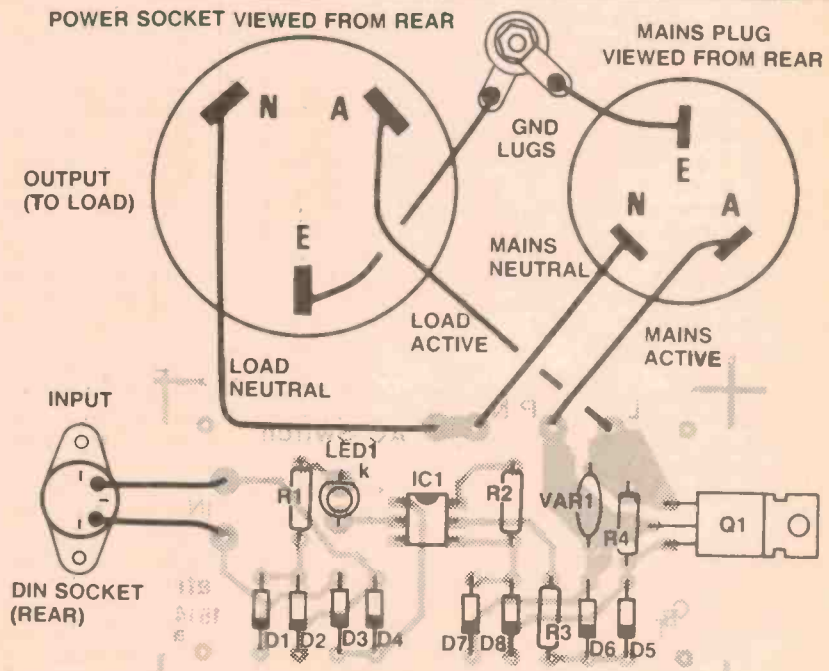
In series with the optocoupler's photon emitter input I have added a LED to indicate the 'on' condition. Resistor R1 acts as a current limiter. If the unit is to operate from a source providing greater than 5 V drive level, it is only necessary to increase the value of R1 to limit the input circuit current to around 15-20 mA.

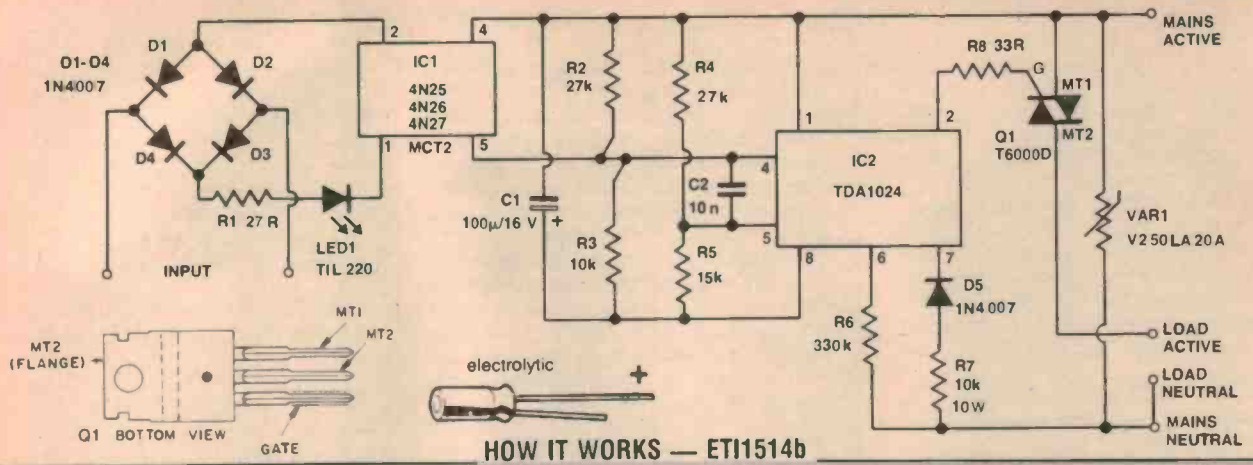
Construction

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 he 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 plugpack 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





HOW IT WORKS — ETI1514b

This is the zero crossing switch. It can only be used on resistive (or substantially so) loads as mains-synchronous switching is employed.

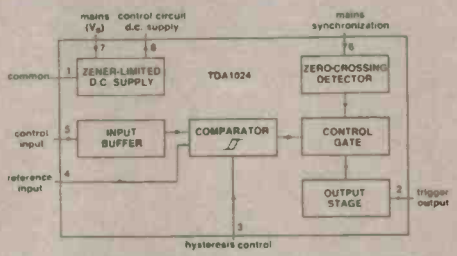
In this unit, the input signal from the computer turns on the photon emitter in the optocoupler (IC1), the output of which activates the control input of the zero crossing driver, IC2. When the mains voltage passes through zero, the trigger output of IC2 turns the triac on, supplying current to the load 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 IC 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 to Q1 is about 125 µs. 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 100 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.

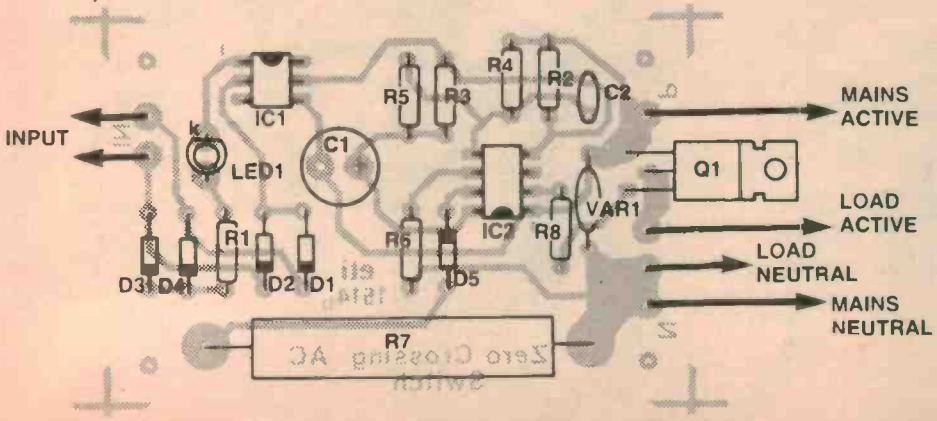
The series resistor must be connected between the trigger output of IC2 and the gate of Q1 to limit the trigger current. Resistor R8 was chosen to limit the output current to about 10 mA average.

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. Here, however, it is 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.

a suitable box and mains outlet sockets provided for connection to the controlled devices, etc. The details will depend on your individual application. However, always make sure the mains wiring is properly terminated and installed in a workmanlike fashion. All exposed metal parts *must* be connected to the mains earth. Take care with active and neutral wiring. Don't mix them up.

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* you get semiconductors and polarised capacitors (C1 in the zero crossing switch) the right way round. ▶



ETI-1514B zero crossing type

Resistors	all ½W, 5% unless noted
R1	27R
R2, R4	27k
R3	10k
R5	15k
R6	330k
R7	10k, 10W
R8	33R
Capacitors	
C1	100µ/16 V single-ended electro.
C2	10n/50 V ceramic or greencap
Semiconductors	
D1-D5	1N4007, EM410
LED1	TIL220R
IC1	4N27 or sim. optocoupler
IC2	TDA1024 zero-crossing switch
Q1	T6000D triac
Miscellaneous	
VAR1	Varistor, G.E. type V250LA20A

ETI-1514B pc board; other parts as per ETI-1514A.

Price estimate: $24-$28

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, SK1), 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 '1514 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 '1514 switch end.

When installing a '1514 board, always run the mains leads *directly away* from the input leads so as to minimise possible interfence being induced into the input circuitry. ●

ZERO-CROSSING AC SWITCHING

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).

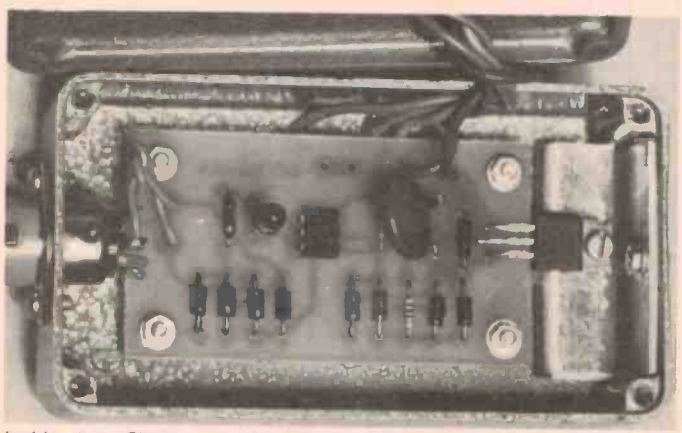
Triac switches are fast-acting devices and do not suffer from arcing problems. Nevertheless, they are still capable of generating considerable RFI at switch-on. Why? As the triac turns on, the load current may rise from zero to several amps in a mere couple of microseconds; since this current flows through the mains wiring, the wiring may radiate a great 'splurge' of RFI in response to this heavy surge current.

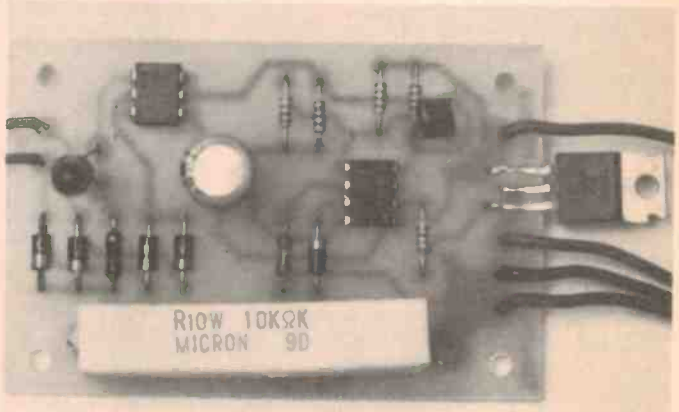
The magnitude of the RFI is proportional to $\delta i/\delta t$ and can be reduced by either reducing the surge current amplitude or increasing the surge current rise time, or possibly both; once the triac has turned on, the subsequent large 'rise time' of the 50 Hz mains signal (5 ms from zero to peak) causes virtually zero RFI, even when load currents of tens of amps are being drawn.

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.

Triacs 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.

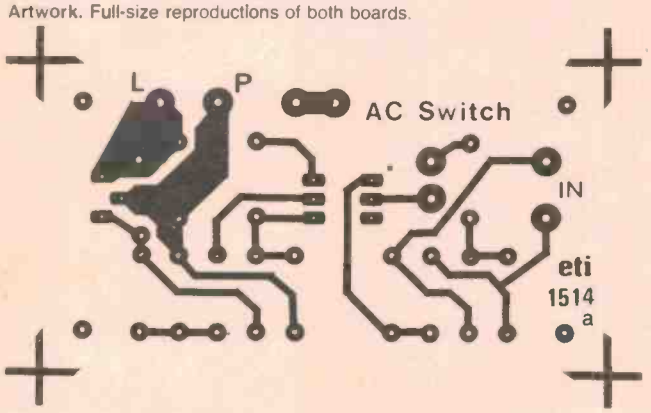
Thus, a triac can be persuaded to generate virtually zero switch-on RFI by feeding it with gate current *only* when the instantaneous mains voltage is close to the zero or crossover value at the start of each half cycle. This technique is known as 'zero crossing switching'. Special triac-driving ICs are available from a number of manufacturers for zero crossing switching applications, such as the CA3059 by RCA and the TDA1024 by Philips/Signetics.

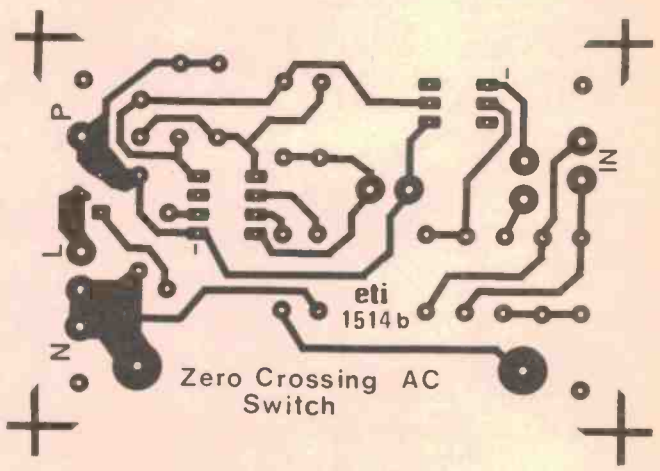




Inside story. Showing how the ETI-1514a was mounted in the plugpack-style diecast box. The ETI-1514b board is shown at right (note that the varistor was not mounted when the picture was taken).

Artwork. Full-size reproductions of both boards.





THE METER BY WHICH ALL OTHERS ARE MEASURED

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 "1999", autopolarity, unit and other annunciators.

Ranging: Auto (manual ranging in current ranges).

Overrange Indicator: "1" in MSD column blinks, audible tone (No audible tone for Ohms; no indicator or buzzer for DC 1000V, AC 600V).

Battery Low Indicator: BATT mark lights.

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. Ω/A: AC 250V max.

Dielectric Strength: AC 3000V/1 min.

Power Source: Two size AA (SUM-3) batteries; Battery current, 5mW.

Dimensions: 160H x 85W x 30D (mm).

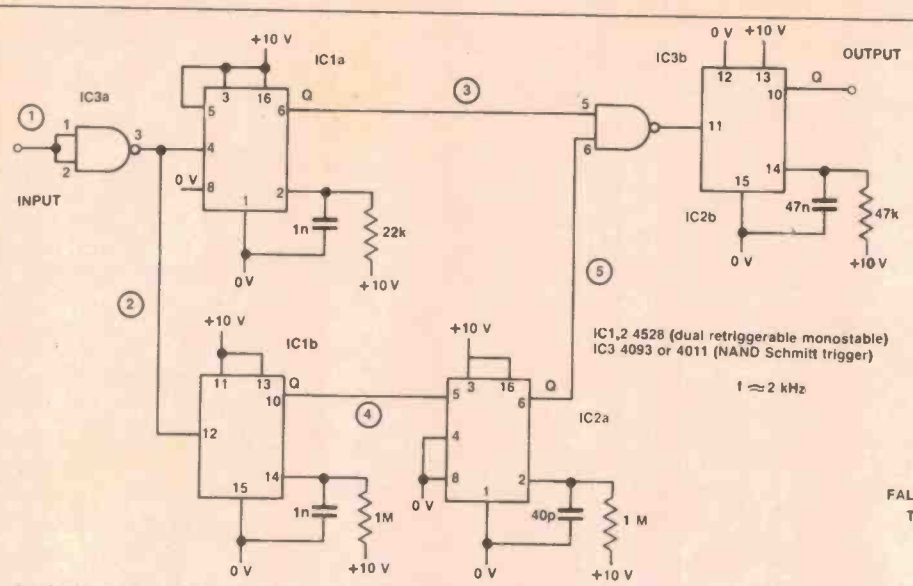
9145 carrying case supplied.

Option: 9014 HV Probe

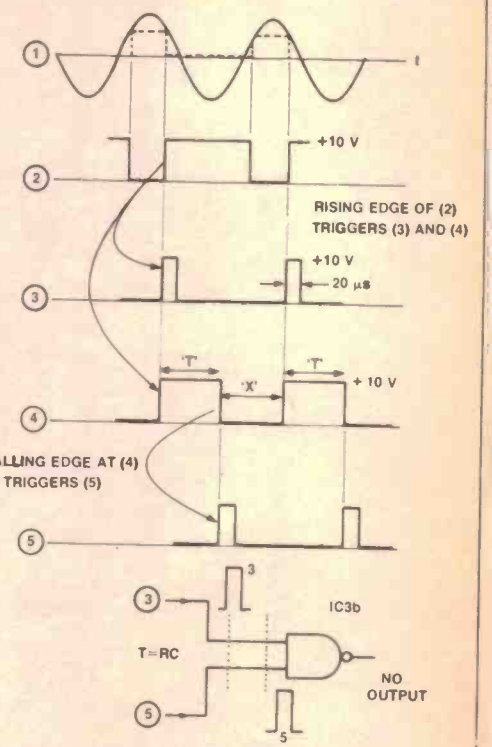
Measurement Range and Accuracy

(Specified for 23°C ± 5°C < 80% RH)

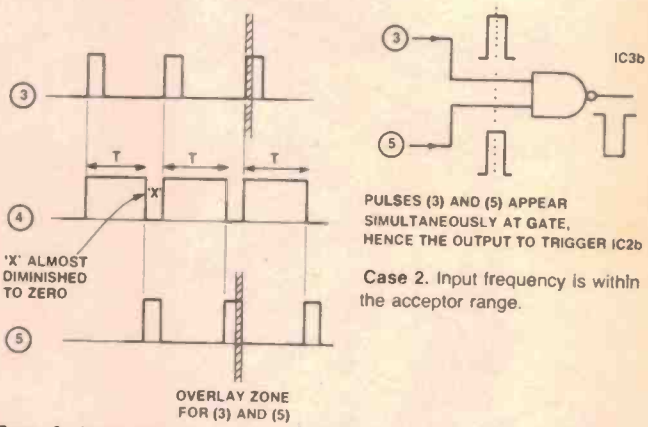
	Range	Resolution	Accuracy	Notes
DCV	200mV	100μV	± 0.5%rdg ± 4dgt	Input resistance 100MΩ, 10MΩ(approx.)
	2V	1mV	± 0.7%rdg ± 4dgt	
	20V	10mV		
	200V	0.1V	± 1.0%rdg ± 4dgt	
	1000V	1V		
ACV	2V	1mV	± 1.0%rdg ± 8dgt	Input resistance approx 10MΩ, approx.) 40Hz to 500Hz
	20V	10mV		
	200V	0.1V	± 1.2%rdg ± 8dgt	
	600V	1V		
DCA	200mA	100μA	± 1.5%rdg ± 4dgt	approx 1Ω incl including fuse resistance)
	10A	10mA	± 1.7%rdg ± 4dgt	approx 15mΩ >
ACA	200mA	100μA	± 2.0%rdg ± 8dgt	1Ω 40Hz ~ 500Hz
	10A	10mA	± 2.2%rdg ± 8dgt	approx 15mΩ >
OHMS	200Ω	0.1Ω	± 0.8%rdg ± 5dgt	Open terminal voltage 1.5V ± 0.2V 0.65V ± 0.065V
	2kΩ	1Ω		
	20kΩ	10Ω		
	200kΩ	100Ω		
	2000kΩ	1kΩ	± 1.8%rdg ± 10dgt	
LPΩ	2kΩ	1Ω	± 1.0%rdg ± 10dgt	Open terminal voltage < 0.4V
	20kΩ	10Ω		
	200kΩ	100Ω		
	2000kΩ	1kΩ	± 2.0%rdg ± 10dgt	



Audio frequency switch. Sine wave input (peak value equal to supply voltage) applied to input will cause output to go high within a certain narrow range of frequency. Response outside this range is zero.



