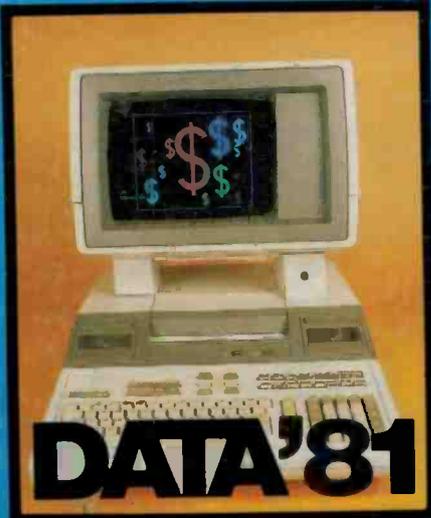


Aug 1981



ELECTRONICS TODAY INTERNATIONAL

NZ \$2.35 \$1.75*



Guide to DATA'81 Computer Show

SIMPLE SOUND EFFECTS PROJECTS



- ELECTRONIC STETHOSCOPE
- BATTERY CHARGER



REVIEW: Nakamichi 480Z Cassette Deck with Dolby C Remote Control Techniques.

WIN
"SUPER INVASION"
Games Program
for your ZX80
Computer

The guarantee on our tape is useless.



Because you'll probably never have to use it.

If, however, anything ever goes wrong with any Maxell cassette you buy, through normal use, we'll replace it. Free.

Of course, we would not make an unconditional offer like that if we thought you'd ever have to take us up on it.

You see, before we sell you a Maxell cassette, we make it so it won't fall apart, warp, jam or stick.

Then there is the tape itself. Maxell is recognised by most critics as the finest recording tape money can buy.

If it wasn't, our guarantee would be very useful indeed.

maxell®



ELECTRONICS TODAY INTERNATIONAL

Registered by Australia Post —
Publication No. NBP0407
ISSN No. 0013-5216

THE AMATEUR RADIO FRATERNITY is losing good talent to 'other interests' because those who have pursued the hobby, within the bounds of their licences and the regulations, to the fullest extent of their ability and interests reach a watershed where licence and regulation limitations restrict further endeavour. Maybe that's a natural progression, but I've seen many a frustrated talent reach this stage and turn in some other direction through frustration at the limitations. I am talking about those whose interest is primarily technical in nature, not certificate hunters, DXers and the like. Where do these amateurs go when they reach this watershed? Skiing, computing, building model railways, politics ...

I'm not denigrating the undoubted attractions offered in the personal challenges of other pursuits; my argument is that the watershed I speak of need not exist. I think it is high time that another class or level of amateur licence was seriously considered. Apart from broadening the scope and challenge of the hobby, such a licence could be issued to particular amateurs as perhaps a concrete *recognition* of technical achievement.

I can anticipate arguments against my proposal on the grounds that it sets up an elite — which it does, but that's what the amateur licence does anyway. Elite, as defined by the dictionary, means 'the best of' and there are plenty of examples within amateur radio where an elite is identified in particular areas — the DXCC listings for one. Whilst there is recognition for expertise and effort in almost every other sphere of pursuit within the hobby, there's nothing offering for the technically inclined in this country. The 'full' licence is it. And it's predicated on demonstrating a limited mechanical expertise in a mode of transmission — morse code. But this is not the place to argue the pros and cons of code examinations.

I would like to conduct a debate on the subject of a 'higher' class or level of amateur licence — should we have one, or shouldn't we? If so, what should be the 'entrance qualifications', what privileges should be offered? — and so on. No holds barred on this one, we'll publish all reasonable letters on the subject, from anyone — amateur or not. Over to you!

Roger Harrison
Editor



QUICK INDEX

FEATURES

- 15 Electronic Distance Measurement
- 123 'Super Invasion' Contest!
- 134 Bone Fone Stereo Radio Offer
- 162 Dregs

PROJECTS & TECHNICAL

- 30 332: Electronic Stethoscope
- 38 1503: Battery Charger
- 47 607A, B, C: Sound Effects
- 57 Lab Notes: Remote Control
- 67 Building a Bench DMM
- 111 Short Ccts: Back-Up Supply
- 139 THD Analyser for audio
- 145 Short Ccts: Slide/Tape Sync.
- 70 Ideas For Experimenters
- 77 Shoparound
- 159 PCB Artwork

COMPUTING TODAY

- 87 Direct Instruction
- 91 Printout — News & Views
- 95 For Sorcerer Apprentices
- 101 DATA '81 Guide
- 114 Review of Anadex DP-9500
- 123 'Super Invasion' Contest!
- 125 NIM for the ZX80

SIGHT & SOUND

- 127 The Bilateral Turntable!
- 139 THD Analyser for audio
- 148 Nakamichi 480Z Review

GENERAL

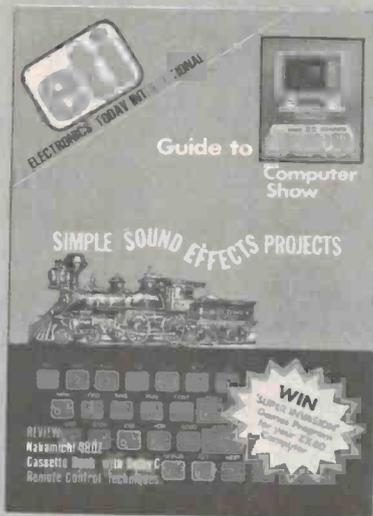
- 8 News Digest
- 64 Books for Hobbyists — Mail Order
- 78 Letters
- 81 Communications News
- 82 ARRL Books by Mail Order
- 118 Superb Binders — Special Offer
- 160 Mini Mart — Readers' Adverts
- 161 ETI Services

advertisers

A&R Sonar	14, 26
Ashpoint	25
Aust. Govt.	27
Applied Technology	35
Altronics	62
All Electronic Components	63
Applied Measurement	110
Atram Electronics	116
Archive Computers	116
AED	122
Audio Engineers	144
Arena	154
Audio Telex	158
BWD	10
Bishop Graphics	34
Bright Star Crystal	76
Bell & Howell	86
Best Vision	100
Bose	138
Consolidated Marketing	48, 19
Clefonics	94
Computailer	89
Commodore	104
Computer Country	108
Customized Technology	113
Cougar Industrial	120
Christie Rand	26
Computerware	120
City Personal Computers	121
Convoy	129, 146, 156
Chadwick	130
Dick Smith	6, 22, 23, 28, 29, 36, 37, 74, 80, 84, 85, 99, 107, 128
Danish Hi Fi	135
David Reid	72
Direct Computer Retail	112
Dave Ryall	122
Elmeasco	7
Electrocraft	25
Ellistronics	44, 50, 51, 75
Electromark	61
Emona	61
Electronic Agencies	61
Energy Control	94
Electric Blue	120
Eisema	120
GFS	83
Hagemeyer	2, 163
Hitachi	150, 151
John F. Rose	10
Jaycar	45, 68
Kitparts	97
Looky Video	94
Lothlorien Farming	110
Logic Shop	113
Liveware	100
Magmedia	12
Microtrix	90
Macquarie School of Educ.	94
MicroPro Design	97
Micro 80	98
Microgear	108
Marantz	136
Northpoint Hi Fi	130
National Panasonic	142, 143, 157
Pre-Pak	71
P.J.B. Systems	110
Philips	124
Q.T. Computers	119
Radofin	164
Radio Parts	26
Rod Irving	54, 56, 88, 109
Radio Despatch	76
Robert Bosch	13
Scope Laboratories	100
SME Systems	108
Software Source	97
S.I. Micro	121
Sony	133
Stanton	147
Sansui	155
Scheaffer	158
TCT	112
TCG	117
VSI	69



ELECTRONICS TODAY INTERNATIONAL



COVER

The nostalgic sounds of the old-time steam train, complete with whistle, can be reproduced with one of our feature projects this month. Australia's biggest annual computer show will no doubt interest many readers and a guide is included inside, too.

*Recommended retail price only.

features

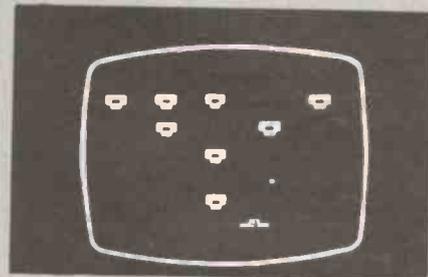


ELECTRONIC DISTANCE MEASUREMENT 15

Hewlett-Packard's new distance meter features a transducer mode in which it measures the distance to a moving target nine times per second for output to a computer or other controller!

BIY DIGITAL MULTIMETER 67

Our lab staff recently had a go at building up one of Sabtronics' kits — the 2010A bench digital multimeter. This is their report on its pros and cons.



'SUPER INVASION' CONTEST 123

Win a program cassette for your ZX80 or MicroAce and kill off all those alien invaders in your own home!

news

NEWS DIGEST 8
Bionics for real; Effects of NASA cuts; Computer programs on shortwave; Peninsula used as antenna for ultra-low frequencies; etc.

COMMUNICATIONS NEWS 81
SX-200 sells 750; British CB channels allocated; Telex Hy-Gain 2 m antenna.

PRINTOUT 91
New SD Systems RAM kit; Come fly your computer, Britain to launch Teletext; For Sorcerer Apprentices; and more.

SIGHT & SOUND NEWS 127
The bilateral turntable arrives; Club for video owners; New Quad electrostatic speakers; Electronics show in Perth; etc.

computing

COMPUTING TODAY 87
Direct Instruction method of computer education; New Commodore VIC.

DATA '81 101
A list of exhibitors and a review of some of the items on display at Australia's biggest computer exhibition, held in Sydney from August 25 to 27.

ANADEX DP-9500 PRINTER 114
Next to the CRT terminal, the second most popular input/output device is a printer. Elaine Ray reviews the Anadex DP-9500.

ZX80 NIM 125
You can just cram this version of NIM into the ZX80's 1K of RAM.

projects



332: ELECTRONIC STETHOSCOPE 30
With this useful device you can actually listen to the inner workings of all those gadgets you've made — and maybe find out why they don't work!

1503: INTELLIGENT BATTERY CHARGER 38
If you run a house alarm system, an amateur repeater or any electronic system with a 12 V battery back-up supply, this charger will keep that battery in a healthy state.



607: SOUND EFFECTS UNITS 47
Steam trains, whistles, gun shots, explosions — you can make all these sounds with this simple project.

sight & sound

SPECIAL OFFER — BONE FONE 134

THD ANALYSER FOR AUDIO CIRCUITS 139
You can build this spot frequency distortion analyser, designed by an ETI reader. Measurements can be made at 100 Hz, 1 kHz and 10 kHz, and the final resolution of the instrument is 0.01%.

NAKAMICHI 480Z CASSETTE DECK 148
Louis Challis reviews this new Nakamichi, which contains the Dolby C noise reduction system.



general

LAB NOTES 57
Remote control systems.

ELECTRONICS BOOKS FROM ETI 64
Beginners' books, data books, circuit books, etc.

IDEAS FOR EXPERIMENTERS 70
Bidirectional audio link; Improving the ZX80 cassette interface; Simple photographic timer; Micropower LED flasher.

SHOPAROUND 77

LETTERS 78

ARRL BOOKS — DIRECT FROM ETI 82

SHORT CIRCUITS 111, 145
Computer back-up supply; Slide/tape synchroniser.

SUPERB BINDERS FROM ETI 118

PCBs 159

MINI-MART 160

ETI SERVICES 161

DREGS 162

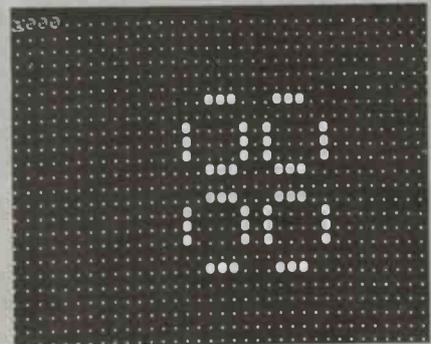
next month

THE FUTURE NOW

Electronic gadgetry barely dreamed of a few short years ago is now mass marketed by an industry that turns over more than the gross national product of the USA. Dennis Lingane brings us a report from the world's largest annual electronics show — the Chicago Consumer Electronics Show. A glimpse of the future that's here and now!

LIFE on a 6800

The program of LIFE is a set of rules to define the growth or death of a moss-like form. This article details an interesting variant, specifically for 6800 owners (SWTPC machines, etc).



AUDIO-TECHNICA ATH-8 HEADPHONES

What with all the trumpeting about loudspeakers recently, one would have thought headphones were a dying breed. Not so! This recently released model from Audio Technica is a top-line, top price set of 'phones that Louis Challis considers "... offer a standard of fidelity, total frequency response and other acoustical attributes for which many audiophiles have long aspired but could not otherwise afford."

SERIES 5000 PREAMP Pt. 2

Description and construction of the low-level input stages of the preamp introduced in the July issue.

MORE SOUND EFFECTS

Two more sound effects units to complete the ETI-607 series commenced in this issue. Next month we have a Phasor & Explosion and a Gun-shot for you to build.

ALPHASORT PROGRAM

Sorting information alphabetically is one of the most common requirements of file handling and data sorting. You can arrange your printout with this program and never lose track of that special lady's phone number again!

Although these articles are in an advanced state of preparation, circumstances may affect the final content. However, we will make every attempt to include all features mentioned here.

HEY KIWIS:
MISSED YOUR DICK SMITH
CATALOGUE LAST MONTH!