Case 1. Input frequency is below the acceptor frequency.



Case 2. Input frequency is within the acceptor range.

Case 3. Input frequency is higher than the acceptor frequency. IC1b is retriggered before its timed interval has elapsed. Its output is permanently high and the waveform (5) disappears. Hence no triggering of IC2b is possible.

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 IC3b.

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 — 1n, 1M5; high note — 1n, 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.

STOP FUTURE SHOCK

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.

Measurement Range and Accuracy (specified for 23°C ± 5°C, <80% R.H. after zero adjustment.)

	Range	Resolution	Accuracy	Notes
DC V	200 mV	100µV	· 15% rdg ± 1 dgt	Input resistance > 1000MΩ
	2 V	1mV	±0.5% rdg ± 1 dgt	approx 12MΩ
	20 V	10mV		approx 11MΩ
	200 V	0.1V		
	1000 V	1V	±1.0% rdg ± 1 dgt	
AC V	2 V	1mV	±1.0% rdg ± 4 dgt	approx 11MΩ 40Hz – 500Hz
			±2.0% rdg ± 4 dgt	500Hz – 1kHz
	20 V	10mV	±1.0% rdg ± 4 dgt	approx 11MΩ 40Hz – 1kHz
			±2.0% rdg ± 4 dgt	1kHz – 5kHz
	200 V	0.1V	±1.0 rdg ± 4 dgt	40Hz – 1kHz
			±2.0 rdg ± 4 dgt	1kHz – 5kHz
	750 V	1V	±1.0 rdg ± 4 dgt	40Hz – 500Hz
			±2.0 rdg ± 4 dgt	500Hz – 1kHz
OHMS	200 Ω	0.1Ω	±0.7 rdg ±2 dgt	Open terminal voltage 0.45V >
	2 kΩ	1Ω		
	20 kΩ	10Ω		

	Range	Resolution	Accuracy	Notes
OHMS	200 kΩ	100Ω	±0.7% rdg ± 2 dgt	Open terminal voltage 0.45V >
	2000 kΩ	1kΩ	±1.0% rdg ± 2 dgt	
	20 MΩ	10kΩ	±2.0% rdg ± [illegible] dgt	
DC A	20 µA	10nA	±1.0% rdg ± 1 dgt	Int. resistance approx 10kΩ
	200 µA	100nA		1kΩ
	20 mA	10µA		10Ω
	200 mA	100µA		1Ω
	10 A	10mA	±1.2% rdg ± 1 dgt	< 15mΩ
AC A	20 µA	10nA	±1.5% rdg ± 4 dgt	approx 10kΩ 40 – 500Hz
	200 µA	100nA	±1.2% rdg ± 4 dgt	± 1kΩ 40 – 1kHz
	20 mA	10µA		10Ω
	200 mA	100µA		1Ω
	10 A	10mA	±1.5% rdg ± 4 dgt	< 15mΩ 40 – 500Hz

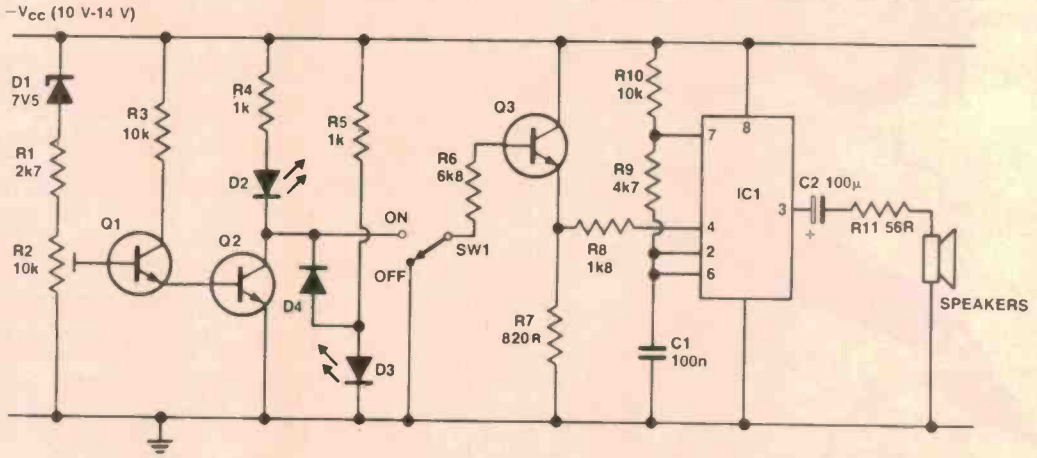
Models:
Protected up to AC 250V . 3200, 3200-01 (With carrying case)
Protected up to AC 600V . 3200-50, 3200-51 (With carrying case)

General Specifications
Display: 3 [illegible] digit LCD maximum reading of 1999, autopolarity, unit and other annunciators
Ranging: Auto and manual
Overrange Indicator: 1 in MSD column blinks, audible tone. No tone for Ohms, no indicator or audible tone for DC 1000V, AC 750V, 10A
Battery Low Indicator: BATT mark lights
Sampling Rate: 2 per second
Continuity Test & Diode Test
Environmental Conditions: Operating: 0-40°C < 80 RH (No condensation)

Maximum Allowable Input: Volts DC 1100V or DC + AC peak. Ω, µA, mA Only ⊣▶⊢ AC 600V max. 1A fuse. 10A range No protection
Power Source: Two size AA (SUM 3) batteries. Life 500 hours (continuous use)
Dimensions: 160H × 85W × 32.5D (mm), 310g
Accessories: Test Leads, Fuse 3200-50 0.5A 1A. 9145 Carrying case supplied
Option: 9018 HV probe

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.

D1	7V5 400 mW Zener
D2	green LED
D3	red LED
D4	1N914
Q1, 2, 3	BC108
IC1	555 timer
SW1	SPDT toggle

'IDEA OF THE MONTH' CONTEST

PRIZE WORTH $90!

COUPON

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

"I agree to the above terms and grant *Electronics Today International* all rights to publish my idea in ETI Magazine or other publications produced by it. I declare that the attached idea is my own original material, that it has not previously been published and that its publication does not violate any other copyright."*

* Breach of copyright is now a criminal offence.

Title of idea .....

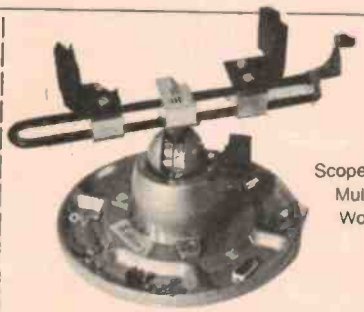
Signature .....

Name .....

Date .....

Address .....

..... **Postcode** .....



Scope Panavise Multi-Purpose Work Centre.

Scope Laboratories, which manufactures and distributes soldering irons and accessory tools, is sponsoring this contest with a prize given away every month for the best item submitted for publication in the 'Ideas for Experimenters' column — one of the most consistently popular features in ETI Magazine. Each month, we will be giving away a Scope Panavise Multi-Purpose Work Centre, Model 376/300/312, comprising a self-centering head (376), standard base (300) and tray base mount (312), all worth about $90! Selections will be made at the sole discretion of the editorial staff of ETI Magazine. Apart from the prize, each winner will be paid $10 for the item published. You must submit original ideas of circuits which have not previously been published. You may send as many entries as you wish.

RULES

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

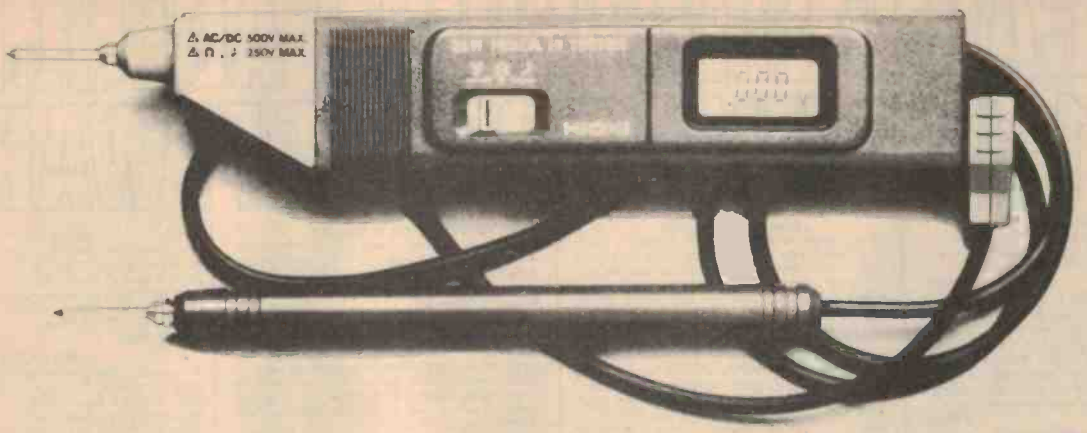
Closing date for each issue is the last day of the month. Entries received within seven days of that date will be accepted if postmarked prior to and including the date of the last day of the month.

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.



CURRENT TECHNOLOGY

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 trouble shooting 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.

Specifications

Display: 3 ½-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. Ω/Cnty., 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

(Specified for 23°C ± 5°C, <80% RH)

	Range	Resolution	Accuracy	Notes
DC V	2V	1mV	±0.5%rdg ± 4dgt	Input resistance approx. 12MΩ approx. 11MΩ
	20V	10mV	±0.7%rdg ± 4dgt	
	200V	0.1V		
	500V	1V	±1.0%rdg ± 4dgt	
AC V	2V	1mV	±1.0%rdg ± 8dgt	Input resistance approx. 12MΩ (40Hz to 500Hz) approx. 11MΩ
	20V	10mV		
	200V	0.1V		
	500V	1V		
OHMS	2kΩ	1Ω	±0.7%rdg ± 4dgt	Open terminal voltage < 0.45V
	20kΩ	10Ω		
	200kΩ	100Ω		
	2000kΩ	1kΩ	±1.2%rdg ± 4dgt	
Continuity Test				Open terminal voltage 1.5V (approx.)

HIOKI

NILSEN ROWE

Registered office: 200 Berkeley St., Carlton, Vic, 3053.

I enclose cheque/postal note for $78 or debit my Bankcard account number.

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., P.O. Box 349, North Melbourne, Vic. 3051.

Please send me further information ☐ a Hioki 3211 Pen – DMM ☐

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KEPLERS LAWS
A simulation of planetary orbits, producing data for analysis by students of the laws of Periods, Ellipses and Areas. Year 11/12 Physics.
Cat. XE-6900 $14.95

GRAPHIC LIFE
Life is "played" on a two dimesional grid of squares, so that every square has eight neighbouring squares or cells. Each cell is either alive or dead and each cell lives or dies depending on its neighbour cells. A dead cell with three live neighbours will be brought to life in the next generation. A very intrigueing experimenters tool kit.
Cat. XE-6905 $14.95

MILLIKAN'S EXPERIMENT
In 1910 Millikan deduced the charge of an electron. Side A is a simulation in HIRES graphics of the experiment. Side B contains a tutorial on Millikan and his experiment and students must answer questions as they work through. Year 11/12 Physics.
Cat. XE-6910 $14.95

DISASSEMBLER By Dreamcards
Some may say "Not another Disassembler". But this one has a difference. It allows you to set out where the data fields are so the computer is saving time, not rying to disassemble data. A program you shouldn't be without.
Cat. XE-6915 $15.00

CHEAPIE By Dreamcards
Two top quality programs for the price of one. The best Hangman we've seen yet on side A and a superb version of Battleship on side B. Both have excellent graphics.
Cat. XE-6920 $15.00

CANNIBALS AND MISSIONARIES
The old logic problem game of transferring 3 Cannibals and 3 Missionaries from one side of a river to the other in a boat that holds two. If there are more Cannibals than Missionaries on either side at any time the Cannibals revert to their favourite form of feeding.
Cat. XE-6925 $14.95

COMPOSER BEE
This is a very well written program for music. This program allows you to compose, play, edit, transpose as well as being able to load and save your music. A program that has been a long time in the writing and well worth buying.
Cat. XE-6930 $22.50

WORD ADVENTURE
A program with very good graphics using little characters to entice the user to think what word is either a synonym, antonym or homonym of the word they are showing. Everytime you get it wrong you are given more clues. After the clues run out you must face the Dragon when you must spell the word he is holding correctly before you.
Cat. XE-6935 $14.95

PONTOON
A quality fast moving card game where up to 6 players can play against the computer who is banker.
Cat. XE-6940 $14.95

WORD PROCESSOR – MYTEK
Mytek Wordprocessor comes with a quality ring binder and features most of the commands of the highly acclaimed SPELLBINDER. Mytek Wordprocessor is screen orientated and re-formats the screen to 32 lines, allowing twice the amount of text to be displayed at once. Commands, which are all single keystrokes, included APPEND BACK, CLOSE, DELETE, EDIT, FORWARD, HOLD, INSERT, KILL, LINE LENGTH, MEMORY, OPEN, PRINT, READ, SEARCH/REPLACE TOP, UNHOLD, VERIFY, WRITE and EXIT.
Mytek Wordprocessor is not a plaything. Although simple to use, it is one of the most powerful cassette based wordprocessors currently available on any microcomputer.
Cat. XE-7015 $50.00

MUSIC – B – MYTEK
MusicB is a music Composer/Editor that lets you create and save music and sound effects with a flexibility that makes chopsticks of the Basic PLAY command. MusicB is a great way to learn and play music! Comprehensive instructions are included.
Cat. XE-7010 $20.00

TRSBEE – MYTEK
TRSBEE is a package of three programs that loads TRS-80 Model 1 and 3 program tapes into the MicroBee without any additional hardware. Although some program editing will still be required prior to their running, the majority of program typing time is saved by TRSBEE. The first program loads TRS-80 BASIC programs into MicroWorld BASIC. Most prgrams may then be edited and run. The second program in the package loads any TRS-80 machine code file into MicroBee memory. The third program loads TRS-80 assembler files into the MicroBee EDITOR/ASSEMBLER. Any TRS-80 Model 1 or 3 tape may be loaded. TRSBEE opens up a whole new world of possible software on your MicroBee!
Cat. XE-7005 $30.00

STOCK SUPERVISOR
This program is the means of creating a stock or product data base which provides an on-line information system. This system is then capable of being continuously and easily updated to reflect all the inventory and accounting aspects of stock on hand.
Cat. XE-6865 $15.95

HOUSEHOLD REGISTER
This program will simplify the task of determing the value of your home's contents for insurance purposes, as well as providing descriptions of all listed items in the event of their loss or destruction. Effects are catalogued by name, description and value. Nine separate rooms are provided, and up to 28 items may be listed in each.
Cat. XE-7000 $15.95

STAT PACK – STATISTICS
This program is a general purpose graph plotting, linear regression, line of best fit and correlation program. It features a t-test of significance for the correlation coefficient and, if no evidence of correlation is found, a determination of minimum sample size is performed.
Cat. XE-6999 $14.95

LOG – GENERAL PURPOSE INDEX
This program is designed to suit a wide range of records where indexing (and later searching) can be on one or two words, or on a string of up to 15 characters. Each record consists of its index heading, plus up to 12 lines of text. Each line can contain up to 41 characters.
Cat. XE-6890 $15.95

PROGRAMMING HINTS
Consists of a collection of modules which you may use to improve your own BASIC programs. They are all linked together under a menu driven display which allows you to RUN or LIST each module to see how they work.
Cat. XE-6895 $14.95

PROSPECTOR
Arcade game in which you are the prospector attempting to get gold and diamonds which are scattered around the field, and at the same time avoid two drunken bandits who are chasing you.
Cat. XE-6885 $14.95

BASIC TUTORIAL
Is a super teaching aid for any classroom. Basic Tutorial is a set of 9 interactive exercises designed for teaching Basic to the computer novice. No previous knowledge is assumed. Basic Tutorial uses a unique double screen technique to display both the normal computer output and the tutorial exercises at the one time. This allows the student to use the MicroBee in the normal way, while the tutorial instructions appear in the lower half of the screen.
Cat. XE-6860 $20.00

MACHINE CODE TUTORIAL – MYTEK
Consists of 8 interactive exercises designed for teaching machine code programming and related topics as they apply to the MicroBee computer. Only a general knowledge of the BASIC language is assumed. Machine Code Tutorial is designed to bridge the gap bewteen BASIC programming and being able to understand and use typical Z80 manuals.
Cat. XE-6855 $25.00

BUDGET – SPREADSHEET
This program is designed to speed up and simplify the task of framing a usable financial budget. Applications range from personal or household to small business finances. A quality program.
Cat. XE-6850 $15.95

SEADOG
Seadog a war game between two ships from the days of Nelson. You may play against a friend, or against the computer. The game features limited resolution graphics for the war battle sequences. As well as the enemy fleet, you must survive hazzards such as hurricanes, diseases, and your own gun almers who do not always shoot straight!
Cat. XE-6845 $14.95

DECODE
Basic decoder and listing formatter
This programme will be an invaluable aid to any one taking first steps in understanding machine code or wants to expand their library of proven machine code routines. Decode will (a) print imbedded machine code routines fully and accurately (b) print all unprintable characters (c) provide a clearer, easier to read listing and send all output to a printer if so required. ED ASM is not required.
Cat. XE-6765 $15.95

CARDEX – CARD INDEX SYSTEM
This program simulates the card index systems of yesteryear in that it neatly files a series of records, and the user can leaf through the file inspecting each record one by one.
Cat. XE-6755 $9.95

FILEX
Filex is a larger version of Cardex, but handles larger amounts of data, and also is easier to find "the cards".
Cat. XE-6760 $14.95

FINANCIAL MANAGER
Provides an accurate and clearly formatted record of any financial account, and a cost analysis stated in money amounts and percentages – Personal Account Monitor and Business Account Analyst.
Cat. XE-6750 $15.95

TEXTED
This program helps to produce a neatly formatted document of word processor appearance, with an absolute minimum of fuss on the user's part. It is the logical alternative when a high powered (and high priced) word processor is not warranted and/or not justified.
Cat. XE-6745 $14.95

DATABEE
This program is a well written data base management system that utilised the MicroBee to its fullest to provide a Data Management System similar to those found on larger and more expensive systems. This comes complete with large bound manual.
Cat. XE-6945 $19.95

TEACHERS MASTER TAPE
This tape allows the user to enter 20 words for a spelling list. These words are then at a later stage displayed back on the screen in clear graphics with four options of speed and display time. It makes a very useful program.
Cat. XE-6985 $21.50

FRACTIONS AND DECIMALS
Side one of the tape goes through a graphic tutorial of what fractions are and what they look like. Side two explains what equivalent fractions are and also introduces decimals to two decimal places. A well written tape which uses graphics to its fullest to teach the principles.
Cat. XE-6980 $16.95

NUMBER HANGMAN
A graphic game which helps improve times in solving mathematical questions. You must answer the question before the hangman has time to hang himself. Optional times and difficulty are available making it suitable for everyone.
Cat. XE-6990 $13.50

MEASUREMENT
This tape starts from scratch and defines the unit of measurement and what its other equivalents are. It gives exercises converting measures small and large to the standard metre. It continues on to show perimeters, length and area and giving various exercises on the way. Another program that uses graphics to prove a point.
Cat. XE-6998 $13.50

MULTIPLICATION TABLES
This program is directed more at operation rather than age or grade. It uses graphics to enhance the display and optional time limits and difficulty to bring anyones multiplication tables up to scratch.
Cat. XE-6975 $10.95

ALGEBRA 1
This program introduces the uses of pronumerals as theoretical numbers with simple problems. Simple algebraic equations are treated showing collection of like terms, etc. It then gives exercises to try to further push the principles of algebra.
Cat. XE-6995 $13.50

ASTEROIDS PLUS – MYTEK
Asteroids Plus is one of the finest high resolution graphic arcade games available for the MicroBee computer. It features 3-D point by point resolution graphics, shields, sound effects, intelligent objects, guided missiles, black holes and a score board. If you enjoy playing computer games, you will be captivated by Asteroids Plus.
Cat. XE-6297 $22.50

BEEZ 80 – MYTEK
This secret code disassembler will disassemble any code sequence. Nothing is illegal. It will allow you to program with codes that no other disassembler can decipher!
Cat. XE-6298 $20.00

SPACE INVADERS
One of the most popular programmes ever released. This version was written especially for the MicroBee.
Cat. XE-6030 $14.95

SCREEN DUMP
This tape comes with two programmes and can be used on both parallel and serial printers such as Star, FX80, Epson and other compatible types.
Side A Horizontal Dump executed from net command.
Side B Vertical Dump executed from CTRL P command.
Cat. XE-6970 $14.95

FORTH
A new language for the MicroBee. Comes complete with Interpreter on one side of the tape and supporting programs on the other side. As well as this it includes a very well written, bound manual.
Cat. XE-6965 $45.00

MINE DROP
You are a tank running around a maze gathering all the supplies you can. It sounds easy, but you have a guided missile hot on your trail. Your only defence is a remote controlled mine which you drop and explode at will. A very fast joystick or key controlled game.
Cat. XE-6960 $14.95

PENETRATOR
A low resolution graphic version of the popular game "Scrambler". You must defeat the rockets and bomb the radars 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 Lores graphics it is a very fast game. If you are bored with the same land pattern you can devise your own.
Cat. XE-6955 $19.95

SPACE PATROL
A lot like Penetrator but in high resolution graphics. You must battle your way through the various stages where at the last stage you have four chances of blowing up a neutron bomb shelter. If you are successful, the next round is a lot harder.
Cat. XE-6950 $16.95

METEOR RESCUE – MYTEK
Your mission is to rescue stranded 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, to land safely on a landing pad. An astronaut will then run to your landing module and you will blast off. You must use your lasers if necessary and dock with the mother ship again. A total of six astronauts must be shuffled to the mother ship.
Cat. XE-7020 $17.50

CORVILLE CASTLE
Corville Castle is an adventure which will take you to a far away place of mystic castles, fierce monsters and evil warlocks. You must enter the warlocks castle and find some dark secret which will help you to destroy the warlock. But remember, you only have until dusk.
Cat. XE-6285 $16.95

CARACE
A fast exciting graphic game for the MicroBee. You must weave your way through a field of cars and oil slicks to produce the highest score. If you're too good at one speed then try the next (10 speeds to choose from!)
Cat. XE-6700 $11.95

EYE OF MIN (32K)
An adventure game with a difference in that it gives you a picture of where you are. Once you enter the castle you are given a floor plan making it easier than moving in the dark. A very thrilling adventure game.
Cat. XE-7025 $14.95

MORSE CODE TUTOR
Perfect for all you budding young amateurs. Quality program which covers the full alphabet, random letters, and allows you to enter a sentence in English and plays it back in morse, plus more.
Cat. XE-6880 $14.95

PSYCHOTEC By Dreamcards
Psychotec provides a striking example of artificial intelligence, allowing a dialogue in English between computer and operator, the computer playing the role of psychiatrist and the operator being a "patient" on the couch. Leaves other "similar" types for dead.
Cat. XE-6875 $15.95

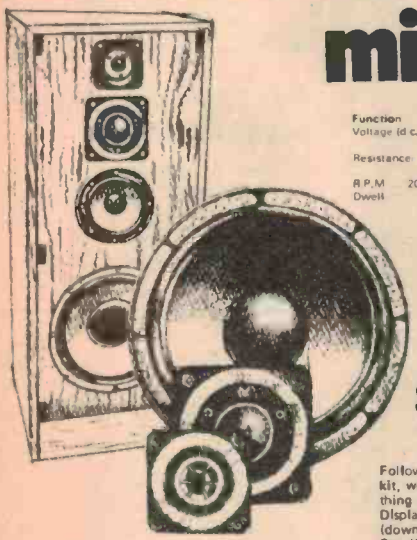
MERLIN By Dreamcards
Merlin is a 32K adventure set in England during the dark ages. Your task is to search through the dark forest inhabited by robbers, outlaws and creatures with awesome magic powers to find a legendary sword. An excellent adventure.
Cat. XE-6870 $25.00

YAHTZE
The famous old addictive dice game. Try to beat your own best score. Up to 3 players.
Cat. XE-6866 $14.95

UNDERWORLD OF KYN
Underworld of Kyn is an advanced adventure, average playing time to complete the game is about 10 to 12 hours for this reason it is recommended for experienced adventurers.
Cat. XE-6840 $14.95

BACUP
A program to assist you in making back-up copies. Allows you to load in a file loaded at 300 baud and save it again at 200 baud or 1200 baud.
Cat. XE-6780 $11.95

MORE OF THE BEST



minitune

Specification

Function	F.S.D.	Resolution	Accuracy
Voltage (d.c.)	20V	10mV	0.5% ± 1 digit
	200V	100mV	0.5% ± 1 digit
Resistance	200Ω	100mΩ	0.5% ± 1 digit
	20kΩ	10Ω	0.5% ± 1 digit
R.P.M.	20,000 r.p.m.	10 r.p.m.	1% ± 3 digits
Dwell	90°	0.1°	2% ± 3 digits

FAR CHEAPER THAN DPM SEPARATELY

$42.95

Following the spectacular success of the DP2010 Digital Multimeter kit, we now have an ENGINE ANALYSER KIT! But the spectacular thing is the price! It is ACTUALLY CHEAPER than the DPM-05 Display and Case!! The Minitune will measure voltage, resistance (down to a very low range), RPM and Dwell Angle.
Cat. KJ-7012 $42.95
TEST LEADS TO SUIT ONLY $2.95

Ref: EA June 1983

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

build your own speakers & SAVE!

4000/1 4-way System
Cat. CE-2430
Speakers only $525
(set of 8 spkrs with x/overs) **$525**

4000/2 3-way System
Cat. CE-2440
Speakers only $397
(set of 6 spkrs with x/overs) **$397**

'Power UP'

Ref: EA 11/82

$39.50 NO ROOM FOR DETAILS

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 insert. The Jaycar kit is absolutely complete including a small dial spring which can be used to connect the PCB to the wall plate. (Beware of other kits that do not include this). In addition to the above, we supply the High Voltage Resistors ALREADY SOLDERED in as a foolproof safety feature!

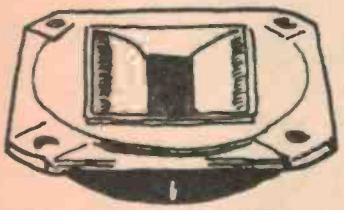
ETI15000 METAL DETECTOR

The Performance of a $500 metal detector for only $219! This is a fully discriminating VLF T/R instrument (yes! the same principle as those expensive American ones) with ground balance. Control facilities are comprehensive – including an 'auto tune' button. This kit includes all parts including a fully built search head and handle assembly and special meter and case.
Cat. KE-1460 $219.00

SEE ETI DEC 1980 and JAN/FEB 1981

SUPER SIREN new low price

Ref: EA November 1982
The complete kit including Piezo siren.
NORMALLY SELLS FOR $22.00
FOR NOVEMBER BUYERS
THE COMPLETE KIT – ONLY $14.95!!
Super Siren shortform
Cat. KA-1484 – ONLY $5.00
PH1038 or PH1005 Piezo to suit $9.95



RIBBON tweeter

Unique regular phase design drives the entire diaphragm, uniformly and completely in phase over the full frequency range. The performance of an electrostatic speaker with the ruggedness and ease of use of a dynamic.
Cat. CE-2042 NORMALLY $36.50 ea
NOVEMBER ONLY
ONLY $19.95 – SAVE $16.95

- 91dB sensitivity
- 50W system power
- 5,000-40,000Hz
- No voice coil

SAVE

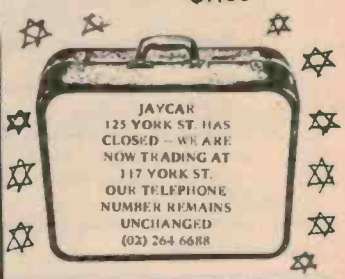
EQUIVALENT TO $500 units

$219

SAVE OVER $7.00

SPECIAL ANNOUCEMENT

JAYCAR IS PLEASED TO ANNOUNCE THAT WE NOW STOCK EVERY PC BOARD FOR EA AND ETI PROJECTS FOR THE LAST 5 YEARS IF YOU REQUIRE A BOARD FOR ANY PROJECT WITHIN THIS PERIOD SIMPLY CALL IN, WRITE OR PHONE – (02) 264 6688



Jaycar

Incorporating ELECTRONIC AGENCIES

SYDNEY SHOWROOMS
117 YORK STREET – PHONE: (02) 264 6688 and (02) 267 1614
TELEX: 72293
CARLINGFORD
Cnr. CARLINGFORD & PENNANT HILLS ROAD – PHONE: (02) 872 4444
CONCORD
115 – 117 PARRAMATTA ROAD – PHONE: (02) 745 3077
HURSTVILLE 121 FOREST ROAD – PHONE: (02) 570 7000

NUMBER 1 FOR KITS

POST AND PACKING CHARGES

$5 – $9.99 ($1.50)	$10 – $24.99 ($3.20)
$25 – $49.99 ($4.50)	$50 – $99.99 ($6.50)
$100 – $198 ($8.00)	Over $199 ($10)

"Free INSURANCE for Road & Registered Post over $200"
All heavy or bulky items (over 20kg.) sent Comet Road Freight $12.00 anywhere in Australia.
SHOP HOURS CARLINGFORD, CONCORD & HURSTVILLE
Mon – Fri 9am – 5.30pm: Sat – 9am – 12pm: Thurs night 8.30pm
SHOP HOURS SYDNEY
Mon – Fri 8.30am – 5.30pm. Sat – 8.30am – 12pm: Thurs night 8.30pm
MAIL ORDERS AND CORRESPONDENCE: BOX K 39 HAYMARKET, SYDNEY 2000

Mail Order By

BANKCARD Via Your Phone

SHOPAROUND

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 — inwatts line (008)99-9007 (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. Prints 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 TDA1024 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 (G.I.) 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.

ET-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 photo-resist 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 o refuse advertisements considered unsuitable.

• **Conditions:** Your name and address plus phone number (if required) must be included with the 24 words. Reasonable abbreviations, such as 25 W RMS or 240 Vac, count as one word. Advertisements must relate to electronics, audio, communications, computing, etc — general advertisements cannot be accepted.

Send your advertisement to: ETI Mini-Mart, P.O. Box 227, Waterloo NSW 2017.

AUDIO

FOR SALE: VIDEO tape, ½" Sony V32 (7" reel 2370 ft), new in sealed container, $7 each. Or little used in perfect condition, $4 each. G. Terei, 8 Wurth Pl, Chifley ACT 2606. (062)81-5091.

FOR SALE: VIDEO cartridge, Sanyo VC20C, new in sealed cartons, $8 each. G. Terei, 8 Wurth Pl, Chifley ACT 2606. (062)81-5091.

SELL: FERROGRAPH RTS2 audio test set. Test recorders and amplifiers, check drift, frequency response, distortion, wow and flutter, S/N ratio. VGC, $500. (07)265-1961.

COMMUNICATIONS

FOR SALE: NATIONAL DR-31 SW/MW/FM receiver, only 16 months old. Bargain at $240. John (03)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. H-P 680D signal generator 10-480 MHz, recently calibrated, $400. T. Collins, 32 Elanora Rd, Armadale WA. (09)399-3418.

FOR SALE: PRINTER for TRS80-PC1 and Sharp PC1211 pocket computer. All the accessories included, $95. Frank Rees, 27 King St, Boort Vic. 3537.

MICROBEE: 32K, EDASM, Wordbee, Ritron monitor, Sharp cassette player. Heaps of games, etc, on tape, $650 ono. Andy Hardy (045)70-2184 bh.

LINE PRINTER: General Electric Terminett 300. Standard RS232, 30 cps, quality printing, 120 character width, pin feed, excellent condition, robust, $350 ono. (046)26-5713.

VIC-20 COMPUTER: Excellent condition, hardly used, includes all connecting cables, bargain price, $250. (08)31-0310 ah.

FOR SALE: MICROACE computer. Leads, manual, newsletters, power supply, modulator and direct video. Many programs, 2K RAM, 4K ROM, details for expansion, $130 ono. (07)209-7841.