60 PAGES
PACKED WITH
ELECTRONIC GOODIES
DIRECT IMPORT PRICES



LOOK AT WHAT
YOU CAN SAVE!

**A PRINTER
CALCULATOR
THAT FITS IN
YOUR HAND!**

Check these features:

- 10 digit Liquid Crystal Display
- Tab key (floating decimal point)
- Print/no print key
- Percentage key
- Square Root key
- Clear entry key
- Rounding off key

Cat. Q-3020

AND
AT
ONLY

\$89⁵⁰

NZ P&P \$4.00



**SUPERB
VALUE**

**DIGITAL
ELECTRONIC
CAR CLOCK**

Ideal for your boat, car, or plane. All controls are counted on the front face for time setting, alarm and lock. Quartz controlled for accuracy and comes complete with power leads and brackets for underdash mounting.



\$32⁵⁰ Cat. Y-1047
NZ P&P \$3.00

**NEW LOWER
PRICE!**

**ON THE BRILLIANT
SYSTEM 80**



- 16K memory
- S-100 expandable
- Compatible with almost all Level II Programs
- Works with any standard TV Set
- Built-in cassette deck with level control plus provision for another (external) cassette

**WAS
\$1188!**

**NOW
ONLY**

\$1050

Cat. X-4005

NZ P&P \$5.50

**3.8 DIGIT LCD
DIGITAL
MULTIMETER**

ONLY
\$95

Cat. Q-1450
P&P \$4.00



This 20 range digital multimeter has highly legible LCD for low power consumption. It offers exceptional performance, is easy to use and has overload protection.

HANDY METER

- Diode protected movement
- 20,000 ohms per volt
- 34 ranges

\$35⁰⁰

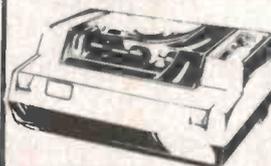
Cat. Q-1024 P&P \$3.00



Comes complete with batteries, test leads and instructions.

**INCREDIBLE
VALUE
PRINTER**

Imagine a tractor-lead impact type dot-matrix printer for less than most thermal printers! Uses ordinary fan-fold paper and features a single hammer print-head.



\$750⁰⁰ Cat. X-3252
NZ P&P \$5.50

**DICK SMITH
FUNWAY
Vol. 1**

Shows a fun way into electronics for the raw beginner with 20 exciting kits to build.

\$595

Cat. B-2600 P&P \$1.00

Vol. 2

For those at a higher level. Shows how to solder, use a multimeter etc.

\$795

Cat. B-2605 P&P \$1.00
**KITS ALSO
AVAILABLE**



High accuracy
**QUARTZ
STOPWATCH**

\$49⁵⁰ Cat. Y-1041
NZ P&P \$4.00

Ideal for any application, specially suited for the sportsman. Use it as a clock or stopwatch!

**TURN YOUR OLD
TV INTO A CRO**

This remarkable kit turns any surplus B&W (or color) TV into a 30kHz audio oscilloscope. It is ideal for Hi-Fi and audio display applications.



only **\$37⁹⁵**

Cat. K-3060 P&P \$3.00

**WE ARE
HERE**



DICK SMITH Electronics

96-98 Carlton Gore Rd. Newmarket
Auckland 1. Ph. (Auckland) 50 4408 50 4409

MAIL ORDER CENTRE: Address as above.

STORE HOURS: Monday to Friday 8.30am to 5pm.

Call into our store and
collect your copy of
our 1st Edition
catalogue!



Facts from Fluke on low-cost digital multimeters.

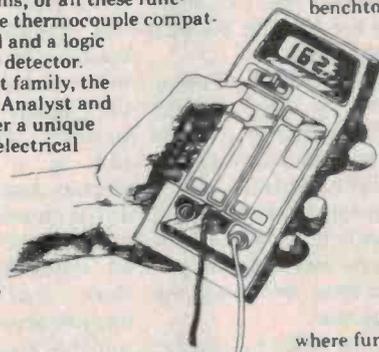
The 8020A Analyst.

People who know electronic test and measurement equipment throughout the world recognize Fluke as a leader in the design and manufacture of precision instrumentation — products that speak for themselves in accuracy, reliability and engineering excellence.

Now users of handheld 3½-digit multimeters are also getting to know us because of the wide acceptance of the 8020A Analyst, the world's best-selling handheld DMM, and the 8022A Troubleshooter, our basic-performance multimeter.

With the addition of the 8024A Investigator to the Fluke low-cost DMM line, we now offer three choices with three distinct levels of performance: basic voltage/current/resistance functions; the added convenience of conductance for high resistance measurements to 10,000 Megohms; or all these functions plus K-type thermocouple compatibility, peak hold and a logic level/continuity detector.

As a product family, the Troubleshooter, Analyst and Investigator offer a unique combination of electrical performance, mechanical ruggedness and environmental endurance to users who want the convenience



Model 8020A: The Analyst

- Seven functions
dc voltage
ac voltage
dc current
ac current
resistance
diode test
conductance (1/R)
- 3½ digit resolution
- 0.1% basic dc accuracy
- LCD display
- Overload protection
- Safety designed test leads

of a handheld DMM without sacrificing the accuracy and performance of a benchtop instrument.

Simple, straightforward and easy on the eyes.

We've always thought a handheld DMM should actually *work* like one — that is, the size and shape and placement of controls should allow true one-hand operation. Fluke handheld DMM's are strikingly simple in design with uncluttered front panels

where function and range combinations are clearly defined by color coding. A single row of eight trouble-free push-buttons replaces the awkward rotary switches still offered on other multimeters.

The crisp, razor-sharp 3½-digit LCD readout in these three instruments features a wide viewing angle that you can see in bright sunshine or low ambient light.

Graduated with honors from the school of hard knocks.

All Fluke handheld DMM's feature tough, lightweight cases that stand up to the abuses of life in the field. Sturdy internal construction surrounded by a high-impact, flame-retardant shell make these units virtually indestructible. And all meet severe shock/vibration tests.

The shock is g t t h about overloading.

Like all Fluke Multimeters, our handheld DMM's are equipped with extensive internal protection against overloads and operator errors. Don't worry if you accidentally plug the test leads of

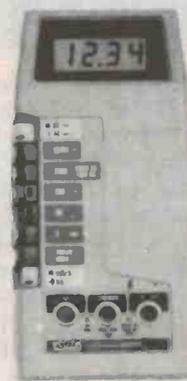
your Fluke DMM into a wall outlet while the instrument is in the resistance function. The same test could destroy a multimeter with lesser defenses. But a Fluke DMM comes through with flying colors. A simple case of survival of the fittest

Our DMM's can stand up to this kind of punishment because a substantial portion of their components are devoted exclusively to reliability. The 8020A, 8022A and 8024A can withstand 500V on resistance ranges, and 1000V dc and 750 rms ac on all voltage ranges. In addition, the instrument is protected against transients to 6 kV.



FLUKE

The 8022A Trouble shooter.



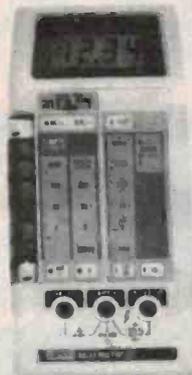
Model 8022A: The Troubleshooter

- Six functions
dc voltage
ac voltage
dc current
ac current
resistance
diode test
- 3½-digit resolution
- 0.25% basic dc accuracy
- LCD display
- Overload protection
- Safety-designed test leads

The 8024A Investigator.

Model 8024A: The Investigator

- Nine functions
dc voltage
ac voltage
dc current
ac current
resistance
diode test
conductance (1/R)
logic level and continuity detect
temperature (K-type thermocouple)
- Peak hold on voltage and current functions
- Selectable audible indicator for continuity or level detection
- 3½-digit resolution
- 0.1% basic dc accuracy
- LCD display
- Overload protection
- Safety-designed test leads



ELMEASCO
Instruments Pty. Ltd.

P.O. Box 30, Concord, NSW, 2137
13 15 McDonald St., Mortlake, NSW, 2137
Phone: (02) 736 2888, Telex: 25887

P.O. Box 107, Mt. Waverley, Vic. 3149
21-23 Anthony Drive, Mt. Waverley, Vic. 3149
Phone: (03) 233-4044, Telex: 36206

Adelaide: (08) 271-1839
Brisbane: (07) 229-3161
Perth: (09) 398-3362

TV's bionic superman a fake!

... As if you didn't already know. However, with the aid of electronically operated limbs, a bionic man with ordinary human strength is well within possibility.



A small team of electronics technicians at the Fidelity laboratories in Miami specialises in designing and building electronically controlled arms and hands for amputees.

They are also working on a voice-controlled environmental centre for quadriplegics, in which a handicapped or non-mobile person could turn on the TV, change channels, raise and lower the volume, answer the telephone, make calls through the operator, open the door after first screening the visitor through a closed circuit TV and intercom, turn lights on and off, and even make coffee — all through voice-controlled electronic equipment.

Myonic hands and arms are the team's speciality, 'myonic' being similar to the famous bionic, except that in a myonic arm the electrodes are mounted over the muscles outside the arm, whereas in bionics the electrodes are surgically implanted.

The process starts with a cast being made of the amputee's stump. To this are fitted the electrodes, one set on one side of the cast and one set on the other. These electrodes are carefully located so they will be in contact with a muscle in the arm.

Although the hand has been amputated, the brain can still send signals to the muscles; these pulses can be sensed by

the electrodes, and using a battery power pack and a tiny amplifier they are amplified to signals big enough to operate an electrical hand.

In the case of an amputee losing a whole arm, small electrical switches are fitted to a harness that straps on to his back. The shrug of one shoulder will raise and lower the arm, a shrug of the other will open and close the hand. The next step is to incorporate a microprocessor into the circuit to enable the hand to perform many more functions.

According to Henry Sylwestrzak, one of the research workers, "By using a code system the amputee would be able to twist his wrist as well as open and close the hand. There is really no limit to what we will be able to do eventually. It's just a matter of time. We have all the technology now."

So with the help of a myonic hand and arm an amputee may be able to leaf through a book or even drink a can of beer — but he won't become a superman.

"Even if you fitted somebody with a pair of super-strong bionic arms he wouldn't be able to become a superman," said Henry. "If he tried to pull a door off its hinges with his super arms he would pull his human shoulder out of its socket. And if

he tried to pick up a heavy weight that was too big for his body, even though his super arms may be able to cope, his back wouldn't — it would simply break ... There won't be a super bionic man. The limbs have to be graded to the performance ability of the human limbs."

However, apparently NASA, without having built a super man, have created a super suit.

Like Superman, when you don the suit you become ten times more powerful. The suit has motorised arms and legs, operated by electrodes attached to the man's body which pick up the signals from the human muscles. When you bend to pick up a heavy weight the electric motors take over, your arm is carried along by the suit's arm, and you can lift a weight ten times heavier than a man alone could. The human inside the suit simply gives the orders with his muscles and the suit does the work.

NASA developed the suit for spacemen working in outer space, but the technology could no doubt eventually be passed into industry. Imagine a 'superman' on a building site moving enormous rocks or hoisting steel beams and holding them up while others bolted them in place! And in a rescue operation a man in a



super suit could lift machinery, rubble, etc. off trapped victims.

Fidelity, however, leave the superman side of things to NASA. Their latest research area is rather to develop a sensory system for the fingers of their myonic and bionic arms, so that an amputee will to some degree regain a sense of touch.

The idea is to fit strain gauges

in the fingers of the myonic hands, which, when touched, will create a small voltage that is sent back to the muscle. This will induce the sensation of feeling in the hands — just one more step in the fast-growing technology that is improving life for amputees and the handicapped.

Dennis Lingane

IBM eliminates distortion in optical fibres

A new technique developed by IBM can exactly compensate for the broadening of optical pulses caused by dispersion differences in the speed of light of different frequencies in the glass fibres.

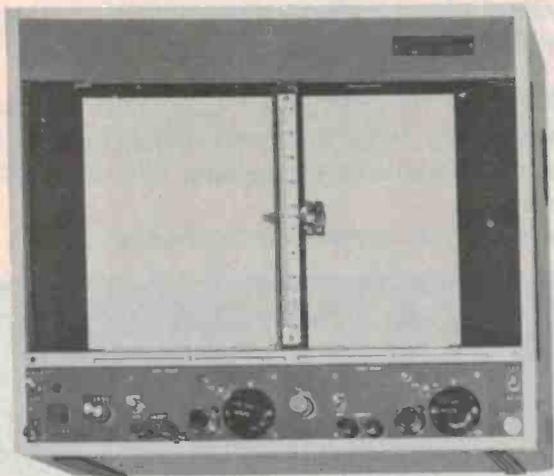
It exploits work done some years ago at IBM on the compression of short laser pulses in alkali metal vapours at frequencies close to an atomic resonance frequency. In this situation the metal vapour is extremely dispersive, but its dispersion is of the opposite sign to that in glass. That is, in glass the longer wavelengths travel faster than the shorter

ones, while in the metal vapours the opposite is true.

The effect in metal vapours is so strong that in the IBM experiments a 50 cm cell exactly compensated for dispersion of some 300 m of optical fibre. By providing for multiple passes through the cell, a cell of modest size could compress pulses travelling over kilometres of fibre.

Riken Denshi general purpose X-Y recorder

The Riken Denshi Model F-3E X-Y recorder features rugged construction, high stability and simplicity of controls, making it suitable for most production and plant testing situations.



A high-efficiency damping circuit, which feeds back a rate signal to the servo amplifier and by a servo-motor generator combines with the usual po-

Halley go home — NASA can't afford you

US President Reagan's decision to cut NASA's budget by US\$241 million for the year beginning October 1981 has meant a severe cutback in NASA's planned operations.