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, 1.2 A power pack, tapes etc. Also 16K RAM pack, $80. Many constructional projects. Write to F. Papadopoulos, 13 Kroombit St, Dulwich Hill NSW 2203.

WANTED: TOSHIBA 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)578-9124 ah.

FOR SALE: SHARP PC-1500 mini-micro with 8K module, printer, cassette interface, spare pens, paper, software, $500. M. Ingall, 42 Shaw St, Mortlake Vic. 3272. (055)99-2056.

SELL: COMMODORE CBM 4032 (Fat Forty) computer with Programmer's Toolkit in ROM, $850. Also CMB/PET to IEEE cable, $45. (02)85-5433.

WANTED: INFORMATION or an address for the Apple User's Group. John Caine, 178 Avoca Drive, Green Point NSW 2250. (043)69-1052.

FOR SALE: 8" floppy disk drive, single sided. No controller, box or power supply.Ex IBM370 Microcode loader, $150 ono. Stever (03)573-2266 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. Kenshaw, 4/141 Hotham St, Saint Kilda East Vic. 3183.

MISCELLANEOUS

WANTED: TALKING ELECTRONICS Nos 3, 6, 7, 8 and 9. Will buy or swap magazines for same. Sell DX160 speaker, $10. 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.

WANTED: COPY of circuit diagram plus any additional information for an AWA Radiola model 715CZ valve radio. Will pay good price. G. Brooker (049)63-4469.

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

SPECIALS TILL END OF NOV. 30th

IT'S TIME TO BE SECURITY CONSCIOUS

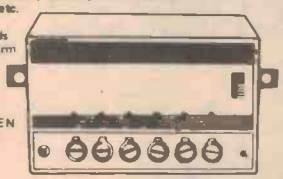
Magnetic reed switch — screw mount
Complete with screws

	1-9	10+
S15055	2.95	2.75

ALARM CONTROL MODULE

Ideal for home, business and factory/warehouse. Control module allows soundless entry and exit. Automatic alarm re-set, 12VDC operation, both normally open for heat, smoke, vibration and normally closed for, doors, windows etc.

- Exit delay approximately 20 seconds
- 10 second closed circuit delayed alarm
- Instant alarm for open circuit
- Auto re-set
- Power 12VDC
- Current drain 2mA system armed



USE WITH OUR SIREN SPEAKER C12012
AT $14.95

GREAT ATTENTION GETTER

Strobe flash — variable flash rate
Ideal for parties — Disco dancing etc.

240V 50Hz — flash rate from 0-12 per second (Improved model)

Both these units are great for shop displays, emergency situations, attention and stock promotions.

SEALED LEAD ACID BATTERY

Re-chargeable gell type sealed battery system. Many applications e.g. alarm systems, emergency lighting, video cameras, portable TV sets etc., etc.

Features — ABS plastic case
Minimum self discharge
Fully sealed & leak proof
Long service life

Specifications

Nominal Voltage	12Volts
Capacity	20 hour rate: 1.2AH
Discharge Current	20 hour rate: 60mA
Charging Current/Time	120mA/10 - 14 hours
Size	100(L) x 45(W) x 53(H)mm
Weight	600 grams

	1-9	10+
S15059	$19.95	$18.50

S150059 $29.50

NICADS

	1-9	10+	
AA	S15020	$1.85	$1.65
C	S15021	$5.95	$5.50
D	S15022	$6.95	$6.10

A15040 $39.50
HOW IS THIS LITTLE BEAUTY

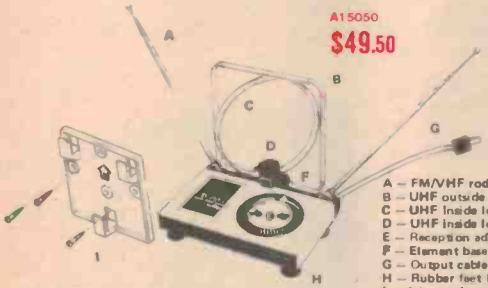
Strobe flash — DC 12V — magnetic base
Complete with 4 metre cable and cigarette lighter plug — flash rate about 120 per minute
Available in Orange, Blue, Red.

	1-9	10+
A15045	$27.50	$23.50

THE ULTIMATE INDOOR ANTENNA

The ultimate indoor antenna — built-in mixer for UHF/VHF/FM — wide frequency band from 40MHz to 890MHz — directional fine tuning possible with variable direction inner loop — easy to mount and will even hang on the wall — 75 ohm impedance with coaxial cable and plug.

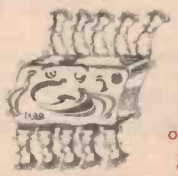
A15050
$49.50



A — FM/VHF rod antenna
B — UHF outside loop element (fixed)
C — UHF inside loop element (45 degree rotating)
D — UHF inside loop direction tuner
E — Reception adjust tuner (12 positions)
F — Element base with 5 position angle adjust
G — Output cable
H — Rubber feet (4 pcs)
I — Adaptor for wall hanging

CD-424 14 BIT P.C.M. HIGH RESOLUTION DIGITAL DELAY

* Pro quality with high signal to noise ratio and wider frequency response * Long delay time from 0 to 1,024mm/s * 8 step sub-delay preset from 5/- 764mm/s * superb combination effect with main and sub-delay * 2 inputs and 3 output levels * Low/High equalizer for sound variation



A15020
OUR PRICE
$779

SPECIFICATIONS

- PCM
  14-bit
- MEMORY
  16K byte
- DELAY TIME
  (main delay) 0-1,024mm/s(1mm/s pitch)
  (sub delay) (A) 50 101 203 308mm/s
  (B) 124 252 508 764mm/s
  * (A) when main delay is less than 308mm/s
  (B) when main delay is more than 408mm/s
  (A) and (B) is changed automatically according with MAIN DELAY time
- CONTROLS
  Input level control, Equalizer(HI/LO) controls
  Delay level control, Feed back control
  Digital delay (UP/DOWN/FAST) push buttons
  Input level selector switch (-20/-40dB)
  Output level selector switch (0/-20/-40dB)
  Main/sub delay selector switch
  Sub delay preset control
  Foot switch jacks for FEED BACK & DELAY TIME
- FREQUENCY RESPONSE
  20Hz - 20KHz ± 1dB (Direct)
  20Hz - 15KHz ± 3dB (0 - 399mm/s)
  20Hz/-6.7KHz ± 3dB (400-1,024mm/s)
- S/N RATIO(IHF-A)
  80dB
- THD
  0.1% max

Video library storage case — looks just like hard cover book — with identification card pouch

		1-9	10+
A15035	BETA	$2.75	$2.25
A15036	VHS	$2.95	$2.35

RING AND ASK LOU BLASCO HOW GOOD THEY ARE.

CX-230 ELECTRONIC CROSSOVER

* 2-way electronic crossover in stereo * 3-way electronic crossover in mono * 8 steps dividing points from 250Hz to 6KHz * Rack mountable compact dimensions (19") * Convenient 2-way input jacks of balanced (50K ohms) and unbalanced (25K ohms)

SPECIFICATIONS

- INPUT LEVEL
  Max 7V RMS (+19dB)
- OUTPUT LEVEL
  Max 7V RMS (+19dB into 10K Ω load)
- CONTROLS (CH1 & 2)
  Cross over control range 250Hz - 6KHz (8 step)
  High frequency cross over 12dB/oct. bessel filter -4dB at cross over point
  Low frequency cross over (drived from high frequency input) -1.5dB at cross over
  Max high low frequency gain +10dB
  Phase switch
- CONNECTIONS (CH1 & 2)
  Input jacks (6.34φ) Balanced (60K Ω)
  Unbalanced (30K Ω)
  Output jacks (6.34φ) High frequency out (300Ω Balanced)
  Low frequency out (300Ω Balanced)

A15030
Our Price
$249

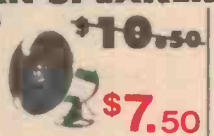
SINCLAIR SPECTRUM IS HERE

sinclair ZX Spectrum $279 PERSONAL COMPUTER
Full range of software in stock.

DIRECT IMPORT PRICES SLASHED FOR THIS MONTH ONLY

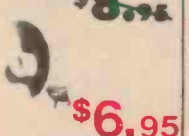
HORN SPEAKERS

C12015 ~~$10.50~~ $7.50



5" Aluminium Material Horn Speaker 8 ohm Freq. Range 600-5000Hz Max Power 8 W

C12010 ~~$8.95~~ $6.95



5" A B S Material Horn Speaker 8 ohm Freq. Range 600—5000Hz Max Power 8 W

C12012 ~~$18.95~~ $14.95

5" Siren Horn (Aluminium) 8 ohm Freq. Range 600—5000Hz Max Power 10 W Rated Voltage 12 VDC

WE ARE SITUATED AT TWO CONVENIENT LOCATIONS:

CITY STORE: 48-50 A'BECKETT STREET, MELBOURNE. (03) 347 9251
425 HIGH STREET, NORTHCOTE, 3070 (03) 489 8866, (03) 489 8131

Mail Order min. P&P $2.00. Please send to P.O. Box 235, Northcote 3070.
Mail Order Hotline (03) 481 1436. Wholesale Enquiries (03) 489 7099.

NEW PRODUCTS NEW PRODUCTS NEW PRODUCTS NEW PRODUCTS NEW PRODUCTS NEW PRODUCTS NEW PRODUCTS NEW PRODUCTS NEW PRODUCTS NEW PRODUCTS

BANKCARD HOLDERS – PHONE YOUR ORDERS TOLL FREE!

AUSTWIDE

NEXT DAY DELIVERY

ALTRONICS 008-999-007

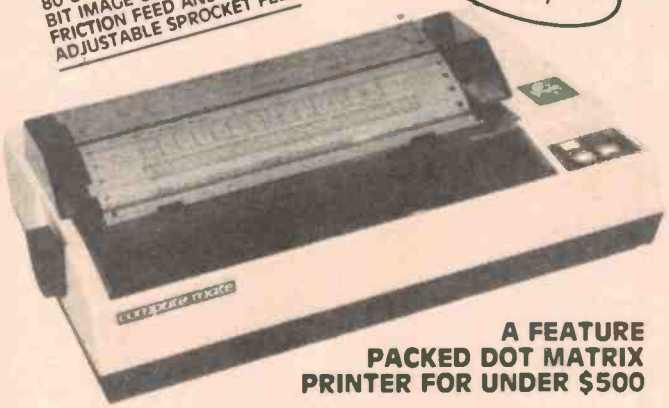
VIA JETSERVICE
(CAPITAL CITY & SUBURBAN AREAS)

ALTRONICS • BANKCARD JETSERVICE DELIVERY NEXT DAY • ALTRONICS • BANKCARD JETSERVICE DELIVERY NEXT DAY • ALTRONICS

MICRON SUPER 80

80 CPS : 80 COLS
BIT IMAGE GRAPHICS
FRICTION FEED AND
ADJUSTABLE SPROCKET FEED

MADE IN JAPAN QUALITY

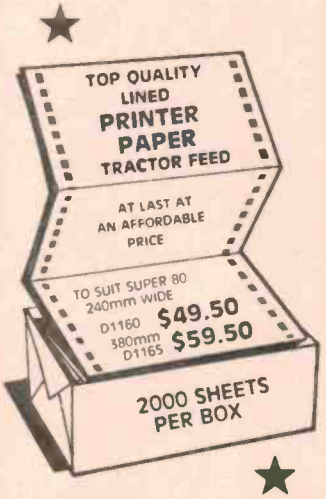


A FEATURE PACKED DOT MATRIX PRINTER FOR UNDER $500

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 software control from any general purpose micro-computer the Super 80 features **13 different print types** including emphasized (LETTER QUALITY). **Bidirectional print action** ensures **smooth, quiet operation.**

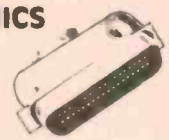
228 ASCII Characters, Handles **4" to 10" Paper**
STANDARD CENTRONICS INTERFACE

VALUE PACKED AT D1174..... **$499.50**
INTERFACE CABLE TO SUIT MICROBEE 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 **MICROBEE USER,** have a look at our **INTERFACE KITS** on the opposing page.

UK MADE, GOLD PLATED
D RANGE CONNECTORS
SAVE 25% ON BULK QUANTITIES!

		ea.	10 +	25 +
P 0880 DB9 Male 9 Pin		2.50	2.20	1.95
P 0881 DB9 Female 9 Pin		2.85	2.70	2.50
P 0885 DB9 Backshell		2.85	2.50	2.30
P 0890 DB15 Male 15 Pin		2.95	2.50	2.29
P 0891 DB15 Female 15 Pin		3.50	3.00	2.80
P 0895 DB15 Backshell		2.85	2.50	2.30
P 0900 DB25 Male 25 Pin		4.50	3.95	3.60
P 0901 DB25 Female 25 Pin		4.95	4.50	3.98
P 0905 DB25 Backshell		2.85	2.50	2.30

SOFTWARE

JUST PHONE OR WRITE & ASK
WE'LL SEND YOU OUR SOFTWARE CATALOGUE
HONEYSOFT • MYTEK • DREAMCARDS

SAVE LOAD AT 1200 BAUD EVERY TIME

Adjustable Azimuth DATA CASSETTE

At last a Data Cassette Recorder/Player you can afford. The Micron D 1120 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**

HIGH RESOLUTION

GREEN PHOSHOR MONITOR

12" SCREEN ★ 10-20 MHz BANDWIDTH
SCREEN INVERT ★ 240 VAC or 12 VDC OPERATION
12 vDC/1.1A Power your micor.

OVER 4,000 SOLD

One of the hassles of sitting there for countless hours operating your computer is eye strain (anyone who has just spent 10 hours solid will agree!!) well our fantastic new MICRON 12 High Resolution Green Phosphor Monitor has a 'reverse' or invert screen function where by simply rotating the contrast control anticlockwise 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

SCREEN FORMAT 64 x 16 OR 80 x 24 WHILE NETWORKING EG. USED AS A TERMINAL

The all new Microbee IC has got to be the most value packed ROM based 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 **zippy 3.375 MHZ** and over **$110** worth of software integrated in ROM i.e. the absolutely delightful **Wordbee** word processor package or **Editor Assembler** plus all the other exciting features that have made the Microbee famous

D1020.... 16K IC.... **$499.00**
D1035.... 32K IC.... **$599.00**

ARCADE GAMES, PERSONAL, BUSINESS AND EDUCATIONAL APPLICATIONS.

• FOR DESPATCH P&P CHARGES AND ADDRESS DETAILS PLEASE REFER TO OUR AD. ON PAGE 95 •

A SINGLE BOARD CP/M COMPUTER

"THE LITTLE BIG BOARD"

64K on board RAM, Z80A based running at 4mHz (Top speed) Floppy disk controller, Real time clock.

That's right! A fully configured Z80 computer running at maximum capacity, on a single **PCB. On board disk controller** drives up to four double sided, double density drives either 8" or 5¼". **2 by RS232 I/O Ports,** both may be software configured, use one for a terminal the other for a printer or modem etc. **Battery backed real time clock** software accessible for automatic dating of documents, timing during games. Fully **STD buss compatible** — choose from thousands of ready available plug in card options. **Bootstrap Monitor** on board — boots to **CP/M.** Choose from the world's **largest range of software.**

ALTRONIC KIT FEATURES

Two versions of the bootstrap monitor supplied. One set **for 1200 baud operation** enables connection to **MICROBEE 16 & 32K IC'S** utilizing their terminal emulation facilities. The other set for **9600 baud** operation.
Complete set of IC sockets.
Double sided plated through **PCB** — solder masked and pretinned.
56 Pin **STD** connector.
2 x **DB25P's** and ribbon cable for peripheral connections.
Quality components used throughout including solder and full documentation.

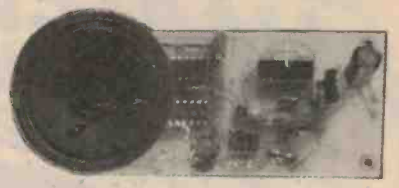
K9690
$499

CP/M Diskettes

8" 9600 Baud
K9691 $150
5¼" 9600 Baud
K9693 $150
8" 1200 Baud
K9692 $150
5¼" 1200 Baud
K9694 $150

COMPUMUSE

YOUR GAMES WILL NEVER BE THE SAME



A computer music synthesizer that is **easy to build** and **easy to use,** connects to any computer with a Centronics-style parallel port and provdes music over a five octave range and a wide variety of sound effects.

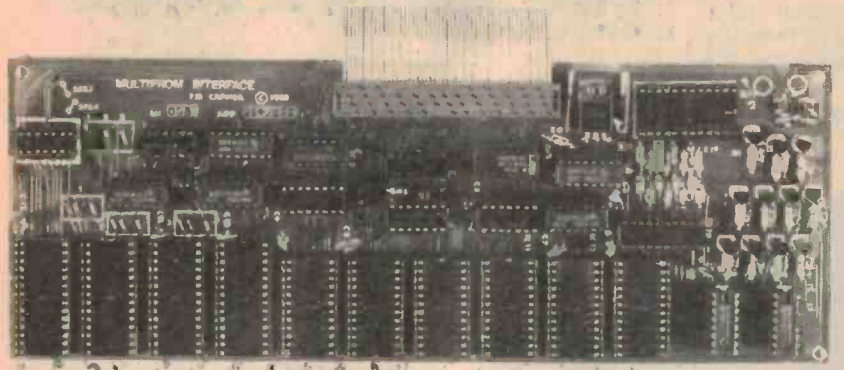
★ EXPERIMENTAL KIT - PCB, COMPONENTS & SOFTWARE.