There will be no US probe to rendezvous with Halley's Comet in 1985; the VOIR project to provide detailed mapping of the surface of Venus will be deferred, as will the launch of an earth satellite carrying instruments to measure the gamma ray emission from distant objects; and the provision of a US\$100 million specialised computer for advanced aircraft design for NASA's Ames Research Centre at Moffett Field has been put off indefinitely.

Space agency officials maintain, however, that they will continue to carry out a "vigorous" programme for the exploration of the solar system in spite of these cuts. NASA expects to keep its option to build a fifth Space Shuttle in addition to the four already authorised, and work on the Space Telescope will continue.

Equipment and staff required to receive the signals from Voyager 2 and to process the data will be fully maintained during its encounters with Saturn, Uranus and Neptune (see ETI, April 1981), and the modified Galileo mission to Jupiter involving the launch of an Orbiter and an atmospheric probe in 1985 will also be preserved (see ETI, October 1980 and March 1981).

In 1981 NASA plans to launch ten satellites from expendable launch vehicles from the Eastern Space and Missile Centre, Cape Canaveral, and a further five from the Western Space and Missile

Centre at Vandenberg Air Force Base in California. However, thirteen of these fifteen missions will be for US government agencies and commercial companies, and NASA will be fully reimbursed for the cost of the launch and related services.

The two NASA-funded scientific payloads are the Dynamic Explorer, set for a July launch by a Delta rocket, and the Solar Mesospheric Explorer, scheduled for launching in September, also from a Delta rocket.

The thirteen cost-reimbursable launches comprise: two weather satellites for the National Oceanic and Atmospheric Administration, three missions for the Department of Defence, and eight geosynchronous communications satellites. These last will be four launches of INTELSAT vehicles for international telecommunications, two launches for RCA, one for Satellite Business Systems (which provides business communications across the USA), and one launch for the Comsat General Corporation.

In addition, the success of the two-day Space Shuttle flight in April has led NASA to plan at least one further launch of this reusable vehicle in 1981. Unfortunately the unexpectedly high cost of the space Shuttle (which is of considerable military significance) has resulted in a noticeable reduction of NASA's budget in purely scientific work.

Brian Dance

sition feedback signal to produce a pen motion which is rapid yet offers high resolution.

The F-3E may be mounted horizontally or vertically, and its specifications include 250 x 180 mm chart, 0.5 s response, $\pm 0.1\%$ resolution, accuracy $\pm 0.3\%$, linearity $\pm 0.2\%$.

For further information contact John Morris Scientific Pty Ltd, P.O. Box 80, Chatswood NSW 2067, (02)407-0206; 21 Stud Rd, Bayswater Vic. 3153, (03)720-2311; 50 Campbell St, Bowen Hills Qld. 4006; 29 Stephen St, Norwood SA 5067; 12 Aberdeen St, Perth WA 6000.

We're viewing the 80's on a greater scope.

BWD have combined the expertise of highly qualified personnel with a dynamic management team to forge ahead stronger than ever before. The strength of our future is reflected in the ever increasing demand for our high quality instruments. A policy of continuous development assures a constant output of original and innovative designs for both general and specialised needs. BWD manufacture first class instruments, widely accepted for their simple, functional designs that can out-perform far more complex competitive products.

In the fields of research, design, education and servicing, BWD provide a wide range of instruments from pure electronics to power line systems... and this range will be rapidly expanded throughout the 80's.

1. BWD 880 POWERSCOPE 4 independent differential channels for measurement of phase, voltage and current, across non-isolated power line equipment.
2. BWD 845. Variable persistence storage dual trace, delayed sweep oscilloscope. 30MHz bandwidth, 1mV/div sensitivity with $\pm 10\text{m}/\mu\text{Sec}$ writing speed, auto erase and store. Mains or battery operation.
3. BWD 820. Versatile portable oscilloscope. Dual trace or differential 25MHz bandwidth. 2mV/div sensitivity DC coupled X-Y-Z operation.
4. BWD 603B 'MINI-LAB'. A portable laboratory instrument combining 5 power supplies, 2 amplifiers, a wide range function generator and sweep ramp in a single unit.
5. A range of power supplies with fully adjustable outputs up to 72 Volts 5 Amps and 18 Volts 12 Amps.
6. BWD 804 single beam, with isolated ground, 10MHz oscilloscope. Internal or External trigger with auto or level select.
7. BWD 540 portable dual trace 100MHz oscilloscope. 5mV/div sensitivity with delayed trigger or sweep. Mains or battery operation.



BWD INSTRUMENTS Pty. Ltd.

Miles Street, Mulgrave, Victoria, 3170. Phone (03) 561 2888

DISTRIBUTORS:

Victoria	BWD Instruments Pty. Ltd. Ph: 561 2888	Queensland	LE. Boughen & Co. Brisbane Ph: 36 1277
New South Wales	Amalgamated Wireless (A/sia) Ltd. Sydney Ph: 888 8111	Western Australia	Warburton Frankl. Perth Ph: 277 7000
New South Wales	George Brown & Co. Pty. Ltd. Sydney Ph: 519 5855	Tasmania	D & I Agencies Hobart Ph: 23 2842
South Australia	Pratronics Pty. Ltd. Adelaide Ph: 242 3111	New Zealand	W. Arthur Fisher Limited. Auckland Ph: 59 2629



OPAL 2000 Based on the Z80, this Microcomputer system is supplied with 64K RAM, fully implemented I/O for a Serial Printer and Serial Terminal. The system uses 2 x QUME Drives with a total online capacity of 2.4 megabytes (formatted). The operating system is CP/M 2.2. OEM enquiries are welcome. The power supply is locally manufactured for 240 volts.

NDKS-4000 The NDK S-4000 printer is ideal for all applications involving high volume wordprocessing where sustained print quality and reliability are of paramount importance. The printer produces wordprocessing quality output at 75 characters per second and draft at 150 characters per second. Super and subscripts are included along with full Greek character set and mathematical symbols for scientific printing applications. The printer is capable of full page graphics.

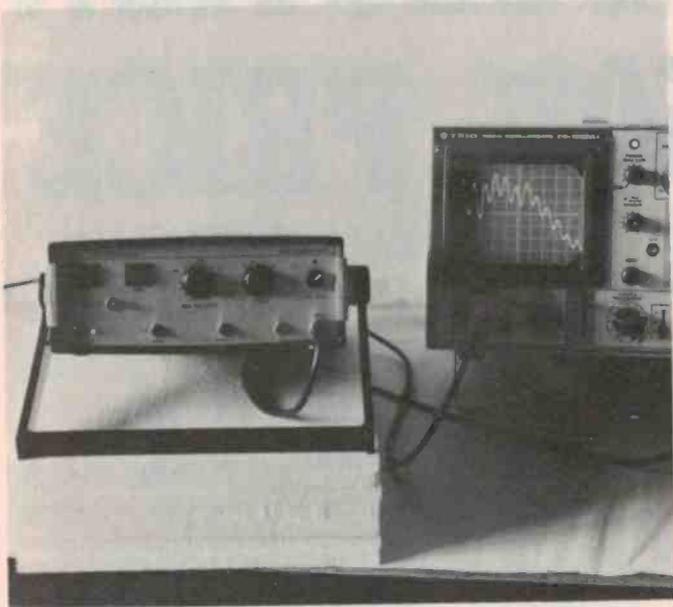
WORDSTAR/MAILMERGE John F Rose Computer Services announce a new release of WORDSTAR/MAILMERGE. Version implements horizontal scrolling with a column move feature thus enabling construction of multi-column pages of text. This new version is compatible with SPELLSTAR (spelling dictionary with 20,000 words plus user defined terms).

We supply a full range of Systems and CP/M software as described in our catalogues.

JOHN F. ROSE COMPUTER SERVICES PTY. LTD.

33-35 ATCHISON STREET, ST. LEONARDS, N.S.W., 2065, AUSTRALIA.
TELEPHONE: (02) 439 1220 TELEX: AA 27901

SEND \$1.00 FOR OUR HARDWARE CATALOGUE. SEND \$5.00 FOR OUR SOFTWARE OMNIBUS.



Low-cost transient recorder

Applied Measurement Aust. Pty Ltd has recently been appointed Australian agent for Epic Instruments of USA. Featured in Epic's range is the Wavesaver, a device for capturing analogue signals and displaying them on a CRO or plotter.

The incoming signal is converted to digital information and stored in memory at speeds up to 2 uS/sample. From here, the stored data can either be output directly to computer or converted back to analogue for display on a CRO at 10 ms repetition, or plotted over 20 seconds.

A major advantage of this type of recording is that data either before or after the trigger point can be captured.

Applications include power

line transient monitoring, explosion recording, shock and vibration testing, chemical kinetics, medical research etc.

Whilst the Wavesaver is by no means the first instrument of its type to become available, Applied Measurement claim it represents a big breakthrough in cost.

For further information contact Applied Measurement Aust. Pty Ltd, 47a Kamak Road, Ashburton Vic 3147. (03) 25-8844.

New digital panel meters

A new range of 3½ and 4½-digit DPMs has been released by Xebec, represented here by Alfatron of Victoria.

The XE-1000 series DPMs are of modular construction and offer high reliability, light weight and easy installation.

Compact designs can be achieved as most of the units measure only 25 mm or 35.5 mm in depth.

All models operate from a single 5 V supply and feature auto-zero, over-range display, sample and hold circuitry,

automatic polarity detection and a single interface connector situated at the rear of each unit.

Optional features such as digital output, use of differential input signals and low power LCDs are available in the new range.

For more details, contact Alfatron Pty Ltd, 1761 Femtree Gully Rd, Femtree Gully Vic 3156. (03)758-9551.

Computer programs on shortwave!

Radio Nederland's External Service broadcasts a weekly communications magazine programme, 'Media Network', in English to a world-wide audience on a range of frequencies.

On Thursday, September 10 1981, the subject of the programme is to be microcomputing, and included will be a short computer program broadcast in machine readable form over the air — quite an innovation!

Provided signal strength is sufficient in the listener's area, it is hoped that the computer program may be recorded on to cassette tape and played back into a home computer. Preliminary experiments have indicated that the system should work, but the purpose of the experiment on September 10 is to gauge whether atmospheric noise is low enough in most of the target areas. If successful, the idea might be repeated on a regular basis.

Radio Nederland has two relay stations, in Bonaire in the Caribbean and in Madagascar, which should ensure a strong signal in the major target areas.

Three computer programs will be transmitted, to be compatible with Tandy Radio Shack, Apple, and Commodore PET micro-computers. They will go on the air at the following times and frequencies:

GMT	SW Frequency (kHz)	Target area
07.47	9770, 9715	Australasia
08.47	9715	Australasia
14.47	11735, 15560, 21480	South-east Asia

The time shown is the beginning of the 'Media Network' programme, which runs for 30 minutes. The programme regularly looks at developments in the broadcasting world, both from a technical and programming viewpoint, reviews equipment, transmits reports from correspondents throughout the world, etc. Its main response is via listeners' letters and phone calls, and the nine editions of the programme reach a wide audience.

Listeners to the September 10 broadcast are encouraged to try out the computer program and write in to Media Network reporting their results, etc. Write to: Computer Experiment, Media Network, Radio Nederland, P.O. Box 222, 1200 JG Hilversum, Holland.

THE ETI-477 MOSFET AMP IS NOT UNSTABLE

... If you build it the way we described, that is. However, some readers have reported difficulties with the amplifier going into high frequency oscillation. There are two reasons for this. If capacitor C9 (220n greencap) has a high self-inductance it will not look like a capacitor, the amplifier output will be unloaded at high frequencies and oscillation will result. We found 'Elna' 630 V greencaps have a low inductance and the amp is not unstable using them.

Secondly, if resistors R25 and R27 have more self-inductance than the 'Noble' types we used, then the output stage may be unstable. There are two cures for this one. Either replace R25 and R27 with Noble types or connect a 47n greencap between the sources of Q9 and Q11. This is best done on the copper side of the board, mounting the capacitor between the two pads where the leads of each resistor go to the sources of Q9 and Q11.

THE 100% SOLUTION FOR THE 50% PRICE*

We at Magmedia believe that VERBATIM'S new Datalife 8" and 5" Floppy Diskettes — now made here, in *Australia!* — are the best in the world.

With 7 shielding improvements, 100% TESTED, 100% CERTIFIED, 100% WARRANTED, we think you'll believe it too — buy a box — you've got nothing to lose but your diskette problems.



Verbatim flexible diskettes now have 7 data shielding improvements that will deliver a longer lifetime of trouble-free data recording storage and retrieval than ever before possible.

SATISFACTION GUARANTEED

	NORMAL PRICE	DISCOUNT PRICE
8" Hard/Soft Sector — Single Sided, Single Density	\$4.50	\$2.25
8" Hard/Soft Sector — Single Sided, Single Density — Critically Tested.	\$5.00	\$2.50
8" Hard/Soft Sector — Single Sided, Double Density	\$5.00	\$2.50
8" Hard/Soft Sector — Double Sided, Double Density	\$6.00	\$3.00
5 1/4" Hard/Soft Sector — Single Sided	\$4.40	\$2.20
5 1/4" Hard/Soft Sector — Double Sided	\$5.00	\$2.50
5 1/4" Hard/Soft Sector — Quad Density (77 Track)	\$5.00	\$2.50

SPECIAL BONUS
PLASTIC BOX SUPPLIED WITH EACH ORDER OF 5 1/4" FLOPPY AT NO EXTRA COST

Note: Add 15% Sales Tax Plus \$1.00 for postage if applicable.

Note: There is a limited order of 1 box only of each type of Disk.

*OFFER CLOSSES: 30 SEPTEMBER, 1981 BY ORIGINAL COUPON ONLY

MAIL OR PRESENT COUPON TO:



magmedia

SYDNEY

5 APOLLO PLACE
LANE COVE NSW 2066
Phone (02) 428-1100 Telex AA22703

MELBOURNE

100 PARK STREET
SOUTH MELBOURNE VIC 3205
Phone (03) 699-9688 Telex AA35968

BRISBANE

123 LEICHHARDT STREET
BRISBANE QLD 4000
Phone (07) 229-1941 Telex AA42367

CANBERRA

25 LONSDALE STREET
BRADDON ACT 2601
Phone (062) 48-6751 Telex AA22703

ORDER FORM: Please supply the following: (Tick appropriate boxes)

SIZE... 8" ... 5"

SECTORED... SOFT... HARD

... 10... 16... 32

DENSITY... SINGLE... DOUBLE... QUAD

SIDES... SINGLE... DOUBLE

STANDARD CERTIFICATE

CRITICALLY CERTIFIED

NAME _____

COMPANY NAME _____

ADDRESS _____

POSTCODE _____

TYPE OF SYSTEM _____ USUAL BRAND OR TYPE

CASH CHEQUE COMPANY ACCOUNT BANKCARD

PHONE NUMBER _____ SIGNATURE _____

BANKCARD No _____ EXPIRY DATE _____

ETI/8/81

Peninsula to be antenna for ultra-low frequencies?

Transmissions at ultra-low frequencies (perhaps 10 Hz to 0.005 Hz) have aroused interest because of their possible military applications.

One such application could be communication with submerged submarines, but workers at Stanford University are more interested in the radiation at such frequencies, which seems to come from outer parts of the radiation belts of the earth. For either type of application at such very low frequencies the main requirement is a huge transmitting or receiving antenna, since the wavelength is about the distance of the moon from the earth.

Initial work by Fraser-Smith was carried out using a small peninsula near Cape Cod, Massachusetts, with 300 m of wire across the neck of the peninsula, each end of the wire being attached to copper sheets 0.45 m² immersed in the sea water. As sea water conducts electricity quite well, the current is forced to flow around the peninsula in an approximately elliptical path, which defines the current loop. A receiver at the middle of the wire picked up signals from space.

Further tests were carried out using aluminium wire stretched

across the same peninsula and attached to large galvanised iron pipe sections some 180 m apart. The low frequency alternating current was produced through the use of four automobile starter relays connected to two 12 V batteries. It was found that an aircraft flying at heights between 160 m and 320 m above the peninsula could detect the signals.

The team now hope to repeat the experiment using a far larger peninsula, about the size of Cape Cod. The construction of a conventional antenna of the required dimensions is out of the question owing to the huge cost which would be involved. The recent work was funded by the National Science Foundation with the help of the US Navy, which is very interested in the possible use of ultra-low frequency waves as a possible future way of communicating with submarines.

Fraser-Smith is especially interested in the slow warbling currents from space, which he detects with a huge antenna by recording them onto tape and

playing them back at a much faster tape speed. Although there is a well-developed theory for the origin of these pulsations, the theory has not yet been tested. Fraser-Smith is interested in the possibility of using a large enough peninsula as an antenna so as to be able to transmit ultra-low frequency signals to the radiation belts on nights when the warbling currents are absent, in order to see if the particles in the belts interact with the transmitted signals in the way predicted by the theory.

For this work a high-power system would need to be situated in a peninsula which has a low population density (since the high field could generate some electric shocks to bathers!). The Russians are reported as having used a peninsula antenna to generate an ultra-low frequency magnetic field which could be measured some 750 km away, but it is thought they employed magnetohydrodynamic portable generators.

Although ultra-low frequency waves can penetrate deeply into the oceans, communications data rates would be very limited.

Brian Dance



Subminiature switches for pcb use

NKK (Nikkai) recently released a new 'washable' range of miniature switches, called the Circuitboy range, suitable for pcb mounting.

The range is available in standard, short, flat and straight-flat toggle, with straight, right-angled, vertical and straight-support bracket terminations. Other features include:

- Water repellancy — the switches can be cleaned with water or lime solution of solvent as they are hermetically sealed to prevent dust, flux and other contaminated substances from entering into the mechanism;
- Contact mechanism and switching mechanism operate independently;
- The incorporated self-contact cleaning will ensure a high degree of contact reliability;
- Contact bounce is 2 ms or less;
- Continuous mounting to pcb;
- Contact area plated with a film of gold under gold strike;
- Contact rating is 0.4 VA max, 28 V max, ac/dc.

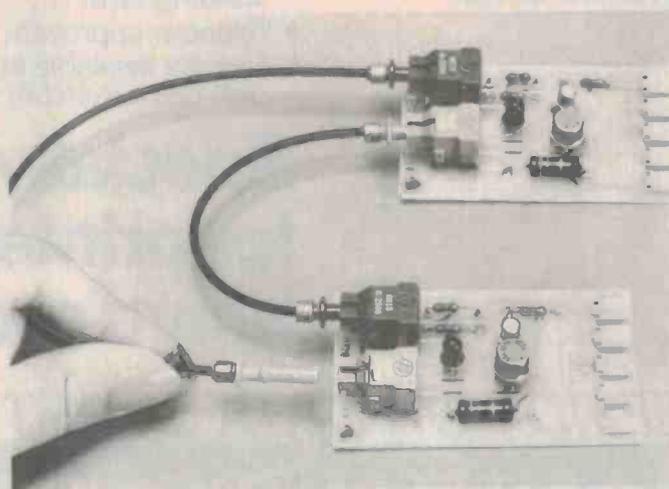
A complete technical catalogue is available on request from Instant Component Service, 248 Wickham Rd, Moorabbin Vic. 3189. (03) 555-9566.

HP fibre optic link

The new Hewlett-Packard HFBR-0500 snap-in fibre optic link is TTL compatible, fully guaranteed, and available for only \$59.95 (NZ\$66).

It is supplied, in kit form and as discrete units, with all the elements of the link including transmitter, LSTTL/TTL compatible receiver, 1 mm core diameter plastic fibre in bulk or terminated lengths, connectors and a polishing kit.

It can be used for low-cost, short length inter- or intra-system data links to solve common mode or high-voltage isolation problems, and may also be useful in educational institutions due to its low-cost cable and connectors, ease of interfacing with other circuits



and easily viewed light output from the cable.

In quantities of one to 99 the

HFBR-0500 snap-in fibre optic link kit is \$59.95, and is stocked by VSI Electronics Pty Ltd.

ARLEC 75000 SERIES

P.C.B. TRANSFORMERS

Ideal for electronic instruments, power supplies, emergency lighting systems, industrial control circuits etc.



Features

- Designed to suit standard 0.1" P.C.B. grid.
- Lightweight and convenient. Simply solders into position.
- Insulated to Australian standard C 126.
- Low price.

Dimensions

All dimension in mm.

Size	1VA	2/3VA	5/7VA	10/12VA
Width	30	35	41†	48
Depth	25	30	33†	40
Height	26	30	31	36
Weight	70gm	90gm	150gm	260gm

†May also be supplied as 43x36

- Available in 7 ratings — 1, 2, 3, 5, 7, 10 and 12 V.A.
- Can be supplied in multi-tapped or dual winding form.
- Telecom approved.
- Readily available in large or small quantities (min 50).

Specially designed for printed circuit board mounting.

SEND FOR DATA SHEET

ARLEC

QUALITY PRODUCTS

A & R ELECTRONICS PTY. LTD.

A MEMBER OF THE A & R SOANAR ELECTRONICS GROUP

30 Lexton Road, Box Hill, Vic., 3128, Australia. Telex: 32286

VICTORIA: 89 0661
N.S.W.: 789 6733
S.T.H. AUST.: 51 6981
QUEENSLAND: 52 1131
WEST. AUST.: 381 9522
TASMANIA: 31 6533

Electronic distance measurement for industrial and scientific applications

This new distance meter features a transducer mode in which it measures the distance to a moving target nine times per second for output to a computer or other controller.

David E. Smith

This article is reprinted with permission from Hewlett-Packard Journal, June 1980, Volume 31, No. 6.

UNTIL NOW, electronic distance measurement (EDM) has mainly benefited the land surveyor. EDM instruments with the ability to measure several kilometres with millimetre resolution have vastly improved the surveyor's efficiency, productivity, and measurement reliability⁽¹⁾. These benefits are now made available to the industrial and scientific user by a new Hewlett-Packard EDM instrument, Model 3850A Industrial Distance Meter (Figure 1).

The 3850A measures distance to a target optoelectronically, using an infrared light beam. It measures the one-dimensional positions not only of stationary targets but also of moving targets with velocities up to 1600 metres per second. The instrument supplies elapsed time in addition

to position data at nine measurements per second. When it is interfaced with a computer, noncontact measurements of the target's position can be made, and the target's velocity and acceleration can be computed. The 3850A's wide dynamic range makes measurement of the position and velocity of an aeroplane 8000 metres away as practical as controlling the position of an industrial crane to a resolution of 0.001 metre.

Electronic distance measurement technique

The 3850A uses phase measurement of a modulated infrared beam to measure distance to a retroreflector target. Unlike interferometric distance measurement, which detects changes in a target's position⁽²⁾, the phase measurement technique provides ab-

solute distance measurements, independent of optical path interruptions.

The infrared light beam is modulated at one of three frequencies: 15 MHz, 375 kHz or 3.75 kHz. These frequencies have corresponding modulation wavelengths of 20 metres, 800 metres, and 80 kilometres respectively. Since the light beam is transmitted to the retroreflector and back, the effective modulation wavelengths, λ_e , are half the actual wavelengths. As the retroreflector moves from 0 to λ_e metres from the 3850A, the phase of the received signal with respect to the transmitted signal varies linearly from 0 to 2π radians. For multiples of λ_e , phase measurements roll over, varying from 0 to 2π radians as the retroreflector moves from $n\lambda_e$ to $(n+1)\lambda_e$, where ▶

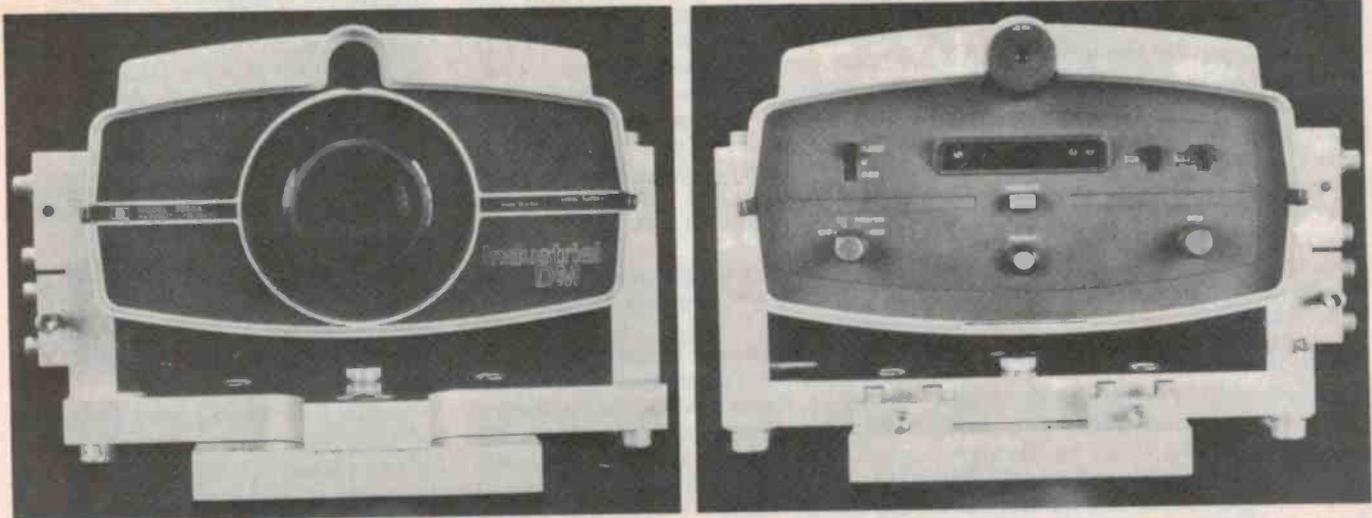


Figure 1. Model 3850A Industrial Distance Meter measures distances to stationary or moving targets using rugged field-proven technology. Its

input/output capabilities include extended remote programmability and data output at nine measurements per second.