K9834..... **$26.50**

MULTIPROM INTERFACE FOR THE MICROBEE

(ETI NOV. '83)

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 fitting of a 50 pin expansion socket. This project is easy to build and will allow you to store and software select up to 44K of eprom storage — acts like a mini disk drive system with the speed of RAM. Extra units may be added to further increase storage.

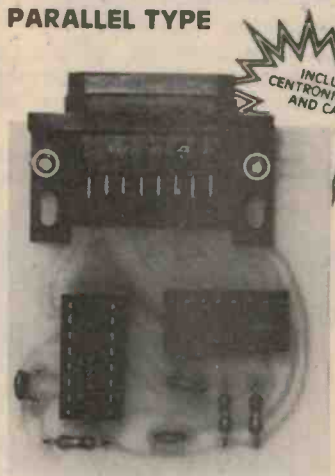
The Altronics kit comes complete in every way
★ Full set of IC sockets.
★ Double sided, plated through board.
★ Assembled connection lead to Microbee.
★ Fully documented.
★ Cassette monitor included (plus sourcefile).

THE MICROBEE KIT OF 1983

K9673..... **$99.50**

PRINTER INTERFACE KITS FOR THE MICROBEE

PARALLEL TYPE



BUILD YOUR OWN INTERFACE AND SAVE $$$

A simple kit to build — takes about 20 minutes, save on the cost of a built interface and save the cost of a serial printer.

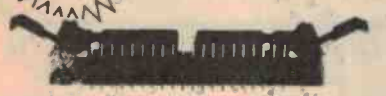
K9671..... **$29.95**

TTY TYPE

Teleprinters are cheap, so is this kit. If you've got an old Teleprinter this is for your.

K9672..... (Only)..... **$17.50**

PRICE BREAK-THROUGH



50 PIN EXPANSION SOCKETS

Right angle type to suit Microbee, floppy disk controllers etc.
Mounts on PCB and mates with IDC sockets.

D1196... **$8.50** EA... 10 +... **$7.50**

★ KIT SUPPORT FOR THE MICROBEE ★

EPROM PROGRAMMER

(ETI JAN. '83)

K9668..... **$55.00**

Versatile, low cost and easy to build. Plugs straight into the microbee I/O port. Suitable for 2716, 2732, 2532, 2732A and 2764 Eproms. Burn your games programmes and eliminate cassette loading time.

KIT FEATURES Sockets for all other IC's. 1 x 2716 supplied — get started straight away. Front Panel and Mains (SEC approved) transformer. 28 pin and 16 pin wire wrap sockets to flush mount personality plugs (2 included) and ZIF socket (included). DB15 Plug. Complete to last nut and bolt.

(See Review ETI AUGUST 1983)

RADIOTELETYPE DECODER

(ETI APRIL '83)

K9733..... **$19.50**

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

NEW

MICROBEE LIGHT PEN

(ETI AUGUST '83)

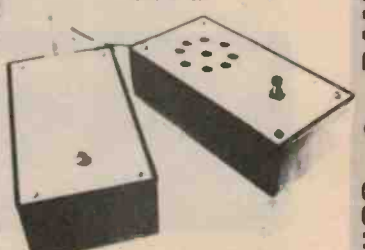
PROVIDES DIRECT PERSONAL CONTACT WITH YOUR BEE!

K9649..... **$19.95**

AT LAST — a light pen for the Bee. This pen works in the low-resolution graphics mode and connects directly to the I/O port. • Complete kit including DB15 2m CORD. • Fully documented with software example.

FAX-DECODER

(ETI SEPT. '83)



K9733..... **$24.50**

This project allows you to decode the signals of shortwave stations transmitting radio facsimile weather maps, satellite pictures etc. and then reproduce them on your dot matrix printer.

• Complete kit of parts includes DB15 Ribbon Cable.
• SOFTWARE LISTING

AMATEURS: CAN YOU MEET THE CHALLENGE!

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.

'HOME BREW' – the very latest technology . . . build yourself a UHF Transceiver

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 some 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!

Exclusive to Dick Smith Electronics

Unit shown is fitted with optional upgrade kit

SPECIFICATIONS	
Frequency Coverage	438.025-439.000MHz in 25kHz steps
No. of Channels	40
Mode of Operation	FM
Supply	13.8v DC. Receiver 340mA with full audio output and all options. Transmitter 2A more (5 watt output)
Receiver	Dual Conversion Superhet
Sensitivity	0.4uV for 20dB quieting
Selectivity	+/−7.5kHz - 6dB, +/−15kHz - 60dB
Adj. Chan. Reject	Better than 80dB
Transmitter	
Power Output	5W (typical)
Deviation	+/−5kHz
Spurious Emissions	Better than -60dB

GREAT VALUE!

DICK SMITH EXPLORER UHF TRANSCEIVER

ONLY $199

Cat K-6300

OPTIONS AVAILABLE:

Upgrade Kit (Cat K-6302) (Repeater, S meter, additional xtal filter & new front panel) **ONLY $24.50**

Antenna Kit (Cat D-4014) ¼ 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).

DSE/A616/LL

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 138 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.**

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.**

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.**

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.

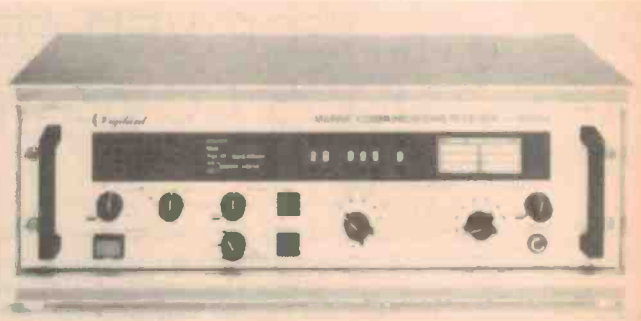
For those applications where slightly higher distortion levels can be tolerated, the unit is claimed to deliver more than 40 W from 1 MHz to 50 MHz and over 35 W to 500 MHz.

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 McKeon Road, Mitcham Vic. 3132. (03)873-3777.**

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. (Soldering iron NOT included).
Cat. TS-1510 $39.50

Horwood Instrument Cases

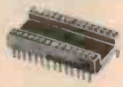
WE'VE GOT THE EDGE!

Quality Australian made cabinets. Aluminium and Marviplate construction with handles.

Cat. No	Description	1–9
HE-1452	84/6V 203(D) x 102(H) x 153(W)	$18.50
HE-1454	84/8V 203(D) x 102(H) x 203(W)	$20.00
HE-1457	84/10V 203(D) x 102(H) x 254(W)	$21.50
HE-1458	84/12V 203(D) x 102(H) x 305(W)	$23.00
HE-1459	84/17V 203(D) x 102(H) x 432(W)	$28.00
HE-1461	93/8V 228(D) x 76(H) x 150(W)	$16.50
HE-1462	93/8V 228(D) x 76(H) x 203(W)	$18.00
HE-1463	93/10V 228(D) x 76(H) x 254(W)	$19.50
HE-1467	93/12V 228(D) x 76(H) x 305(W)	$22.00
HE-1469	93/17V 228(D) x 76(H) x 432(W)	$25.50

NEW MACHINED PIN GOLD CONTACT IC SOCKETS. . .

Expensive. But the best for professional work. Each pin is machined out of solid material (not punched out of a flimsy sheet). High quality heavily gold plated inserts form 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 costs are a distinct possibility or where high reliability is essential.

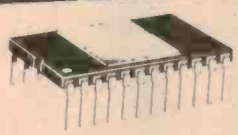


Amazing

Cat. No.	Description	1–9	10+
PI-6452	8 WAY SOCKET	$0.90	$0.84
PI-6454	14 WAY SOCKET	$1.15	$1.10
PI-6456	16 WAY SOCKET	$1.25	$1.15
PI-6458	18 WAY SOCKET	$1.45	$1.35
PI-6460	20 WAY SOCKET	$1.60	$1.50
PI-6462	22 WAY SOCKET	$1.75	$1.60
PI-6464	24 WAY SOCKET	$1.95	$1.80
PI-6466	28 WAY SOCKET	$2.25	$2.10
PI-6468	40 WAY SOCKET	$2.95	$2.75

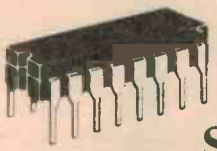
BACK IN STOCK! RIGHT ANGLE 'D' CONNECTORS

RIGHT ANGLE 'D' CONNECTORS
Now back in stock! P.C.B. mount 15 way.
Cannon DA15 R/A plug Cat. PP-2415 $8.95
Cannon DA15 R/A socket Cat. PS-4415 $8.95



$7.95 2708 EPROM

2708 EPROM FAIRCHILD PRIME SPEC – IN STOCK
What more can we say?
Cat. ZZ-8450 $7.95 each



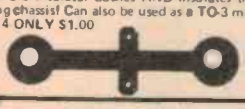
MN3001 BUCKET BRIGADE

This has been used in many projects lately and has been very hard to get. They are now available from us at a lower-than-normal price.
NORMALLY $22.50
NOVEMBER ONLY $19.50 each – Cat. ZK-8001

SLASHED $3

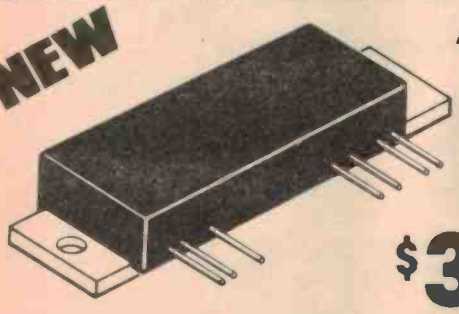
UNIQUE TO-3 BUSH ASSEMBLY NEW

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 stout emitter and base feed thru connections from the surrounding chassis! Can also be used as a TO-3 marking template!
PACK OF 4 ONLY $1.00



Only $1 for 4

NEW



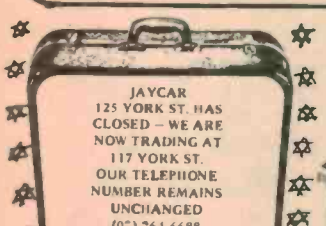
AMAZING PLEASE NOTE

$39.95

UHF AMPLIFIER SENSATION

MASSIVE SCOOP PURCHASE! MANUFACTURERS DISTRESS STOCK!
Jaycar has purchased a quantity of genuine Brand New MOTOROLA Brand MHW-710-1 UHF Power Amplifier modules. These units are designed for industrial and commercial FM transmitters!
The unit (pictured) is a rugged, tuned train of RF Power Amplifier transistors featuring thin-film gold metallization, laser trimmed Nichrome resistors and MOS capacitors. The MHW-710-1 bolts to any flat metal surface to assist heat dissipation.
SPECIFICATIONS:
– RF POWER OUT @ 12.5V 13 WATTS – RF POWER OUT @ 15V 17 WATTS!!
(BOTH OF THE ABOVE RATINGS ARE LIKELY TO BE EXCEEDED AS MOTOROLA'S POWER RATING CLAIMS ARE CONSERVATIVE)
– 19.4 dB (Min) POWER GAIN. TYPICAL DRIVE LEVEL TO FULL POWER 90 - 150mW
– FREQUENCY BAND 400 - 440MHz. Will work to 450MHz and therefore covers the AUSTRALIAN UHF AMATEUR BAND!!
CIRCUIT DIAGRAM INCLUDED
Each MHW-710-1 comes individually packed with full manufacturers data. A manufactufers recommended circuit is included (only a few external components required), as well as a PCB pattern for the circuit. This component makes an ideal base for a "Home Brew" UHF Linear Amplifier! GREAT for UHF Mobile!
SERVICEMEN
The MHW-710-1 has been used extensively in Australian Manufactured UHF Mobile 2-way radios. If you own or service a UHF radio that uses this part, now is your chance to grab a spare at an unrepeatable price! The MHW-710-1 sells for A$68 plus tax in the USA.
QUANTITIES STRICTLY LIMITED
To be fair to all, we have limited this offer to 2 per person. Jaycar's Scoop offers are so successful that usually hundreds miss out. Even at 2 per customer we will probably run out quickly. Be early to avoid disappointment!!

STAGGERING VALUE! ONLY $39.95!! – Cat. ZK-8882



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Cat. PI-6520 40 pin $6.95 – $6.25 10+

Incredible Value!

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Slimline 8" Disk Drive, Double Sided, Double Density, No AC Power required. 3ms track to track, 1.6 mbytes unformatted, 77 track/side, 10^9 bit soft error rate.
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M2894
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M4853
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UA7824UC	0.60
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MJ802	2.40
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BU126	1.40
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2N3772	2.50
2N3773	2.50
FND500	1.10
FND507	1.10
MAN74A	1.50
MAN72A	1.50
4N28	0.60
4N33	0.70
BDV64B	2.00
BDV65B	2.00
AD149	1.50
2SK134	3.80
2SJ49	3.80
W02	0.20
W04	0.25
IN5401	0.10
IN5404	0.12
BC547	0.05
BC548	0.05
BC549	0.05
C122D	0.65
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MEMORY SPECIALS

27C16 CMOS PROM	$9.50
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58725 2Kx8 RAM	$4.50
2716 500NS	$3.95
2732 450NS	$4.50
2764 250NS	$7.00
4164 150NS	$6.50
per 100 + @	$6.00
27128	$28.00 + tax
1771	$15.00
1791	$25.00
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Z80 CPU	$3.40

Z80A CPU	$3.60
Z80 CTC	$3.20
Z80A CTC	$3.95
Z80 P10	$2.90
Z80A P10	$3.40
Z80 S10	$8.00
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6800	$3.90
6802	$4.90
6809	$10.60
6821	$2.00
6840	$13.50
6845	$8.90
6850	$1.75
8212	$1.30
8216	$1.30
8224	$1.50
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4011	$0.14
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4066	$0.50
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8005	Black on Aluminium	300mm x 600mm	$10.00	$43.00 (5sh)
8009	Blue on Aluminium	250mm x 300mm	$ 5.50	$40.00 (10sh)
8009	Blue on Aluminium	300mm x 600mm	$10.00	$43.00 (5sh)
8007	Reversing Film	250mm x 300mm	$ 4.00	$22.50 (10sh)
8007	Reversing Film	300mm x 600mm	$ 8.50	$30.00 (5sh)
8011	Red on White Plastic	250mm x 300mm		$43.00 (10sh)
8013	Black on Yellow Plastic	250mm x 300mm		$43.00 (10sh)
8015	Black on White Plastic	250mm x 300mm		$43.00 (10sh)
8016	Blue on White Plastic	250mm x 300mm		$43.00 (10sh)
8018	Green on White Plastic	250mm x 300mm		$43.00 (10sh)
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8500	250ml Developer			$2.50 per bottle
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All prices plus Sales Tax. Dealer and Trade inquiries welcome.
Please note full range of products are available on order.
Please contact Tim Bray on (03) 489-7099 for further information.

10% off all Verbatim Disc prices for November
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			Per Box of 10
MD525-01	Single Sided, Double Density	soft sectored	43.00
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MD577-10	SSDD 10 Sectors 80 Tracks		57.00
MD577-16	SSDD 16 Sectors 80 Tracks		57.00
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MD557-16	DSDD 16 Sectors 80 Tracks		63.00

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FD32-1000	Single Sided, Single Density	hard sectored	43.00
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FD32-9000	SSDD Critically Certified		53.00
FD34-1000	Single Sided, Single Density	soft sectored	43.00
FD34-8000	Single Sided, Double Density		51.00
FD10-4008	Double Sided, Single Density		59.00
FD10-4015	Double Sided, Single Density		59.00
FD10-4026	Double Sided, Single Density		59.00
FF32-2000	SD FLIPPY FLOPPY		62.00
FF34-2000	SD FLIPPY FLOPPY		62.00
DD32-4000	Double Sided, Double Density	hard sectored	53.00
DD34-4001	Double Sided, Double Density		53.00
DD34-4008	Double Sided, Double Density		53.00
DD34-4015	Double Sided, Double Density		55.00
DD34-4026	Double Sided, Double Density		55.00

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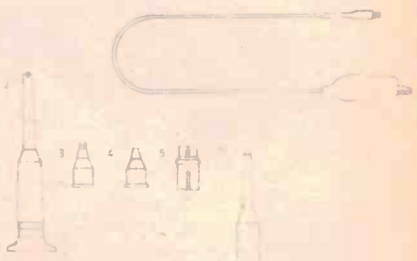
100MHz Probe Sets, great value @ ..... $23.00 + Tax

Greenpar **PROBE ACCESSORIES**

Standard Kit

Items 1-6 are standard accessories supplied where appropriate with probe kits.