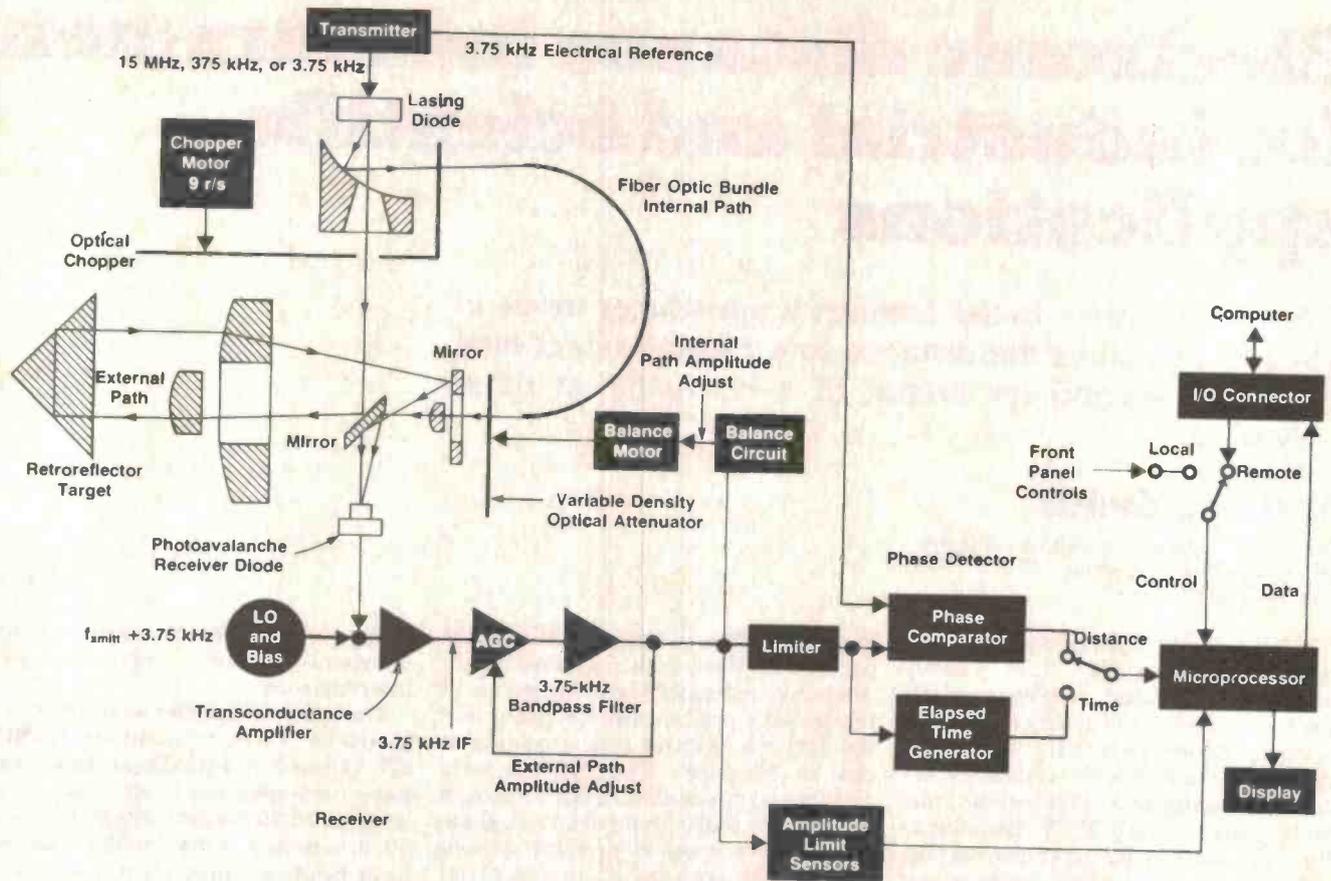


Figure 2. Simplified block diagram of Model 3850A Industrial Distance Meter. The phase difference between the external and internal paths represents the distance to the target. The microprocessor performs computation, control, and input/output functions.

$n = 1, 2, \dots$ To obtain an absolute distance measurement the 3850A measures the phase of each modulation frequency and merges the three readings into one.

The 3850A measures phase with a resolution of 0.6 milliradians (0.04 degree). This high resolution dictates maximum suppression of any drift in the instrument's electronics. To suppress drift, the 3850A employs two optical paths, generated by splitting the infrared light beam into an internal fixed path and a variable-distance external path. Any phase shift caused by the electronics is common to both paths. The 3850A measures the phase of the internal path and subtracts this reading from each external path reading. Thus the common-mode phase drift is subtracted out.

What's inside

All measurement signals in the 3850A start at the transmitter (see block diagram, Figure 2). A temperature-compensated crystal oscillator (TCXO) establishes the instrument's reference transmit frequency of 14 987 090 Hz. This frequency determines the overall distance scale factor, and its stability

determines the 3850A's accuracy at long distances. The TCXO's output is stable to within ± 1 ppm over the 3850A's operating temperature range of 0°C to $+55^\circ\text{C}$. Maximum drift is $< \pm 1$ ppm per year, guaranteeing long-term accurate operation.

The output of the TCXO is divided down to produce the other two transmit frequencies, 375 kHz and 3.75 kHz. Under processor control, these signals are multiplexed to the lasing diode driver. The lasing diode assembly (Figure 3) is a proprietary device developed for HP distance measuring instruments. The diode produces approximately 1.4 mW of infrared optical power at a wavelength of 840 nm. This output is stabilised by an optical feedback loop built into the diode assembly.

The output of the lasing diode is split into external and internal optical paths using an annular ellipsoidal reflector. The centre of the diode's diverging beam passes through a hole in the reflector to become the external path. The rest of the diode's output is focused by the reflector's ellipsoidal surface onto the end of a fibre optic bundle to become the internal path. An optical chopper ro-

tating at nine revolutions per second continuously alternates between paths for processing by the receiver.

During the external path time (when light to the fibre optic bundle is blocked by the chopper) the diode's beam is reflected by a 45° mirror and passes through the transmitter lens. This lens collimates the transmit beam, reducing its divergence to within 0.9 milliradians. The maximum optical power of this transmit beam is $60 \mu\text{W}$, well within safe limits for the human eye.

The transmit beam is reflected by a retroreflector attached to the target. The returning beam passes through the receiver lens and is reflected by an annular mirror and the back of the 45° mirror onto the receiver diode. Depending on the distance to the target and atmospheric conditions, the amplitude of the optical signal at the diode can vary from 60 nW to 20 pW.

During the internal path time (when light to the transmitter optics is blocked by the chopper) light travels through the fibre optic bundle. The bundle's output passes through a variable-density rotary attenuator that can be rotated by a motor to equalise the internal and external path optical signal

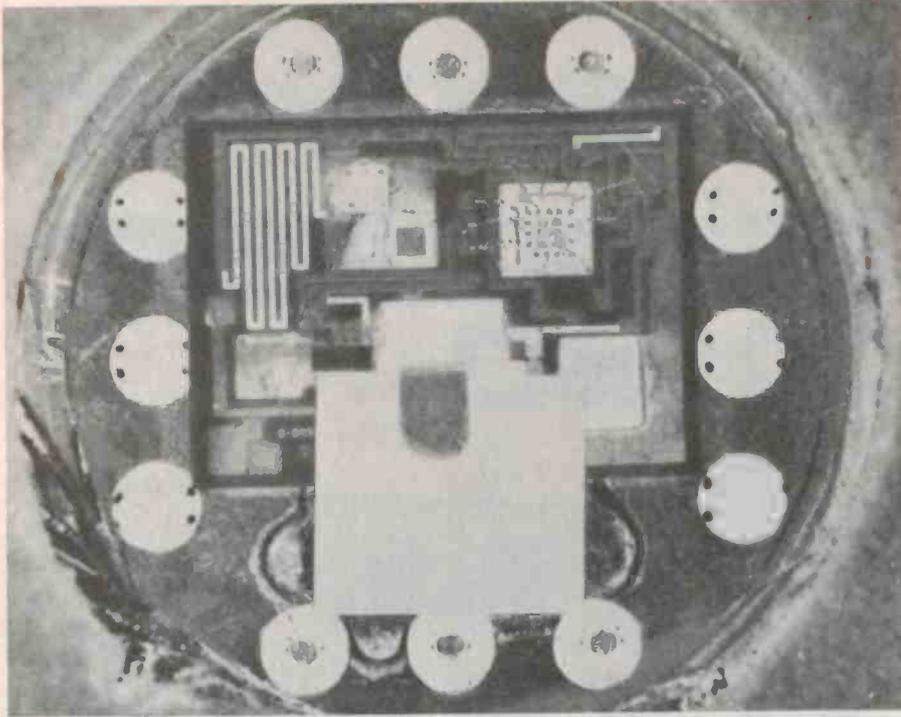


Figure 3. The optical source in the 3850A is a proprietary HP solid-state lasing diode. An on-board optical feedback loop stabilises the output power.

amplitudes. The equalised output from the attenuator is then focused by the optics onto the receiver diode by reflecting off the back of the 45° mirror.

To recap, at the receiver diode we have two optical signals that alternate at 55.5 ms intervals. One signal represents the length of the external, variable path, while the other signal represents the length of the fixed internal path.

The purpose of the photoavalanche receiver diode is threefold. First, the diode converts the optical signal into an electrical current. Second, by means of photoavalanche action the diode amplifies this current by a factor of 35. Third, an electrical current generated by local oscillators is applied to the diode to mix the 15 MHz and 375 kHz signals down to the receiver's 3.75 kHz intermediate frequency. Since phase information is preserved in the mixing process, the 3850A's phase detector can operate at a low frequency to produce high-resolution results.

The 3.75 kHz current at the receiver diode's output is converted by a transconductance amplifier to a proportional voltage. This is applied to an AGC stage with a dynamic range of 80 dB. The gain of the AGC stage is adjusted to compensate for external path amplitude variance. The output of the AGC stage passes through a four-pole active bandpass filter with a Q of 12.5. The resulting 3.75 kHz sine wave signal is then processed by the limiter.

The amplitude of the external path signal may vary greatly. The heat shimmer that a person observes on a warm day distorts not only visible light but also infrared. These perturbations of the atmospheric index of refraction tend to disturb the transmit beam, sometimes deflecting it off the target at long distances. This deflection results in up to 100% amplitude modulation of the received signal. To avoid processing data that is outside the limiter's 23 dB dynamic range, amplitude sensors monitor the receiver's output. These sensors tell the processor when the signal is in-bounds. The sensors also monitor the receiver output amplitude on the internal path. This information is used by the balance circuit to equalise the internal path amplitude by means of a motor-driven variable-density attenuator.

The limiter acts as a precision zero-crossing detector to 'square up' the receiver's output. This square wave is sent on to the phase detector.

The phase detector has several functions. It compares the phase of a 3.75 kHz electrical reference from the transmitter with the phase of the internal and external signals. The average of 50 phase comparisons on each path is transferred to the processor, which takes the difference between successive internal and external comparisons. This difference eliminates common-mode phase drifts and yields the true distance to the

target. The phase detector also generates time data for use with moving targets. A time mark signal is issued during the 50 phase comparisons on the external path. The leading edge of this mark indicates precisely when the instrument is measuring a stationary or moving target's position. Also, the elapsed time between successive external path comparisons is accumulated and transferred to the processor.

The processor, like the phase detector, is a multifunctional block. It accepts programming inputs from either the front panel or the remote I/O connector. All key signal timing in the instrument is processor controlled. Moreover, the processor processes distance information differently depending upon which operational mode is selected.

In the distance instrument (DI) mode the processor sequentially averages measurements in all three resolution functions (i.e. using all three modulation frequencies). It takes the three averages, merges them into one number representing the absolute distance, and corrects for instrument offset and atmospheric scale factor. The resulting number goes either to the display or the I/O connector.

In the distance transducer (DT) mode the processor outputs raw distance, elapsed time, and status information directly to the I/O connector. It allows the external computer to select either raw distance or signal strength using any of the three resolution functions. The processor also generates status digits containing information from the amplitude sensors at the receiver's output.

Extended remote programmability

Although digital output is not unique to the 3850A, the new instrument is the first HP distance meter to be remotely programmable. Not only are the 3850A's major front-panel controls programmable, but the powerful distance transducer mode has been added for measuring moving targets. In this mode the 3850A outputs 14 digits of information about the target to a computer at a rate of nine measurements per second. Four of these digits represent the target's position. Five digits represent the elapsed time since the previous measurement and may be used by the computer to calculate target velocity and acceleration. The last five digits represent the mode and function programmed and the status of the optical path. The optical path status digit can warn the computer immediately of an obstruction in the optical path, a necessity if the 3850A is used as the position transducer in a closed-loop ▶

**YOUR NEAREST
Sinclair
ZX80**

DEALER IS

NEW SOUTH WALES
City Personal Computer,
75 Castlereagh Street,
Sydney, NSW, 2000.
Phone 233-8992.

Emona Enterprises Pty. Ltd.,
Suite 206/611 George Street,
Sydney, NSW, 2000.
Phone 212-4815.

Electron 2000,
181 Wharf Road,
Newcastle, NSW, 2300.
Phone (049) 26-2918.

David Reid Electronics Pty. Ltd.,
127 York Street,
Sydney, NSW, 2000.
Phone 29-6601.

A.C.T.
Computer World,
Shop G71,
Gallery Level,
Woden Plaza, A.C.T., 2606.
Phone 81-1368.

ALBURY
Minit Computer Service,
530 Kiewa Street,
Albury, NSW, 2640.
Phone 21-5933.

SOUTH AUSTRALIA
Acuis Trading,
185 Pirie Street,
Adelaide, S.A., 5000.
Phone 223-1900.

VICTORIA
Minit Computer Service,
119 McCrae Street,
Bendigo, Vic., 3550.
Phone 43-2589.
David Reid Electronics Pty. Ltd.,
356 Lonsdale Street,
Melbourne, Vic., 3000.
Phone 602-4673.
Radio Parts Group,
562 Spencer Street,
West Melbourne, Vic., 3003.
Phone 329-7888.
Rod Irving Electronics,
425 High Street,
Northcote, Vic., 3070.
Phone 489-8131.

QUEENSLAND
Datacom,
101 F.E. Walker Street,
Bundaberg, Qld., 4670.
Phone (071) 71-4740.
Software 80,
200 Moggill Road,
Taringa, Qld., 4068.
Phone (07) 371-6996.

WESTERN AUSTRALIA
Micro-Base,
127 Fitzgerald Street,
Perth, W.A., 6005.
Phone 328-9308.

**expand your
Sinclair
ZX80**

8K ROM \$75
16K RAM \$150
available now!

**The perfect way to upgrade
your Sinclair ZX80 inexpensively.**

**CASSETTES, BOOKS ... and FLICKER FREE,
REAL TIME MOVING GRAPHICS**

- BREAKOUT • LUNA LANDER • SPACE BATTLE • PING PONG •
- GRAPHICS • MUSIC • HEXADECIMAL • ACTIVE DISPLAY • MOVIES •

No modifications to hardware whatsoever. All software is thoroughly tested and claimed to be the most advanced developed so-far. Games are written in machine code to make maximum use of memory and provide continuous live action without loss of TV synchronisation. All programs run in 1K memory unless otherwise stated.

ORDER FORM: SINCLAIR EQUIPMENT (AUSTRALASIA) PTY. LTD.
86-88 Nicholson Street, Abbotsford, Victoria, 3067. Telephone 419 3033.

Quantity	Item	Item Price	Total
	Ready-assembled Sinclair ZX80 Personal Computer(s) Price incl. ZX80 BASIC manual, excl. mains adaptor	\$199.00	
	Mains Adaptor(s) (600 Ma at 9V DC Nominal unregulated)	\$ 16.00	
	8K ROM	\$ 75.00	
	16K RAM	\$150.00	

I enclose cheque/Bankcard/Diners Club/Amex

Name _____

Address _____

Postcode _____

SPECIAL

sinclair

down to amazing
new low price

was
\$295

NOW

\$199

Remember — all prices shown include sales tax, postage and packing. N. B. Your Sinclair ZX80 may qualify as a business expense.



Until now, building your own computer could cost you around \$600 — and still leave you with only a bare board for your trouble. The Sinclair ZX80 changes all that. For just \$199 you get everything you need including leads for direct connection to your own cassette recorder and television. The ZX80 really is a complete, powerful full-facility computer matching or surpassing other personal computers costing much more. The ZX80 is programmed in BASIC and you could use it for anything from chess to running a power station.

Two unique and valuable components of the Sinclair ZX80: the Sinclair BASIC interpreter and the Sinclair teach-yourself BASIC manual. The unique Sinclair BASIC interpreter: offers remarkable programming advantages — unique 'one touch' key word entry. The ZX80 eliminates a great deal of tiresome typing. Key words (RUN, PRINT, LIST etc) have their own

single key entry. Unique syntax check. Only lines with correct syntax are accepted into programs. A cursor identifies errors immediately, preventing entry of long and complicated programs with faults only to discover them when you run.

Excellent string handling capability — takes up to 26 string variables of any length. All strings can undergo all rational tests (e.g. comparison). The ZX80 also has string input to request a line of text; strings do not need to be dimensioned. Up to 26 single dimension arrays. FOR/NEXT loops nested up to 26. Variable names of any length. BASIC language also handles full Boolean arithmetic, conditional expressions, etc.

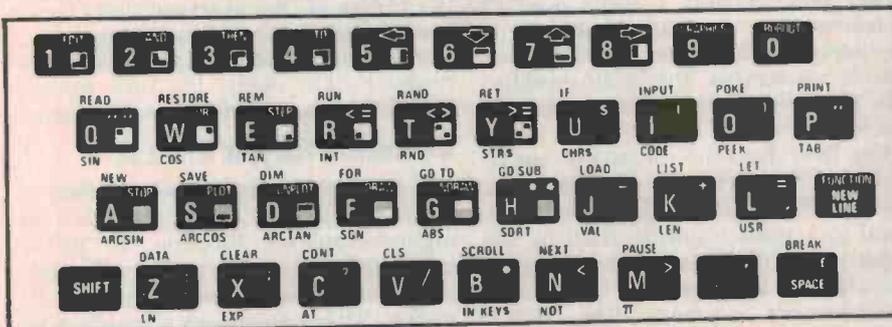
Exceptionally powerful edit facilities, allows modification of existing program lines. Randomise function, useful for games and secret codes. Timer under program control. PEEK and

POKE enable entry of machine code instructions, USR causes jump to a user's machine language sub-routine. High resolution graphics with 22 standard graphic symbols. The Sinclair teach-yourself-BASIC manual 96 page book free with every kit.

Fewer chips, compact design, volume production means MORE POWER FOR YOUR DOLLAR! The ZX80 owes its low price to its remarkable design; the whole system is packed onto fewer, newer more powerful and advanced LSI chips. A single SUPER ROM, for instance, contains the BASIC interpreter, the character set, operating system and monitor. And the ZX80's 1K byte RAM is roughly equivalent to 4K bytes in a conventional computer because the ZX80's brilliant design packs the RAM so much more tightly. (Key words occupy just a single byte). You can add to the memory via the expansion port, giving a maximum potential of 16K.

ZX80 8K BASIC ROM

THE CHIP



A drop-in replacement for the existing 4K BASIC ROM, comes with a new keyboard template and a supplementary operating manual. Designed for high-level, full facility computing.

Available NOW from:
SINCLAIR EQUIPMENT (AUSTRALASIA) PTY. LTD., 86 Nicholson St., Abbotsford, Vic., 3067. Tel. 419 3033.

position control system. The 3850A may be interfaced with computers using the 38001A HP-IB Distance Meter Interface.

The basic measurement system for static and dynamic monitoring applications consists of the 3850A, the 38001A, a 9825S computer and a 62012E power supply. Figure 4 shows the first three of these. Additional HP-IB peripherals such as the 59501A isolated digital-to-analogue converter and the 59306A relay actuator are available to expand the basic system for closed-loop position control applications.

Operational modes

The 3850A may be programmed by the computer to operate in one of three different modes: the distance instrument (DI) mode, the distance transducer (DT) mode, or the self-test mode. The DI mode is used for absolute position measurements on stationary targets. Functions in this mode may be selected either locally by means of the 3850A's front-panel controls or remotely via the I/O connector. Thus a measurement may be initiated either from the 3850A's front-panel MEASURE button or remotely from the computer. Once initiated, the measurement proceeds under complete control of the instrument's microprocessor. After a minimum of nine seconds, the microprocessor outputs a distance measurement accurate to within $\pm(5 \text{ mm} + 1 \text{ mm/k})$ mean square error to either the 3850A's display or the computer. This measurement is a composite of at least 24 raw distance measurements using all three resolution functions.

Another function remotely programmable in DI mode is the environmental correction/return signal strength function. This function allows the user to insert a correction factor for the variation of the speed of light with atmospheric temperature and pressure. This function also allows the operator to observe the strength of the signal being received from the target.

The DI mode is well suited for applications such as surveying where measurement speed is not crucial, targets are stationary, and measurement simplicity is paramount.

Measurement of moving targets requires a fast, flexible operating mode. The distance transducer mode gives the 3850A the capabilities needed to measure the dynamics of a moving target. As mentioned previously, this mode features a high-speed data rate of nine measurements per second. Each measurement consists of four digits of raw distance, five digits of elapsed time between successive measurements, and

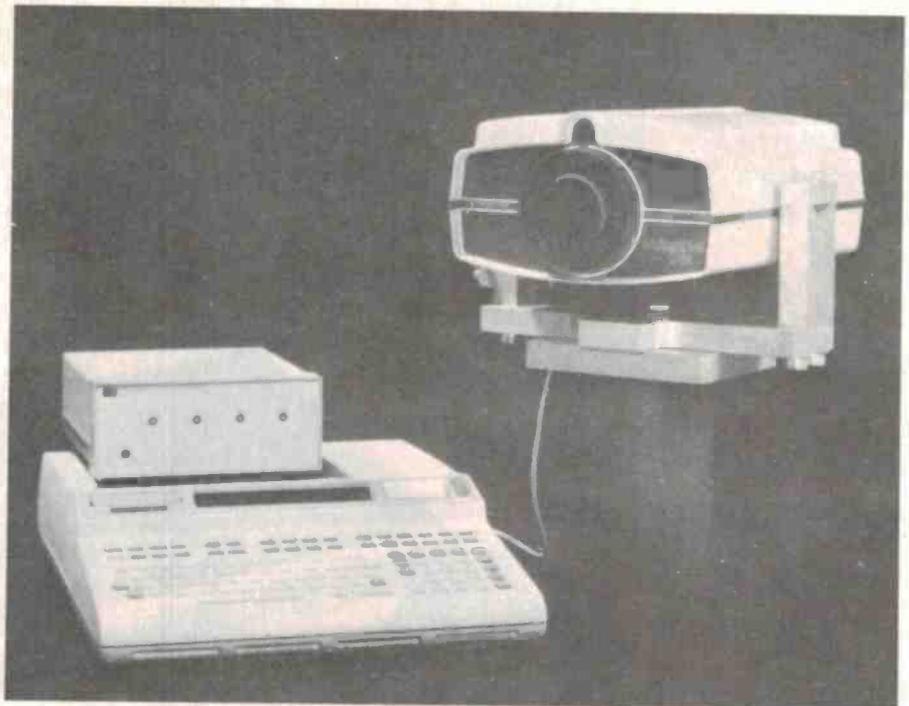


Figure 4. This basic dynamic measurement system can be used for measurements on moving or static targets. For industrial position control applications a digital-to-analogue converter or relay actuator may be added.

five digits of instrument status information. The computer may select distance information using any of the three resolution functions: high (1 mm), medium (40 mm), or low (4 m). In the highest-resolution function the positional accuracy of $\pm(5 \text{ mm} + 1 \text{ mm/km})$ mean square error for target velocities up to 40 metres per second is the same as stationary-target accuracies.

The third operational mode is the self-test mode. The 3850A's integrity may be verified using this mode. When self-test is initiated, the processor executes an internal test to confirm that the distance measuring system is operational. If a failure occurs, one of 32 failure codes is returned to the computer. These codes allow the user to pinpoint instrument failures.

Measuring moving targets

While measurement of a stationary target requires only a static position measurement, measurement of a moving target demands a distance-plus-time measurement. The 3850A specifies this time-distance coordinate pair in two ways.

The first dynamic method of operation is the time sync method. In this case the 3850A's elapsed timer is synchronised to a master system clock by the system controller. The controller resets the elapsed timer at the start of a measurement sequence. The 3850A subsequently outputs the elapsed time between the reset point and the first

distance measurement, the time between the first measurement and the second, and so on. Thus, in spite of the fact that the 3850A measures distance asynchronously, the system controller can determine when each measurement occurs in real time.

The second dynamic method of operation is the triggered sync method. In this case the 3850A outputs a time mark signal whose leading edge coincides with the point in time when the distance measurement is perceived to have occurred. Each distance reading that the 3850A outputs to the computer is composed of the average of 50 phase comparisons at 3.75 kHz on the external path minus the average of 50 phase comparisons on the internal path. Thus the 3850A actually determines the average target position over a 13 ms aperture time, i.e. $50 \times (1/3750)$ s. One might conclude that the leading edge of the time mark should occur at the centre of this aperture time. However, because of an interesting combination of the Doppler effect and receiver filter delay, the time mark's position is predictably skewed in time.

Dynamic target effects

Let us now determine what effect a moving target has on the 3850A. In its highest-resolution function, the 3850A transmits to the target a signal whose effective modulation wavelength is 10 metres. This corresponds to an effective modulation frequency of $\approx 30 \text{ MHz}$. Now assume that the target is moving

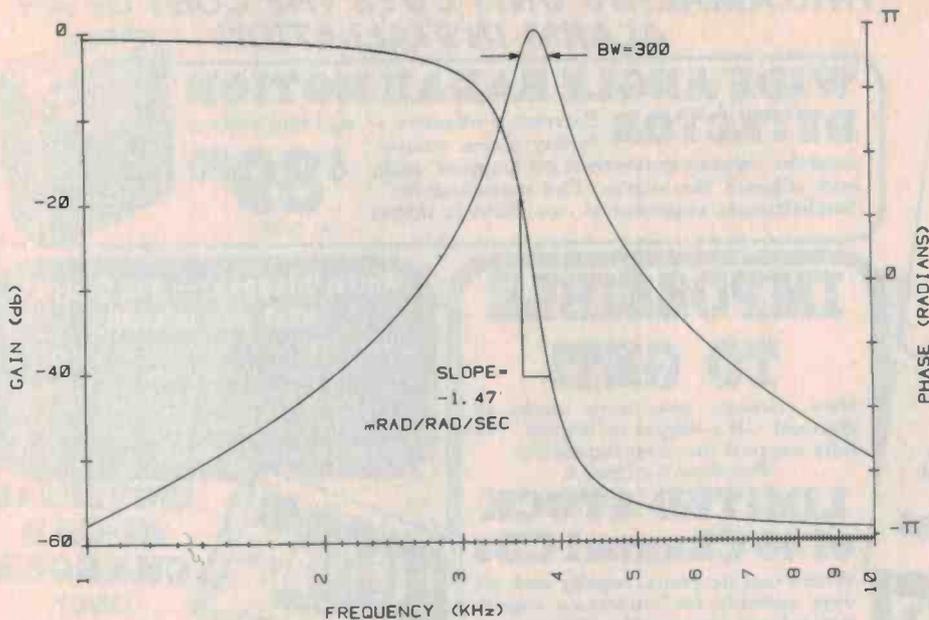


Figure 5. Amplitude and phase characteristics of the 3850A receiver's four-pole IF bandpass filter. The filter delay results in an error proportional to target velocity. This error is compensated internally so the 3850A's distance measurement accuracy is independent of target velocity.

towards the 3850A at a constant velocity of 40 metres/second. Because of Doppler shift, the frequency perceived by the receiver is approximately:

$$f_{rec} \approx \left(\frac{c}{c - \mu_s} \right) f_{trans}$$

where c is the speed of light and μ_s is the target's velocity. Thus:

$$f_{rec} \approx 30 \text{ MHz} + 4 \text{ Hz}$$

and after mixing down:

$$f_{IF} \approx 3.75 \text{ kHz} - 4 \text{ Hz}$$

Although this Doppler shift of 4 Hz does not appear significant, a considerable error is observed when the signal is passed through the receiver's four-pole bandpass filter. At 3.75 kHz \pm 4 Hz this filter exhibits a linear rate of change of phase lag with frequency of 1.47 milliradian/(rad/s), as shown in Figure 5. Since 0.63 milliradian of phase shift represents 1 millimetre of distance, the 4 Hz Doppler shift results in a position error of:

$$X_{Doppler} = 2\pi f_{Doppler} \cdot \left(\frac{1.47 \text{ mrad}}{\text{rad/s}} \right) \left(\frac{1 \text{ mm}}{0.63 \text{ mrad}} \right) \\ = 59 \text{ millimetres.}$$

This result means that for a target approaching the instrument at 40 metres per second, the 3850A will perceive the target to be 59 millimetres farther away than it actually is. Similarly, for a target moving away from the 3850A at 40 metres/second, the instrument observes the target to be

59 mm closer than it is. Must the user account for this error, or can the 3850A automatically correct for it?