1. Earth lead and clip 6".
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3. I.C. test tip.
4. Tip insulator.
5. BNC adaptor.
6. Trimming tool.

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- 3 Mode SCANNER
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- 3 Mode VHF-UHF Monitor

FEATURES:

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- **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!

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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	12DB SINAD
	Wide FM	1.0uV	12DB SINAD
	AM	0.5uV	10DB S/N
Threshold Squelch:	NFM 0.2uV WFM 2.5uV AM 0.2uV		
Selectivity:	NFM ±7.5KHz @6DB, ±20KHz @70DB WFM ±50.0KHz @6DB, ±250KHz @60DB AM ±5.0KHz @6DB, ±10KHz @70DB		
Spurious and Image Rejection:	−50DB		
Modulation Acceptance:	NFM ±7.5KHz WFM ±50KHz AM 100%		

IF Frequencies:	1st IF 750MHz	SAW Filter
	2nd IF 45.0275MHz	Crystal Filter
	3rd IF 455KHz	Ceramic Filter
	(WFM) 5.5 MHz	Ceramic Filter
Reference Oscillator:	(Synthesiser) Crystal Controlled	
Scanning Rate:	Approx. 5 Channels per Second	
Search Scanning Rate:	Approx. 6 Seconds per mega-Hertz	
Scan Delay:	Normal.	Approx. 1 second
	With Delay Option	Approx. 2.5 seconds
Search Delay:	Approx. 2.5 seconds	
Priority Sampling Rate:	Approx. 2 seconds	
Audio Output:	1W @10% 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	

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VHF LISTENERS' GUIDE

Part 2 100-400 MHz

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.

ACT

101.900	FM	ACT	CANBERRA 1ABC
144.475	CW	ACT CANBERRA	VK1RTA AMATEUR BEACON

NATIONAL

135.550	FM	NATIONAL	ATS-1 GEOSTATIONARY SATELLITE
135.555	FM	NATIONAL	ATS 3 SATELLITE DOWNLINK
135.575	FM	NATIONAL	ATS 3 SATELLITE DOWNLINK
135.600	FM	NATIONAL	ATS-1 SATELLITE
135.600	FM	NATIONAL	ATS 3 SATELLITE DOWNLINK
135.625	FM	NATIONAL	ATS 3 SATELLITE DOWNLINK
135.645	FM	NATIONAL	ATS 3 SATELLITE DOWNLINK
137.150	FM	NATIONAL	METEOR (RUSSIAN) WEATHER SAT.
137.300	FM	NATIONAL	METEOR (RUSSIAN) WEATHER SAT.
137.500	FM	NATIONAL	TIRO/NOAA WEATHER SATELLITE
137.620	FM	NATIONAL	TIRO/NOAA WEATHER SATELLITE
145.825	FM	NATIONAL	UOSAT AMATEUR SATELLITE DATA DOWNLINK
145.825	FM	NATIONAL	UOSAT OSCAR 9 SATELLITE BEACON
146.025	FM	NATIONAL	2 M AMATEUR REPEATER INPUT CH 6025
146.050	FM	NATIONAL	2 M AMATEUR REPEATER INPUT CH 6050
146.075	FM	NATIONAL	2 M AMATEUR REPEATER INPUT CH 6075
146.100	FM	NATIONAL	2 M AMATEUR REPEATER INPUT CH 6100
146.125	FM	NATIONAL	2 M AMATEUR REPEATER INPUT CH 6125
146.150	FM	NATIONAL	2 M AMATEUR REPEATER OUTPUT CH 6750
146.150	FM	NATIONAL	2 M AMATEUR REPEATER INPUT CH 6150
146.175	FM	NATIONAL	2 M AMATEUR REPEATER INPUT CH 6175
146.200	FM	NATIONAL	2 M AMATEUR REPEATER INPUT CH 6200
146.225	FM	NATIONAL	2 M AMATEUR REPEATER INPUT CH 6225
146.250	FM	NATIONAL	2 M AMATEUR REPEATER INPUT CH 6250
146.275	FM	NATIONAL	2 M AMATEUR REPEATER INPUT CH 6275
146.300	FM	NATIONAL	2 M AMATEUR REPEATER INPUT CH 6300
146.325	FM	NATIONAL	2 M AMATEUR REPEATER INPUT CH 6325
146.350	FM	NATIONAL	2 M AMATEUR REPEATER INPUT CH 6350
146.375	FM	NATIONAL	2 M AMATEUR REPEATER INPUT CH 6375
146.400	FM	NATIONAL	2 M AMATEUR REPEATER INPUT CH 6400
146.450	FM	NATIONAL	AMATEUR 2 M BAND PRI VOICE CHANNEL
146.425	FM	NATIONAL	AMATEUR 2 M BAND SEC VOICE CHANNEL
146.475	FM	NATIONAL	AMATEUR 2 M BAND SEC VOICE CHANNEL
146.500	FM	NATIONAL	AMATEUR 2 M BAND NATIONAL CALL CHAN
146.525	FM	NATIONAL	AMATEUR 2 M BAND SEC VOICE CHANNEL
146.550	FM	NATIONAL	AMATEUR 2 M BAND PRI VOICE CHANNEL
146.575	FM	NATIONAL	AMATEUR 2 M BAND SEC VOICE CHANNEL
146.600	FM	NATIONAL	AMATEUR 2 M BAND NATIONAL RTTY
146.625	FM	NATIONAL	2 M AMATEUR REPEATER OUTPUT CH 6625
146.650	FM	NATIONAL	2 M AMATEUR REPEATER OUTPUT CH 6650
146.675	FM	NATIONAL	2 M AMATEUR REPEATER OUTPUT CH 6675
146.700	FM	NATIONAL	2 M AMATEUR REPEATER OUTPUT CH 6700
146.725	FM	NATIONAL	2 M AMATEUR REPEATER OUTPUT CH 6725
146.775	FM	NATIONAL	2 M AMATEUR REPEATER OUTPUT CH 6775
146.800	FM	NATIONAL	2 M AMATEUR REPEATER OUTPUT CH 6800
146.825	FM	NATIONAL	2 M AMATEUR REPEATER OUTPUT CH 6825
146.850	FM	NATIONAL	2 M AMATEUR REPEATER OUTPUT CH 6850
146.875	FM	NATIONAL	2 M AMATEUR REPEATER OUTPUT CH 6875
146.900	FM	NATIONAL	2 M AMATEUR REPEATER OUTPUT CH 6900
146.925	FM	NATIONAL	2 M AMATEUR REPEATER OUTPUT CH 6925
146.950	FM	NATIONAL	2 M AMATEUR REPEATER OUTPUT CH 6950
146.975	FM	NATIONAL	2 M AMATEUR REPEATER OUTPUT CH 6975
147.000	FM	NATIONAL	2 M AMATEUR REPEATER OUTPUT CH 7000
147.025	FM	NATIONAL	2 M AMATEUR REPEATER OUTPUT CH 7025
147.050	FM	NATIONAL	2 M AMATEUR REPEATER OUTPUT CH 7050
147.075	FM	NATIONAL	2 M AMATEUR REPEATER OUTPUT CH 7075
147.100	FM	NATIONAL	2 M AMATEUR REPEATER OUTPUT CH 7100
147.125	FM	NATIONAL	2 M AMATEUR REPEATER OUTPUT CH 7125
147.150	FM	NATIONAL	2 M AMATEUR REPEATER OUTPUT CH 7150
147.175	FM	NATIONAL	2 M AMATEUR REPEATER OUTPUT CH 7175
147.200	FM	NATIONAL	2 M AMATEUR REPEATER OUTPUT CH 7200
147.250	FM	NATIONAL	2 M AMATEUR REPEATER OUTPUT CH 7250
147.275	FM	NATIONAL	2 M AMATEUR REPEATER OUTPUT CH 7275
147.300	FM	NATIONAL	2 M AMATEUR REPEATER OUTPUT CH 7300
147.325	FM	NATIONAL	2 M AMATEUR REPEATER OUTPUT CH 7325
147.350	FM	NATIONAL	2 M AMATEUR REPEATER OUTPUT CH 7350
147.375	FM	NATIONAL	2 M AMATEUR REPEATER OUTPUT CH 7375
147.400	FM	NATIONAL	AMATEUR 2 M BAND ATV LIAISON

147.425	FM	NATIONAL	AMATEUR 2 M BAND NATIONAL
147.450	FM	NATIONAL	AMATEUR 2 M BAND ATV/SSTV/FAX
147.475	FM	NATIONAL	AMATEUR 2 M BAND SSTV/FAX LIAISON
147.500	FM	NATIONAL	AMATEUR 2 M BAND
147.525	FM	NATIONAL	AMATEUR 2 M BAND
147.550	FM	NATIONAL	AMATEUR 2 M BAND MICRO NET
147.575	FM	NATIONAL	AMATEUR 2 M BAND
147.600	FM	NATIONAL	AMATEUR 2 M BAND DATA NET
147.625	FM	NATIONAL	2 M AMATEUR REPEATER INPUT CH 7625
147.650	FM	NATIONAL	2 M AMATEUR REPEATER INPUT CH 7650
147.675	FM	NATIONAL	2 M AMATEUR REPEATER INPUT CH 7675
147.700	FM	NATIONAL	2 M AMATEUR REPEATER INPUT CH 7700
147.725	FM	NATIONAL	2 M AMATEUR REPEATER INPUT CH 7725
147.750	FM	NATIONAL	2 M AMATEUR REPEATER INPUT CH 7750
147.775	FM	NATIONAL	2 M AMATEUR REPEATER INPUT CH 7775
147.800	FM	NATIONAL	2 M AMATEUR REPEATER INPUT CH 7800
147.825	FM	NATIONAL	2 M AMATEUR REPEATER INPUT CH 7825
147.850	FM	NATIONAL	2 M AMATEUR REPEATER INPUT CH 7850
147.875	FM	NATIONAL	2 M AMATEUR REPEATER INPUT CH 7875
147.900	FM	NATIONAL	2 M AMATEUR REPEATER INPUT CH 7900
147.925	FM	NATIONAL	2 M AMATEUR REPEATER INPUT CH 7925
147.950	FM	NATIONAL	2 M AMATEUR REPEATER INPUT CH 7950
147.975	FM	NATIONAL	2 M AMATEUR REPEATER INPUT CH 7975
243.000	FM	NATIONAL	NASA SPACE SHUTTLE
250.450	FM	NATIONAL	FLTSATCOM SATELLITE
259.700	FM	NATIONAL	NASA SPACE SHUTTLE
269.950	FM	NATIONAL	FLTSATCOM SATELLITE
296.800	FM	NATIONAL	NASA SPACE SHUTTLE
144.200	SSB	NZ	SSB SIMPLEX CALLING 2 M AMATEUR BAND
144.800	FSK	NZ	RTTY PRIMARY 2 M AMATEUR BAND
144.850	FSK	NZ	RTTY 2 M AMATEUR BAND
144.900	FSK	NZ	RTTY 2 M AMATEUR BAND
146.050	FM	NZ	2 M AMATEUR REPEATER INPUT 665
146.100	FM	NZ	2 M AMATEUR REPEATER INPUT 670
146.150	FM	NZ	2 M AMATEUR REPEATER INPUT 675
146.200	FM	NZ	2 M AMATEUR REPEATER INPUT 680
146.250	FM	NZ	2 M AMATEUR REPEATER INPUT 685
146.300	FM	NZ	2 M AMATEUR REPEATER INPUT 690
146.350	FM	NZ	2 M AMATEUR REPEATER INPUT 695
146.400	FM	NZ	2 M AMATEUR REPEATER INPUT 700
146.475	FM	NZ	FM SIMPLEX CALLING 2 M AMATEUR BAND
146.525	FM	NZ	FM SIMPLEX 2 M AMATEUR BAND
146.575	FM	NZ	FM SIMPLEX 2 M AMATEUR BAND
146.650	FM	NZ	2 M AMATEUR REPEATER OUTPUT 665
146.700	FM	NZ	2 M AMATEUR REPEATER OUTPUT 670
146.750	FM	NZ	2 M AMATEUR REPEATER OUTPUT 675
146.800	FM	NZ	2 M AMATEUR REPEATER OUTPUT 680
146.850	FM	NZ	2 M AMATEUR REPEATER OUTPUT 685
146.900	FM	NZ	2 M AMATEUR REPEATER OUTPUT 690
146.950	FM	NZ	2 M AMATEUR REPEATER OUTPUT 695
147.000	FM	NZ	2 M AMATEUR REPEATER OUTPUT 700
147.050	FM	NZ	2 M AMATEUR REPEATER OUTPUT 705
147.100	FM	NZ	2 M AMATEUR REPEATER OUTPUT 710
147.150	FM	NZ	2 M AMATEUR REPEATER OUTPUT 715
147.200	FM	NZ	2 M AMATEUR REPEATER OUTPUT 720
147.250	FM	NZ	2 M AMATEUR REPEATER OUTPUT 725
147.300	FM	NZ	2 M AMATEUR REPEATER OUTPUT 730
147.350	FM	NZ	2 M AMATEUR REPEATER OUTPUT 735
147.425	FM	NZ	FM SIMPLEX 2 M AMATEUR BAND
147.475	FM	NZ	FM SIMPLEX 2 M AMATEUR BAND
147.525	FM	NZ	FM SIMPLEX 2 M AMATEUR BAND
147.575	FM	NZ	FM SIMPLEX 2 M AMATEUR BAND
147.650	FM	NZ	2 M AMATEUR REPEATER INPUT 705
147.700	FM	NZ	2 M AMATEUR REPEATER INPUT 710
147.750	FM	NZ	2 M AMATEUR REPEATER INPUT 715
147.800	FM	NZ	2 M AMATEUR REPEATER INPUT 720
147.850	FM	NZ	2 M AMATEUR REPEATER INPUT 725
147.900	FM	NZ	2 M AMATEUR REPEATER INPUT 730
147.950	FM	NZ	2 M AMATEUR REPEATER INPUT 735

NSW

102.500	FM	NSW	SYDNEY 2MBS
103.200	FM	NSW	SYDNEY 2CBA
103.700	FM	NSW	NEWCASTLE 2NUR
104.100	FM	NSW	SYDNEY 2DAY
104.900	FM	NSW	SYDNEY 2MMM
105.700	FM	NSW	SYDNEY 2JJJ
106.100	FM	NSW	NEWCASTLE 2ABC
107.100	FM	NSW	WAGGA WAGGA 2AAA
107.500	FM	NSW	SYDNEY 2SER
107.900	FM	NSW	ALBURY 2REM
115.115	FM	NSW	CHECKING SERVICE
115.400	AM	NSW	SYDNEY AIR INFO
118.000	AM	NSW	BANKSTOWN + TOWERS AIRCRAFT
118.100	AM	NSW	TAMWORTH AIRPORT
118.100	AM	NSW	LANDING INFORMATION AIRCRAFT
119.100	AM	NSW	UNCONTROLLED AIRPORTS
119.400	AM	NSW	SYDNEY APPROACH AIRCRAFT
120.500	AM	NSW	SYDNEY TOWER AIRCRAFT
120.895	AM	NSW	BANKSTOWN AIR INFO
121.100	AM	NSW	AIRCRAFT INFO
121.500	AM	NSW	AIRCRAFT DISTRESS
123.000	AM	NSW	SYDNEY DEPARTURE AIRCRAFT
123.450	AM	NSW	INTERNATIONAL CHASER AIRCRAFT
124.400	AM	NSW	SYDNEY APPROACH AIRCRAFT
124.600	AM	NSW	SYDNEY AIRPORT AIRCRAFT
125.300	AM	NSW	SYDNEY DEPARTURE AIRCRAFT
125.600	AM	NSW	AIRPORT CONTROL
128.800	AM	NSW	EAST-WEST AIRLINES
129.500	AM	NSW	TAA AIRLINES
130.550	AM	NSW	ANSETT AIRLINES
130.655	AM	NSW	AIRCRAFT
131.100	AM	NSW	SINGAPORE AIRLINES
131.700	AM	NSW	QANTAS AIRLINES
131.900	AM	NSW	PAN AM AIRLINES
144.420	CW	NSW SYDNEY	VK2RSY AMATEUR BEACON
144.420	CW	NSW/SYDNEY	AMATEUR BEACON VK2WI
147.400	CW	NSW SYDNEY	VK2RCW AMATEUR MORSE PRACTICE
148.012	FM	NSW	TELECOM TELEFINDER
149.885	FM	NSW	PAGER LIVERPOOL HOSPITAL
149.887	FM	NSW	VOICE CALL
156.375	FM	NSW	MARITIME NAV.WARNING 67
156.525	FM	NSW	MARITIME SEARCH/RESCUE
156.650	FM	NSW	MARITIME SERVICES BOARD
156.800	FM	NSW	MARITIME WEATHER 16
157.150	FM	NSW	SHIPS STATION TX 23
157.300	FM	NSW	SHIPS STATION TX 23
158.740	FM	NSW	TELECOM
159.220	FM	NSW	BUSH FIRE
159.436	FM	NSW	PARK RANGERS
160.420	FM	NSW	RENTAL TV COMPANY
160.565	FM	NSW	TAXI
161.900	FM	NSW	COAST STATION TX 26
162.040	FM	NSW	NRMA TAMWORTH
162.190	FM	NSW	HIRE CAR
163.730	FM	NSW	POLICE
163.760	FM	NSW	POLICE ORANGE WAGGA MITTAGONG
163.790	FM	NSW	POLICE
163.820	FM	NSW	POLICE WYONG
163.850	FM	NSW	POLICE MAITLAND MAYFIELD
163.880	FM	NSW	POLICE WYONG WAGGA
163.910	FM	NSW	POLICE GOULBURN