The Doppler frequency shift produces a position error equal to approximately (1.47 μ_s) mm if we assume that the time of the average measurement is the centre of the aperture time. To compensate for this, the 3850A time

mark signal has been moved 1.47 ms ahead of the centre of the aperture time. For the target approaching the instrument at μ_s metres/second, its position at the adjusted time mark signal is (μ_s metres/second) \cdot (1.47 ms) or (1.47 μ_s) mm farther away than the position at the centre of the aperture time. Thus the reading that the 3850A produces now coincides precisely with the adjusted time mark signal. Similarly, the same situation exists for receding targets and varying velocities. Thus the 3850A is able to measure the position of a moving target to an accuracy of $\pm(5 \text{ mm} + 1 \text{ mm/km})$ mean square error with no user velocity correction factor.

Dynamic accuracy testing

To prove the dynamic positional accuracy of the 3850A, two special test instruments have been developed. One of these, the dynamic target simulator (DTS), has been used to observe hundreds of thousands of data points for position accuracy. An example is shown in Figure 6. Each data point represents the error between the position of the DTS target at the leading edge of the time mark signal and the 3850A's position measurement. This error is plotted against the target's velocity and a first-order curve is fitted to the data. The extremely small value of the proportionality coefficient is an indication of the 3850A's velocity independence. ►

HP3850A DYNAMIC PERFORMANCE TEST 1

AVE ERROR 0.181 OF 1998 POINTS

STANDARD DEVIATION = 1.173

CURVE FIT:

E (mm) = 0.188mm - 0.021mm/m * VELOCITY m/s

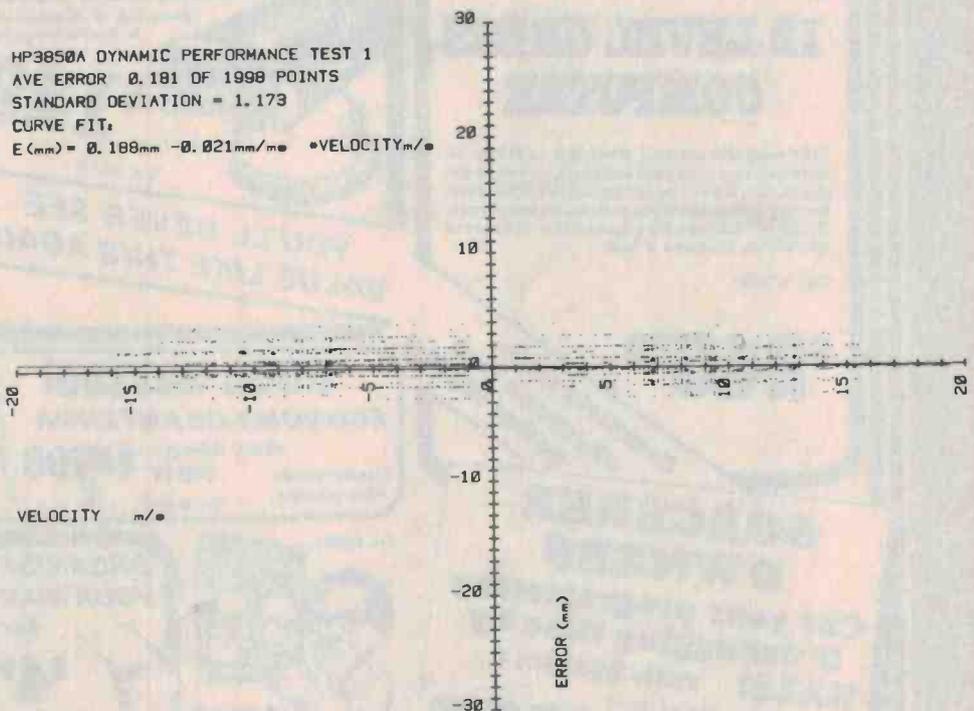


Figure 6. Typical 3850A position accuracy for moving targets. The curve is the average of 1998 data points for one 3850A as measured by a special test instrument, the Dynamic Target Simulator.

NEW!!!

Thirty Programs for the ZX 80

\$12⁹⁵

Cat. B-2359

YES! Written just for the Sinclair ZX-80 and the MicroAce computers: 30 exciting and interesting programs to use and further explore the possibilities of these incredible little computers. No ZX-80 or MicroAce owner can afford to be without this book. Incredible value!

MICROACE INVASION

Yes, Space Invaders program for the ZX-80 and MicroAce. Now you can join in the fun: get zonked by the aliens or shoot them out of the sky!

Cat. X-3585 **\$19.50**

SUPERBREAKOUT

Another fantastic game for the ZX-80/MicroAce. Play this one and find out how good you really are!

Cat. X-3586 **\$19.50**

ANNOUNCING . . .

The winner of our fantastic 'Win a Trip to Hong Kong' competition: Mr Bill White, VK2ZWF



Don't pay \$1,000 or more!

12 LEVEL CHESS COMPUTER

This magnificent and attractive unit has 12 different levels of skill enabling you to learn gradually. It even plays against itself! A must for any professional or serious chess player. You'll have to see for yourself the number of incredible features it has.

Cat. Y-1256

\$245⁰⁰

Complete with chessmen and power supply!

SORCERER OWNERS

Cut your programming & debugging time by **HALF!** with System 3

System 3 is the ultimate toolkit and guarantees to cut your programming and debugging time by AT LEAST half! Once loaded, System 3 gives your Sorcerer 15 new commands, some of which you'd never have thought possible!

\$29⁹⁵

Cat. X-3630

THIS AMAZING UNIT CUTS THE COST OF AN ALARM INSTALLATION

WIDE ANGLE RADAR MOTION DETECTOR

Extremely effective — an ideal add-on to any alarm control module. Senses movement by Doppler shift, and triggers the alarm. Flat mounting for unobtrusive appearance, too. Easy to install.

\$89⁵⁰

Cat. L-5000



IMPOSSIBLE TO GET!

New customs laws have made 40 channel CB's illegal to import. We fully support this new legislation.

However we have a

LIMITED STOCK of 40 Channel CBs

Which can be yours, legally and are very suitable for amateur's experimental use, they are brand new and fully workable.

40 Ch. CB



STALKER VII Cat. D-1447

Has 'TX' or modulation light and a slim style microphone that's easy to hold. Comes with mounting kit and full instructions.

\$139

MIDLAND 100M

Famous Midland brand that is almost as small as hand-helds! Covers full 40 channels and is simple to operate.



\$129

Cat. D-1445

YOU'LL NEVER SEE VALUE LIKE THIS AGAIN

HUGE SAVING!

ECONOMY CB ANTENNA

WAS \$14.50 NOW **\$7⁹⁵**

Centre-loaded whip antenna. Cat. D-9013

Cat. B-5060



\$200

YES! We stock 'Your Computer' magazine. We also stock 'Australian Computer' as well as many overseas publications!

ORGANISE YOUR MAGS

for **\$4⁹⁹**



Cat. B-4045

Watch this space — and find out what you missed!

Last month: a handy power point with safety shutter For only \$1.98. Normally \$3.75 Saving \$1.76 Next month? Call in and find out!



UNIVERSAL NI-CAD CHARGER ONLY

\$19⁹⁵

Keep your batteries fully charged so your appliances are never without power!

Cat. M-9519

TWO SWITCHES IN ONE!

Can be used in place of one toggle and one pushbutton, with the added feature of a momentary spring "ON" on one side.

\$230

Cat. S-1287

PRO FINISH WITH THESE BULLET CONNECTOR INSULATORS

Avoid short circuits and earthing with these handy insulating covers.

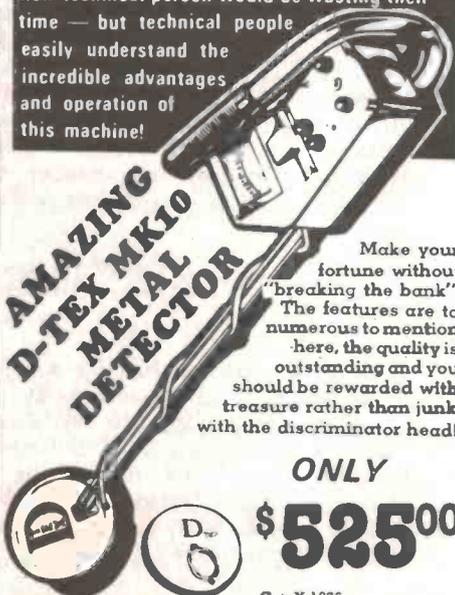


Cat. P-5007/9

50¢

BECAUSE YOU'RE TECHNICAL

You'll be able to use this superb metal detector to its fullest potential. The average non-technical person would be wasting their time — but technical people easily understand the incredible advantages and operation of this machine!



Make your fortune without "breaking the bank". The features are too numerous to mention here, the quality is outstanding and you should be rewarded with treasure rather than junk with the discriminator head!

ONLY

\$525⁰⁰

Cat. Y-1076

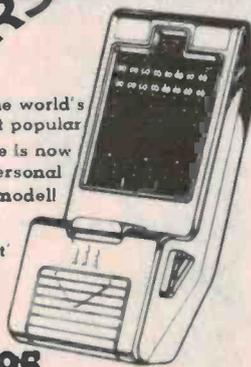
SPACE INVADERS

The world's most popular game is now available in a personal model

You can take this game anywhere and doesn't eat 20¢ coins. It requires the same skill as the 'real' machine but is small enough to carry in the pocket or briefcase!

\$29⁹⁵

Cat. Y-1152



NOW YOU CAN HAVE FM STEREO AND AM WHEREVER YOU GO!!

SOUNDTRIPPER AM/FM RADIO

Equipped with light weight high quality headphones the sound tripper is ideal for walking, playing golf, working or even jogging. The clear, precise sound will keep you in touch with music or news, wherever you are!

\$49⁵⁰

Cat. A-4330



NEW HAND HELD PRINTER CALCULATOR

If you're in the market for an outstanding miniature printer calculator — then look no further! Call in and see the numerous features for yourself!

ONLY **\$65**

Cat. Q-3020



WALKIE STEREO CASSETTE

The ideal compact stereo cassette play unit. You can listen to your favourite pre-recorded tapes with supplied headphones wherever you go!

\$99⁰⁰

Cat. A-4055

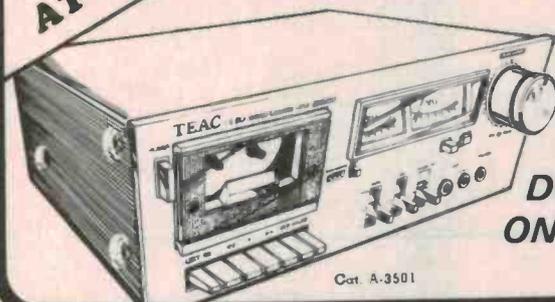


LOOK AT THIS!

TEAC METAL DECK DICK'S PRICE ONLY \$179!

Outstanding sound performance and metal tape compatibility with exceptional economy. The CX-310 has a highly stable transport system and advanced electronic circuitry providing everything you need to enjoy the finest sound!

DON'T MISS OUT ON THIS OUTSTANDING VALUE!!



Cat. A-3501

WARNING

Consumer Affairs Department warns that with some mail order companies you can

KISS YOUR MONEY GOODBYE as soon as you post the order.

Buy with confidence with Dick Smith Electronics 14 years in the mail order business and our exclusive 14 Day Satisfaction Money Back Guarantee

THE AFFORDABLE ANSWER



Cat. Y-2100

Not Telecom approved. **\$99⁵⁰**
Ideal for experimenters

Even more than a telephone answering machine.

- Can handle up to 30 calls
- Monitors your calls
- Use as a dictation/transcriber
- Use as a tape recorder — it uses standard cassettes so you can play your favourite tapes on this machine.

MAJOR DICK SMITH RE-SELLERS

These re-sellers stock a large range of our products. However, we cannot guarantee they will have all items in stock, or at the prices we advertise.