163.940	FM	NSW	POLICE
163.970	FM	NSW	POLICE HORNSBY GOSFORD
166.355	FM	NSW	TV CHANNEL
166.660	FM	NSW	SECURITY
167.770	FM	NSW	DEPT MAIN ROADS
167.890	FM	NSW	POLICE
168.820	FM	NSW	STATE EMERGENCY SERVICES
168.850	FM	NSW	STATE EMERGENCY SERVICES

QLD

101.500	FM	QLD	TOWNSVILLE 4ABC
102.100	FM	QLD	BRISBANE 4ZZZ
102.700	FM	QLD	TOOWOOMBA 4DDB
103.300	FM	QLD	BRISBANE 4MBS
104.100	FM	QLD	BRISBANE 4MMM
106.100	FM	QLD	BRISBANE 4ABC
144.400	CW	QLD MT MOUBULLAN	VK4RTT AMATEUR BEACON

SA-NT

102.100	FM	NT	ALICE SPRINGS 8CCC
104.100	FM	NT	DARWIN 8TOP
104.100	FM	SA	MT GAMBIER 5ABC
105.100	FM	SA	LOXTON 5ABC
107.500	FM	SA	ADELAIDE 5SSA
135.500	FM	SA	CHECKING SERVICE
144.480	CW	NT DARWIN	VK8VF AMATEUR BEACON
144.550	CW	SA/MT GAMBIER	AMATEUR BEACON VK5RSE
144.800	CW	SA/MT LOFTY	AMATEUR BEACON LOFTY VK5VF
159.070	FM	SA	AMBULANCE
159.190	FM	SA	AMBULANCE (COUNTRY)
159.220	FM	SA	AMBULANCE (LIFE SAVING)
159.250	FM	SA	AMBULANCE
159.280	FM	SA	AMBULANCE (COUNTRY)
159.600	FM	SA	AMBULANCE
162.970	FM	SA	NATIONAL PARKS
163 510	FM	SA	ORROROO VL5IK CFS
163.060	FM	SA	LACAPEDE VL5GK CFS
163.060	FM	SA	KIMBA VL5DF CFS
163.060	FM	SA	ATHELSTONE VL5JX CFS
163.060	FM	SA	LUCINDALE VL5JP CFS
163.060	FM	SA	BURNSIDE VL5NO CFS
163.060	FM	SA	EAST TORRENS VL5GG CFS
163.075	FM	SA	BALAKLAVA VL5JB CFS
163.075	FM	SA	SADDLEWORTH & AUBURN VL5NE CFS
163.075	FM	SA	RIVERTON VL5NB CFS
163.075	FM	SA	PT WAKEFIELD VL5IQ CFS
163.090	FM	SA	GLOSSOP VL5BM CFS
163.090	FM	SA	NOARLUNGA VL5TB CFS
163.090	FM	SA	PEAKE VL5FC CFS
163.090	FM	SA	TATIARA VL5AZ CFS
163.090	FM	SA	COONALPYN DOWNS VL5EX CFS
163.090	FM	SA	MURRAY BRIDGE VL5EW CFS
163.090	FM	SA	PINNAROO VL5IA CFS
163.090	FM	SA	LE HUNTE VL5GD CFS
163.090	FM	SA	MENINGIE VL5DH CFS
163.090	FM	SA	MINLATON VL5NP CFS
163.090	FM	SA	BARMERA VL5BM CFS
163.090	FM	SA	MONARTO VL5XO CFS
163.150	FM	SA	TORRETOWN VL5EY CFS
163.150	FM	SA	ELLISTON VL5CV CFS
163.150	FM	SA	WAROOKA VL5EZ CFS
163.150	FM	SA	STRATHALBYN VL5CS CFS
163.150	FM	SA	KAROONDA/EAST MURRAY CFS
163.150	FM	SA	MEADOWS VL5CM CFS
163.150	FM	SA	NARACOORTE VL5BN CFS
163.150	FM	SA	PT ELLIOT & GOOLWA VL5GE CFS
163.165	FM	SA	KINGSCOTE VL5JZ CSS
163.165	FM	SA	DUDLEY VL5JZ CFS
163.165	FM	SA	FRANKLIN HARBOUR VL5HC CFS
163.195	FM	SA	LINCOLN VL5GZ CFS
163.195	FM	SA	SPALDING VL5DQ CFS
163.195	FM	SA	CLARE VL5CG CFS
163.195	FM	SA	BURRA BURRA VL5GN CFS
163.195	FM	SA	HALLET VL5LQ CFS
163.210	FM	SA	WAIKERIE VL5QT CFS
163.210	FM	SA	CLEVE VL5ME CFS
163.210	FM	SA	LOXTON VL5EV CFS
163.210	FM	SA	STIRLING VL5ES CFS
163.210	FM	SA	PARINGA VL5AL CFS
163.270	FM	SA	SALISBURY VL5FS CFS
163.270	FM	SA	TEA TREE GULLEY VL5DZ CFS
163.270	FM	SA	BEACHPORT VL5FW CFS
163.270	FM	SA	KANYAKA-QUORN VL5IN CFS
163.270	FM	SA	STIRLING NORTH VL5BB CFS
163.270	FM	SA	MILLICENT VL5IL CFS
163.285	FM	SA	TRUMBY BAY VL5LK CFS
163.285	FM	SA	VICTOR HARBOUR VL5FM CFAS
163.285	FM	SA	YANKALILLA VL5GH FFS
163.285	FM	SA	WILLUNGA VL5JY CFS
163.300	FM	SA	CENTRAL YORKE PENINSULA VL5LL CFS
163.300	FM	SA	MURAT BAY VL5QJ CFS
163.300	FM	SA	BUTE VL5JF CFS
163.300	FM	SA	PENOLA VL5CP CFS
163.300	FM	SA	CLINTON VL5AG CFS
163.300	FM	SA	LAMEROO VL5IZ CFS
163.300	FM	SA	KADINA VL5JD CFS
163.300	FM	SA	MITCHAM VL5BA CFS
163.360	FM	SA	BAROSSA VL5AF CFS
163.360	FM	SA	ANGASTON VL5BQ CFS
163.360	FM	SA	GUMERACHA VL5GS CFS
163.360	FM	SA	TRURO VL5BQ CFS
163.360	FM	SA	RIDLEY VL5LG CFS
163.360	FM	SA	MOUNT GAMBIER VL5AM CFS
163.360	FM	SA	MOUNT PLEASANT VL5HU CFS
163.360	FM	SA	PT MACDONNELL VL5AY CFS
163.405	FM	SA	WILMINGTON VL5DL CFS
163.405	FM	SA	PT GERMEIN VL5AC CFS
163.405	FM	SA	STIRLING NORTH VL5BB CFS
163.420	FM	SA	ONKAPARINGA VL5AO CFS
163.420	FM	SA	STREAKY BAY VL5CT CFS
163.420	FM	SA	MUNNO PARA VL5AS CFS
163.510	FM	SA	GEORGETOWN VL5AB CFS
163.510	FM	SA	JAMESTOWN VL5FF CFS
163.510	FM	SA	LAURA VL5HZ CFS
163.510	FM	SA	GLADSTONE VL5JG CFS
163.510	FM	SA	ROBE VL5LH CFS
163.510	FM	SA	PETERBOROUGH VZ5FB CFS
163.525	FM	SA	MALLALA VL5FZ CFS
163.525	FM	SA	OWEN VL5IW CFS
163.540	FM	SA	BLYTH VL5DG FFS
163.540	FM	SA	CRYSTAL BROOK VL5DX CFS
163.540	FM	SA	PIRIE VL5NF CFS
163.540	FM	SA	SNOWTOWN VL5GA CFS
163.540	FM	SA	REDHILL VL5IV CFS
163.570	FM	SA	ROBERTSTOWN VL5AY CFS
163.570	FM	SA	MORGAN VL5ZZ CFS
163.570	FM	SA	KAPUNDA VL5PG CFS
163.570	FM	SA	EUDUNDA VL5MX CFS
163.960	FM	SA	MOUNT BARKER VL5AE CFS
168.820	FM	SA	FIRE ADELAIDE PT PYRIE PT AUGUSTA
168.850	FM	SA	FIRE ADELAIDE PT PYRIE PT AUGUSTA

TAS

103.300	FM	TAS	HOBART 7HFC
144.900	CW	TAS/ULVERSTONE	AMATEUR BEACON VK7RTX

VIC

101.900	FM	VIC	MELBOURNE 3FOX
102.700	FM	VIC	MELBOURNE 3RRR
103.500	FM	VIC	CHURCHILL 3GCR
103.900	FM	VIC	CASTLEMAINE 3CCC
105.300	FM	VIC	BALLARAT 3ABC
105.700	FM	VIC	MELBOURNE 3ABC
107.700	FM	VIC	MELBOURNE 3PBS
113.900	AM	VIC	ESSENDON (ATIS)
114.100	AM	VIC	ML MELBOURNE AIRPORT NAVIG BEACON
114.300	AM	VIC	YWE YARRAWAE AIR NAVIG BEACON
115.300	AM	VIC	FTH FENTONS HILL AIR NAVIG BEACON
115.900	AM	VIC	WON WONTHAGGI AIR NAVIG BEACON
118.100	AM	VIC	MOORABBIN TOWER
118.900	AM	VIC	MELBOURNE DEPARTURES
119.100	AM	VIC	SMALL AIRPORT LOCAL FREQUENCY
119.800	AM	VIC	ESSENDON (ATIS)
119.900	AM	VIC	MOORABBIN SURFACE MOVEMENT (SMC)
120.100	AM	VIC	AVALON TOWER
120.500	AM	VIC	MELBOURNE TOWER
120.700	AM	VIC	DEVONPORT (ATIS)
120.900	AM	VIC	MOORABBIN TERMINAL INFORMATION (ATIS)
121.300	AM	VIC	SMC MELBOURNE AIRPORT SURFACE COMM'S
121.700	AM	VIC	SMC MELBOURNE AIRPORT SURFACE COMM'S
122.400	AM	VIC	FLIGHT SERVICE NTH MELBOURNE
123.000	AM	VIC	MOORABBIN TOWER
123.600	AM	VIC	MELBOURNE CONTROL (30 -80 N MILES)
124.700	AM	VIC	MELBOURNE APPROACH
124.900	AM	VIC	FLIGHT SERVICE WEST MELBOURNE
125.000	FM	VIC	CHECKING SERVICE
125.100	AM	VIC	ESSENDON TOWER
125.700	AM	VIC	MELBOURNE CONTROL OUT MELB/PERTH/ADLD
125.900	AM	VIC	PORT PHILIP BAY
126.600	AM	VIC	MELBOURNE CONTROL INBOUND FROM NTH
127.000	AM	VIC	MELBOURNE CONTROL MELB-TAS
127.400	AM	VIC	MELBOURNE CONTROL IN MELB/PERTH/ADLD
128.500	AM	VIC	MELBOURNE CONTROL (80 N MILES)
129.400	AM	VIC	ESSENDON APPROACH
129.500	AM	VIC	TAA
130.400	AM	VIC	MELBOURNE CONTROL (30 - 80 N MILES)
130.650	AM	VIC	ANSETT
131.600	FM	VIC	AIRWING POLICE
131.700	AM	VIC	QANTAS
131.900	AM	VIC	PAN AM
144.700	CW	VIC/VERMONT	AMATEUR BEACON VK3RTG
148.0125	FM	VIC	TELECOM PAGING SYSTEM
149.890	FM	VIC	VOICE CALL PAGER
155.100	FM	VIC	SORRENTO & ST LEONARDS RESCUE SQUAD
155.125	FM	VIC	ELWOOD LIFE SAVING CLUB
155.195	FM	VIC	WESTERNPORT SAFETY COUNCIL
155.950	FM	VIC	COAST GUARD
156.300	FM	VIC	MARINE CHANNEL 6 SHIP TO SHIP
156.375	FM	VIC	MARITIME WEATHER & WORKING CHANNEL 67
156.400	FM	VIC	HARBOUR CONTROL CHANNEL 6
156.550	FM	VIC	HARBOUR CONTROL CHANNEL 11
156.600	FM	VIC	HARBOUR CONTROL CHANNEL 12
156.675	FM	VIC	MARITIME WEATHER & WORKING CHANNEL 73
156.700	FM	VIC	HARBOUR CONTROL CHANNEL 14
156.800	FM	VIC	MARITIME DISTRESS & GEN CALLING CH 16
157.150	FM	VIC	SEAPHONE INPUT CHANNEL 23
157.300	FM	VIC	SEAPHONE INPUT CHANNEL 26
157.450	FM	VIC	VERMONT MOTORS (3JS)
157.450	FM	VIC	HUTTONS HAMS (31P)
157.450	FM	VIC	AGP HEATING
157.450	FM	VIC	BROWN EARTHMOVERS (3WA)
157.450	FM	VIC	ROBERTSON PORTLAND
157.480	FM	VIC	MOBIL OIL -- IRYMPLE & SWAN HILL
157.480	FM	VIC	MOBIL OIL -- GREEN - MYRTLEFORD
157.510	FM	VIC	M S S
157.540	FM	VIC	MOBIL OIL -- KERAN
157.540	FM	VIC	THOMPSON
157.570	FM	VIC	RYAN J & SONS
157.570	FM	VIC	JACOB & LOUIS
157.600	FM	VIC	BANDAG
157.690	FM	VIC	BARRY CONSTRUCTION (3EW)
157.690	FM	VIC	MORRIS A D (3EC)
157.690	FM	VIC	NOTLEY F
157.690	FM	VIC	FRED NOTLEY
157.720	FM	VIC	BLUE CIRCLE 100 ON (3HM)
158.230	FM	VIC	SEA-LYNE TOWING
158.800	FM	VIC	FERRANTI TRANSPORT
158.920	FM	VIC	SUBURBAN TOWING
158.920	FM	VIC	BP AUSTRALIA
158.950	FM	VIC	BAILEY MOTORS (3RW)
158.950	FM	VIC	GENDORE PTY LTD (TOORADIN) (3MH)
158.950	FM	VIC	HUISMANS (3KB)
158.950	FM	VIC	BAYPORT CONSTRUCTION
158.950	FM	VIC	O'CONNOR & BEXERIDGE (3MG)
159.040	FM	VIC	D & R PANELS
159.040	FM	VIC	BANFIELD CLIVE
159.040	FM	VIC	OBAN TOWING
159.040	FM	VIC	RINGWOOD PANELS (3HJ)
159.070	FM	VIC	LACEY TOWING
159.400	FM	VIC	TV CHANNEL ATV 10
159.430	FM	VIC	CLARKES CRANES
159.490	FM	VIC	MONIER ROOFING (3GI)
159.610	FM	VIC	FLETCHER FLOOR COVERINGS
159.670	FM	VIC	HOOPER
159.670	FM	VIC	McDERMIT TOWING (3LW)
159.670	FM	VIC	MONASH GARDEN SUPPLIES (3AO)
159.790	FM	VIC	MOBIL OIL -- GEELONG
160.060	FM	VIC	REDCLIFF CO-OP
160.060	FM	VIC	MERRITT & MORRIS
160.060	FM	VIC	HEWITT CONSTRUCTIONS
160.090	FM	VIC	F.W. ALLEN
160.090	FM	VIC	NELSON (LEONGATHA)
160.120	FM	VIC	ALLNIGHT TOWING (3FO)
160.120	FM	VIC	TELEFILM
160.120	FM	VIC	KAYS MINI MESSENGERS (3CK)
160.120	FM	VIC	ATS TOWING
160.150	FM	VIC	GRENDAS BUSLINES (3JW)
160.180	FM	VIC	HERALD SUN
160.240	FM	VIC	LILYDALE SHIRE COUNCIL
160.330	FM	VIC	REILLY J E TRANSPORT
160.360	FM	VIC	HYTECO (3RC)
160.360	FM	VIC	ARMSTRONGS TOWING DANDENONG
160.360	FM	VIC	COOKS CONSTRUCTIONS (3EI)
160.360	FM	VIC	APEX HEATING (3XJ)
160.360	FM	VIC	CONMAK ASHPHALT (3SB)
160.420	FM	VIC	KELLY REFRIGERATION
160.420	FM	VIC	BROTHERHOOD OF ST LAWRENCE
160.450	FM	VIC	AUA VH3UU
160.540	FM	VIC	TV CHANNEL HSV 7

160.590	FM	VIC	TV CHANNEL 7 (3IC)
160.780	FM	VIC	MELBOURNE CITY COUNCIL TRAFFIC LIGHTS
161.140	FM	VIC	AAA TOWING (3UJ)
161.140	FM	VIC	HYDRO ELEC COMM (TAS) RX MOBILE
161.200	FM	VIC	LATROBE VALLEY WATER
161.260	FM	VIC	MET WATER BOARD
161.320	FM	VIC	PIRROTTA READY MIX
161.320	FM	VIC	BELGROVE CONSTRUCTION
161.320	FM	VIC	TEMPLE TOWING
161.320	FM	VIC	WHITEHEAD (3EK)
161.320	FM	VIC	COMMERCIAL WASTE (3CG)
161.350	FM	VIC	FOUR-WHEEL DRIVE CLUBS
161.750	FM	VIC	SEAPHONE OUTPUT CHANNEL 23
161.900	FM	VIC	SEAPHONE OUTPUT CHANNEL 26
162.100	FM	VIC	DOWNARDS (MELBOURNE)
162.160	FM	VIC	STATION 3 AK
162.160	FM	VIC	TV CHANNEL 9 NEWS (3FS)
162.220	FM	VIC	STATE ELECTRICITY COMM.
162.280	FM	VIC	ALVIN B.J.
162.310	FM	VIC	GOLDEN FLEECE (3NK)
162.310	FM	VIC	NEWHAM (ENG)
162.370	FM	VIC	CENTRAL TOWING
162.420	FM	VIC	ROBERTS J & A J (3RI)
162.430	FM	VIC	MODERN HEAT
162.430	FM	VIC	REPCO
162.460	FM	VIC	RACV
162.490	FM	VIC	RACV
162.520	FM	VIC	RACV
162.550	FM	VIC	RACV
162.640	FM	VIC	BULLEEN NURSERY (3EN)
162.640	FM	VIC	GORDON HARRISON MOTORS
162.640	FM	VIC	ROSLYN HIRE SERVICE (3KD)
162.760	FM	VIC	DICK D G (MOE)
162.880	FM	VIC	AQUELLA STEEL
162.880	FM	VIC	HICKS W G
162.970	FM	VIC	CFA CHANNEL 10
163.030	FM	VIC	CFA CHANNEL 8
163.030	FM	VIC	DANDENONG RANGES CFA CH8
163.060	FM	VIC	TOBIN BROS
163.090	FM	VIC	CFA CHANNEL 3
163.120	FM	VIC	CFA CHANNEL 1
163.150	FM	VIC	CFA CHANNEL 4
163.180	FM	VIC	CFA CHANNEL 9
163.180	FM	VIC	BLUE CIRCLE 1 TO 99 (3RV)
163.240	FM	VIC	CFA CHANNEL 2
163.270	FM	VIC	CFA CHANNEL 5
163.300	FM	VIC	CFA CHANNEL 6
163.330	FM	VIC	CFA CHANNEL 7
163.420	FM	VIC	AG DEPOT
163.450	FM	VIC	AG DEPOT
163.480	FM	VIC	AG DEPOT
163.540	FM	VIC	ANSETT FREIGHT
163.720	FM	VIC	COLONIAL GAS (3PD) CHANNEL 1
163.750	FM	VIC	RAAF SONOBOUYS
163.900	FM	VIC	COLONIAL GAS (3PZ) CHANNEL 2
163.930	FM	VIC	LAMEN & BOUTCHE
163.930	FM	VIC	MOBIL OIL -- OLNEY MT EVELYN
163.960	FM	VIC	APOLLO PAVING
163.960	FM	VIC	BOULDERS
164.020	FM	VIC	MED CALL
164.350	FM	VIC	YOUNG W H & O H
164.350	FM	VIC	McKAY & GREEN
164.380	FM	VIC	STRATEWAY T T (3WG)
164.380	FM	VIC	LINFOX DISTRICT MESSENGERS (3TV)
164.380	FM	VIC	ALBURY TAXI SERVICE
164.380	FM	VIC	DISTRICT MESSENGERS (3TX)
164.500	FM	VIC	ABV CH. 2
164.560	FM	VIC	MASSEY FERGUSON
164.620	FM	VIC	KINGSTON PLANT HIRE
164.620	FM	VIC	BLACKBURN TOWING (3CZ)
164.620	FM	VIC	GMH DANDENONG
164.710	FM	VIC	FLEETWAYS
164.770	FM	VIC	MURDOCK ELECTRICAL
164.800	FM	VIC	CORKHILL TV & RADIO (3CX)
164.800	FM	VIC	EXPRESSWAYS (3LO)
164.800	FM	VIC	DE VERS (3UY)
164.800	FM	VIC	BARRY BROTHERS (PLUMBERS)(3HI)
164.800	FM	VIC	SPEC BUILDING SERVICE (3CU)
164.860	FM	VIC	TUBBS & SON (3QG)
164.980	FM	VIC	BARLOW TRANSPORT
164.980	FM	VIC	PICTON HOPKINS
164.980	FM	VIC	ERICSSON L M
165.010	FM	VIC	R & A TOWING (3CR)
165.070	FM	VIC	LAVER
165.070	FM	VIC	MOBIL OIL -- CAMPERDOWN
165.160	FM	VIC	AMWORLD P/L MORDIALLOC (CONCRETE)
165.520	FM	VIC	BELL FREIGHTLINES (3BE)
165.580	FM	VIC	STATE ELECTRICITY COMMISSION
165.670	FM	VIC	DREW PLUMBERS
165.730	FM	VIC	LOVETT COMMERCIAL SECURITY
165.730	FM	VIC	ADAMS (TOBY) MORNINGTON
165.910	FM	VIC	HUGHES HIRE CARS
165.970	FM	VIC	YELLOW EXPRESS
166.000	FM	VIC	STATE RIVERS & WATER SUPPLY
166.060	FM	VIC	STATE ELECTRICITY COMM.
166.120	FM	VIC	McINTYRE & ASSOC (M C ALARMS)
166.240	FM	VIC	PYE TV SERVICE
166.240	FM	VIC	RICHARDSON JAMES (3JR)
166.240	FM	VIC	PHILIPS TMC
166.270	FM	VIC	PAL TV SERVICE
166.270	FM	VIC	KEEN & CO
166.300	FM	VIC	BISSET & STEPHENS
166.300	FM	VIC	CAMER AIR CONDITIONING
166.300	FM	VIC	BRETHERTON
166.300	FM	VIC	ELITE MESSENGERS (3AI)
166.360	FM	VIC	MAYNE NICKLESS
166.480	FM	VIC	SIGN CRAFT
166.540	FM	VIC	DEMO CHANNELS
166.690	FM	VIC	SPRINGFIELD TRUCKING
166.720	FM	VIC	KOSCHADE D R
166.840	FM	VIC	OLYMPIC DRIVING SCHOOL (3IX)
166.840	FM	VIC	FRIGRITE
166.960	FM	VIC	ALL SYSTEMS TOW TRUCKS (3QC)
166.960	FM	VIC	BORO TRANSPORT TT
166.990	FM	VIC	LEONGATHA REFRIGERATION
167.170	FM	VIC	DORSET MESSENGERS (3HJ)
167.170	FM	VIC	CHADWICK INDUSTRIES (3BJ)
167.170	FM	VIC	WAYBURN HEATING (3AK)
167.170	FM	VIC	TEMPLE SERVICE STATION (3AD)
167.170	FM	VIC	CHARLES K (3WG)
167.170	FM	VIC	BONDS
167.170	FM	VIC	BORONIA TV (3TM)
167.170	FM	VIC	MENNY & ASSOCIATES
167.170	FM	VIC	SPACE LINE HOMES (3QT)
167.200	FM	VIC	LATROBE VALLEY WATER
167.230	FM	VIC	LINFOX (PASCOE VALE) (3HLF)
167.230	FM	VIC	ANSETT TRANSPORT
167.290	FM	VIC	IMPRESS PRINTING
167.290	FM	VIC	ENDOST CARRIERS
167.320	FM	VIC	VAUGHAN TRANSPORT
167.320	FM	VIC	CARRIER AIR CONDITIONING (3ZB)
167.320	FM	VIC	PETER MACK TOWING (3RM)
167.410	FM	VIC	BP AUSTRALIA (CRIB POINT)
167.410	FM	VIC	OWNER REAL ESTATE - FRANKSTON
167.410	FM	VIC	WELCOMBE MOTORS SOMMERVILLE
167.410	FM	VIC	COMELLI (SOMMERVILLE)
167.530	FM	VIC	FINDLAYS TRANSPORT (KERANG)

167.530	FM	VIC	McKERN CONTRACTORS (3XK)
167.530	FM	VIC	THOMPSON EARTH MOVING (3XK)
167.680	FM	VIC	NICHOLLS GLEDHILL (3AR)
167.680	FM	VIC	MOTOR TREND
167.710	FM	VIC	WILKINS SERVICE
167.740	FM	VIC	FINDLAYS TRANSPORT (FOOTSCRAY)
167.770	FM	VIC	ESSO OIL RIGS
167.830	FM	VIC	IPEC
167.890	FM	VIC	INTERNATIONAL TOWING
167.890	FM	VIC	INTERNATIONAL SERVICE PANELS
167.890	FM	VIC	LINFOX (MOORABBIN) (3LI)
167.920	FM	VIC	BELL S S
167.920	FM	VIC	VEIGH TRANSPORT (3PQ)
167.920	FM	VIC	WILLIAMS J B
167.950	FM	VIC	SWIFTWAY GEELONG
168.010	FM	VIC	INTERNATIONAL SERVICE PANELS
168.040	FM	VIC	DUDLEY KING
168.100	FM	VIC	STATE ELECTRICITY COMM.
168.160	FM	VIC	POLICE EAST CHANNEL 4
168.190	FM	VIC	POLICE CAR TO CAR CHANNEL 6
168.220	FM	VIC	POLICE NTH CHANNEL 1
168.250	FM	VIC	POLICE CITY PRAHRAN RICHMOND CH7
168.280	FM	VIC	POLICE COUNTRY AREA CHANNEL 3
168.310	FM	VIC	POLICE WEST CHANNEL 8
168.340	FM	VIC	POLICE DANDENONG-PEN CHANNEL 2
168.370	FM	VIC	POLICE SOUTH EAST CHANNEL 9
168.400	FM	VIC	POLICE CAR TO CAR CHANNEL 5
168.430	FM	VIC	M T W R
168.430	FM	VIC	K & V PLUMBING (3CB)
168.430	FM	VIC	MILLERS TRANSPORT (3KW)
168.430	FM	VIC	UNIVERSAL POOLS (3MB)
168.430	FM	VIC	ALLIED AIR CONDITIONING (3YV)
168.430	FM	VIC	EPSOM HIRE (3LA)
168.460	FM	VIC	VICTORIA TRANSPORT CO-OP (3ZE)
168.460	FM	VIC	AAA MESSEMGERS (3EO)
168.460	FM	VIC	PRONTO PLUMBING (3FH)
168.460	FM	VIC	VICTORIAN RAILWAYS TRANSPORT
168.490	FM	VIC	MODERN MESSENGERS (3UO)
168.520	FM	VIC	POLICE GEELONG OCEAN GVE LORNE CH10
168.580	FM	VIC	NORTHERN RADIATORS
168.610	FM	VIC	BAILEY & McCARTHY (3RZ)
168.700	FM	VIC	ANM
168.700	FM	VIC	TV CHANNEL 9 ENGINEERING (3MJ)
168.760	FM	VIC	ALL BRITE TOW TRUCKS
168.850	FM	VIC	ABBOTSFORD TOW TRUCKS
168.850	FM	VIC	ADVANCE TOWING (GARDINER)(3HL)
168.850	FM	VIC	GARDINER (ADVANCE) TOWING (3HL)
168.880	FM	VIC	COOMBS A G
168.880	FM	VIC	METRO OIL (3CN)
168.880	FM	VIC	NOLENS PTY LTD (3UT)
168.880	FM	VIC	RADIO RENTALS (3EH)
168.880	FM	VIC	BENTLEIGH
168.880	FM	VIC	DMF HOMES
168.940	FM	VIC	MALOR PANELS
168.940	FM	VIC	SK TAXI TRUCKS
169.240	FM	VIC	MMBW CHANNEL 8
169.300	FM	VIC	HYDRO ELEC COMM (TAS) TX MOBILE
169.300	FM	VIC	ARG ENGINEERING
169.330	FM	VIC	FIELD & HALL (ELECTRONICS)
169.330	FM	VIC	LAUREL DRIVING SCHOOL (3MV)
169.330	FM	VIC	COLLERAFI JOE (3VO)
169.330	FM	VIC	DANDY TOWING
169.330	FM	VIC	D'BARCO (3EF)
169.420	FM	VIC	MMBW CHANNEL 1
169.440	FM	VIC	BUREAU OF METEOROLOGY
169.450	FM	VIC	MMBW CHANNEL 2
169.465	FM	VIC	MMBW CHANNEL 9
169.480	FM	VIC	MMBW CHANNEL 3
169.510	FM	VIC	MMBW CHANNEL 6
169.540	FM	VIC	MMBW CHANNEL 7
169.600	FM	VIC	BUREAU OF METEOROLOGY
169.600	FM	VIC	BELLS ASBESTOS (BESTOBELL)
169.660	FM	VIC	FORD MORORTCOMPANY SECURITY
169.660	FM	VIC	STATE RIVERS & WATER SUPPLY LINK
169.660	FM	VIC	FORD MOTOR CO
169.690	FM	VIC	BEAMISH W
169.780	FM	VIC	MYER TV SERVICE
169.870	FM	VIC	AKS TOW TRUCKS
169.900	FM	VIC	KERRIGANS TOWING
169.900	FM	VIC	ELLIOTTS EARTHMOVING (3UW)
169.900	FM	VIC	CARTER G C
169.900	FM	VIC	AGE NEWSPAPER
170.070	FM	VIC	SES CHANNEL 6 FRANKSTON
170.070	FM	VIC	CIVIL DEFENCE
170.100	FM	VIC	STATION 3DB
170.130	FM	VIC	HERR FAGE FUNERALS
170.330	FM	VIC	RURAL TRACTORS LILYDALE
170.330	FM	VIC	RAFFERTYS
170.400	FM	VIC	ALLAN CAPP MOTORS
170.430	FM	VIC	HOUGH REFRIGERATION (3WX)
170.430	FM	VIC	AUTO PAINTS MORNINGOON (3HQ)
170.430	FM	VIC	MAYS VIBRATED CONCRETE (3TJ)
170.430	FM	VIC	PENINSULA MOBILE CRANES (3VI)
170.430	FM	VIC	McKAY & POLLACKINHORN
170.460	FM	VIC	ROUGHAN HAULAGE (3YU)
170.460	FM	VIC	GARRETT & GRIFFITHS
170.460	FM	VIC	AGS HAULAGE
170.460	FM	VIC	BRIGHTON TOWING
170.520	FM	VIC	CASSIDY (3CY)
170.520	FM	VIC	CAMPBELL MOTORS (3NM)
170.520	FM	VIC	HANNAMS (MITCHAM) (3FM)
170.520	FM	VIC	CHASEMORE EXCAVATIONS
170.520	FM	VIC	EMBEE (ENGINE RECONDITIONERS)(3FZ)
170.550	FM	VIC	HARDWARE CO OF AUSTRALIA
170.700	FM	VIC	STATION 3XY
170.760	FM	VIC	STATE RIVERS & WATER SUPPLY
170.880	FM	VIC	IPEC (GEELONG)
170.940	FM	VIC	BRASH'S P/L
171.060	FM	VIC	STATION 3 AW
171.090	FM	VIC	HAWKER ELECTRIC
171.300	FM	VIC	DEPT OF SUPPLY CHANNEL 1
171.360	FM	VIC	DEPT OF SUPPLY CHANNEL 2
171.420	FM	VIC	DEPT OF SUPPLY CHANNEL 3
171.630	FM	VIC	MEURS TRANSPORT
171.780	FM	VIC	TV CHANNEL ABC 2
171.900	FM	VIC	ABV CH. 2
172.350	FM	VIC	BELL GEOFF (3ST)
172.890	FM	VIC	BERWICK COUNCIL
173.040	FM	VIC	GOLDEN MESSENGERS
173.250	FM	VIC	LEITCH J
174.100	FM	VIC	ABC B
257.800	FM	VIC	RAAF LAVERTON TOWER
258.200	FM	VIC	RAAF POINT COOK
261.400	FM	VIC	RAAF EAST SALE APPROACH
275.800	FM	VIC	RAAF EAST SALE TOWER
305.400	FM	VIC	RAAF LAVERTON APPROACH
317.700	FM	VIC	RAAF MELBOURNE CONTROL

WA

144.465	CW	WA ALBANY	VK6RTW AMATEUR BEACON
144.600	CW	WA CARNARVON	VK6RTT AMATEUR BEACON
145.000	CW	WA PERTH	VK6RTV AMATEUR BEACON

D REGS

(apologies to the publishers of Dick Smith's book on his round-the-world flight)

AS REPORTED elsewhere in this issue, ETI's ex-Managing Editor, Collyn Rivers, flew to Boston last month to study Wang's extra-ordinary 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 Beancounter', 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 auxilliary, 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 .....

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..... Postcode .....

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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".

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