ATHERTON, QLD: Joe Sue's Radio Service
55 Main St Phone 911 208

BENICUI, VIC: Sumner Electronics
95 Mitchell Street Phone 431 977

BLACKHEATH, NSW: Goodwin Electronics
123 Station Street Phone 878 379

BROKEN HILL, NSW: Crystal TV Rentals
66 Crystal Street Phone 6897

CAIRNS, QLD: Thompson Instrument Services
79 81 McLeod Street Phone 512 404

COFFS HARBOUR, NSW: Coffs Harbour Electronics
3 Coffs Harbour Plaza, Park Ave Phone 575 684

DARWIN, NT: Kent Electronics
42 Stuart Highway Phone 814 749

DUBBO, NSW: Dubbo Electronic Services
157 Brisbane St Phone 829 355

EAST MAITLAND, NSW: East Maitland Electronics
Cnr Lewis & High Streets 337 327

FAIRY MEADOW, NSW: Trilogy Wholesale Elect.
40 Princes Hwy Phone 831 219

GERALDTON, WA: KB Electronics & Marine
161 Mann Terrace Phone 212 176

GOSFORD, NSW: Tomorrow's Electronics & Hi Fi
68 William Street Phone 247 246

HOBART, TAS: Aero Electronics
122a Bathurst Street Phone 338 222

KINGSTON, TAS: Kingston Electronics & Records
Channel Court Phone 235 802

LAUNCESTON, TAS: Advanced Electronics
5a The Quadrant Phone 317 075

LISMORE, NSW: Decro Electric
Magellan St & Brunner Hwy Phone 214 137

MACKAY, QLD: Stevens Electronics
42 Victoria Street Phone 511 723

MARYBOROUGH, QLD: Keller Electronics
218 Adelaide Street Phone 214 559

MORUYA, NSW: Coastal Electronics
43 Vulcan Street Phone 742 545

MT GAMBIER, SA: Hutchesson's Communications
5 Elizabeth Street Phone 295 404

MUSWELLBROOK, NSW: Silicon Chip Electronics
Suite 3 98 Bridge Street Phone 43 1056

NAMBOUR, QLD: Nambour Electronic Shop
Shop 4 Lowan House, Ann St Phone 611 604

NEWCASTLE, NSW: Elektron 2000
181 Wharf Road Phone 262 644

ORANGE, NSW: M&W Electronics
48 McNamee Street Phone 626 491

ROCKHAMPTON, QLD: Purely Electronics
15 East Street Phone 21 050

SOUTHPORT, QLD: Amateur's Paradise
121 Nerang Street Phone 322 644

TAMWORTH, NSW: Sound Components
78 Brisbane Street Phone 661 363

TOOWOOMBA, QLD: Munis Electronics
18 Neil Street Phone 326 944

TOWNSVILLE, Qld: Tropical TV
40 Fulham Rd, Vincent Village Phone 791 421

TRARALGON, VIC: Power N' Sound
147 Argyle Street Phone 743 638

WAGGA, NSW: Wagga Wholesale Electronics
82 Forsyth Street

WODDONGA, VIC: A & M Electronics
78a High Street Phone 244 588

WHYALLA NORRIE, SA: Mellor Enterprises
Shop 2, Forsyth Street Phone 454 764

Dear Customer:

Quite often, the products we advertise are so popular they run out within a few days. Or, unforeseen circumstances might hold up goods so that advertised lines are not in the store by the time the advert appears. Please don't blame the store manager or staff; they cannot solve a dock strike on the other side of the world, or even locate a shipment that has gone astray. What we are trying to say is that, if you are about to drive across town to pick up a particular line at a Dick Smith Store, why not give the store a ring first (addresses/phone numbers below) — just in case! Thanks, Dick Smith & Staff.

DICK SMITH Electronics

MAIL ORDER CENTRE: P.O. Box 321 North Ryde, NSW 2113. Ph. (02) 888 3200

NSW: 145 Parramatta Rd Auburn 648 0558. 613 Princes Hwy Blakehurst 546 7744. 818 George St Broadway 211 3777. 531 Pittwater Rd Brookvale 93 0441. 147 Hume Hwy Chullora 642 9822. 162 Pacific Hwy Gore Hill 439 5311. 30 Grose St Parramatta 683 1133. 125 York St Sydney 290 3377. 173 Maitland Rd Tighes Hill 61 1896. 263 Keira St Wollongong 28 3800.

ACT: 96 Gladstone St Fyshwick 80 4944. **QLD:** 166 Logan Rd Buranda 391 6233. 842 Gympie Rd Chermerside 59 6255. **SA:** 60 Wright St Adelaide 212 1962. **VIC:** 399 Lonsdale St Melbourne 67 9834. 656 Bridge Rd Richmond 428 1614. Cnr Dandenong & Springvale Rds Springvale 547 0522. **WA:** Cnr Wharf St & Albany Hwy Cannington 451 8666. 414 William St Perth 328 69 44.

Order Value	Charges
\$5-\$9.99	\$1.20
\$10-\$24.99	\$2.20
\$25-\$49.99	\$3.30
\$50-\$99.99	\$4.40
\$100 or more	\$6.00

These charges for goods sent by Post in Australia only — Not airmail, overseas or road freight.



(a) Target under constant acceleration

(b) Target under constant velocity

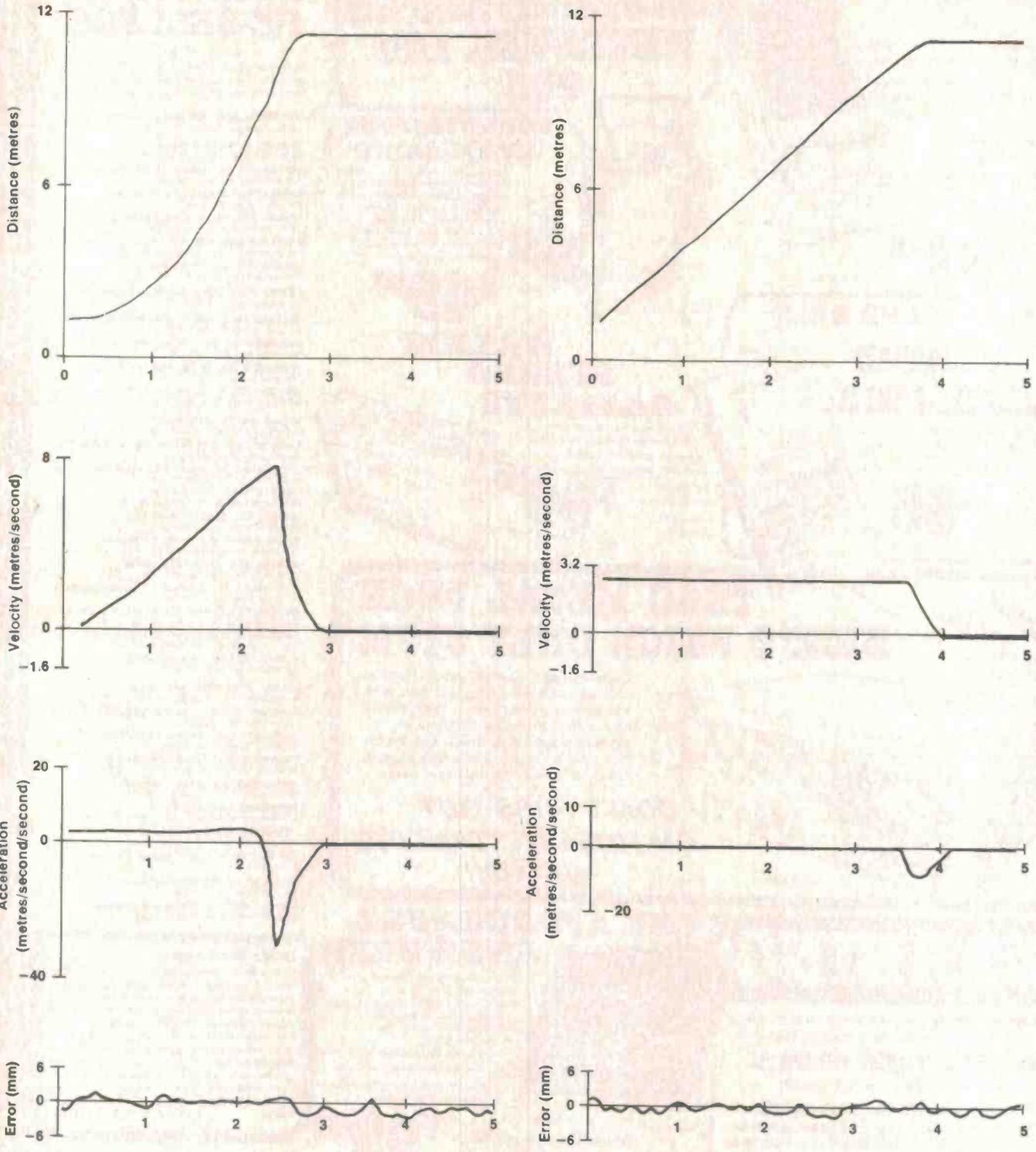


Figure 7. Measurements of the dynamic characteristics of moving targets using the 3850A.

The DTS may also be used to demonstrate the accuracy of the 3850A under different velocity profiles. Figure 7a demonstrates the versatility of the 3850A in determining the position,

velocity, acceleration, and the resulting position error versus time of a target under constant acceleration. In spite of the nonconstant velocity profile, the position error remains quite small.

Figure 7b shows a similar test run with the DTS programmed to generate a constant velocity.

Although the DTS is limited by its physical properties to a maximum

velocity of 15 metres/second, 3850A accuracy is specified for up to 40 metres/second. The physical limitations of the DTS made necessary an electronic simulation of higher-speed targets. The dynamic phase electronic tool (DPET) was developed to simulate target velocities up to 180 kilometres/second. Accuracy at these higher velocities has been verified using this device.

The speed limit

The 3850A uses three internal resolution functions to measure distance. The distance measurements roll over when the rollover interval for a particular resolution function is exceeded. The rollover intervals are 10 m for the high-resolution function and 400 m for the medium-resolution function. Thus a target at 15.241 m or 25.241 m appears to be at 5.241 m in the high-resolution function.

For a moving target the external computer must keep track of when these rollover intervals are exceeded. To accomplish this, the computer must be guaranteed that the target has not travelled more than one-half the rollover interval between successive measurements. This Nyquist speed is nominally 40 metres/second for the high-resolution function, 1600 metres/second for the medium-resolution function, and 160 kilometres/second for the low-resolution function.

Conclusion

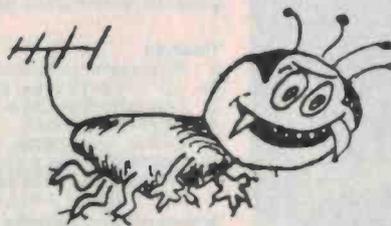
In conclusion, the 3850A Industrial Distance Meter has extended electronic distance measurement capability to include dynamic position measurement. With the 38001A HP-IB Distance Meter Interface, the 3850A can be computer controlled to output high-speed position and elapsed time data. Software packages now under development will enhance the system for use in automated position control, dynamic monitoring, and static monitoring.

References

1. M.L. Bullock and R.E. Warren, "Electronic Total Station Speeds Survey Operations", *Hewlett-Packard Journal*, April 1976.
2. R.R. Baldwin, G.B. Gordon, and A.F. Rudé, "Remote Laser Interferometry", *Hewlett-Packard Journal*, December 1971.

The 3850A and the 38001A were designed and developed by a Hewlett-Packard team including Jerry Bybee, Dave Rustici, Dean Buck, Rick Frey, Troy Brown, Rod Harris, Jerry Wasinger, Arnold Joslin, Randy Waite, Bill Smith and Rick Warren. ●

BUGS



WE SELL TO WHITE ANTS BLACK ANTS AND NOW COLOUR ANTS — WHY NOT YOU?

Are you plagued with BUGS in your TV — FM or video cassette, the performance is dependant on the level and quality of the signal being fed into the equipment. Regardless of how much you spend on your TV/FM receiver or video cassette your equipment will only perform as well as the Antennae system will allow, a good installation will rectify these problems and let your equipment prove how good it can perform.

FM AERIALS	GAIN
FMG	1.9dB
FMG.2	7.0dB
FMG.4	8.5dB
FMG.5	8.2dB
FMG.6	8.7dB
FM.700	7.5dB
FM.3	6.0dB
FM.353	6.0dB
207/345	8.0dB

UHF & VHF Ch.O. ANTENNAS			
Hills			
TC10/B4	Ch.28	471-605Mhz	10.6dB Gain
TC18/B4	Ch.28	471-605Mhz	13.2dB Gain
TC10/B5	Ch's 2.7.9.10	616-850Mhz	10.6dB Gain
TC18/B5	Ch's 2.7.9.10	616-850Mhz	13.2dB Gain

Channel Master			
M2	B/4 & 5	500-850Mhz	9.5dB Gain
M3	B/4 & 5	500-850Mhz	10.5dB Gain
M4	B/4 & 5	500-850Mhz	12.0dB Gain
4225-4	Bay Bow Tie	500-850Mhz	12.0dB Gain

VHF Chs 0.2.7.9.10 ANTENNAS			
Hills			
3/5.0	8 element		High Gain
TL3/0	10 element		High Gain
TL4/0	12 element		V/High Gain
EFC3/03	Anti-Ghost		V/High Gain
PI7/10	Anti-Ghost		City Area
Channel Master			
3110/A	Anti-Ghost		City Area
3111/0	Anti-Ghost		
CX7	Good all rounder		
CX13	Anti-Ghost		High Gain
CX17	Anti-Ghost		V/High Gain
CX21	Anti-Ghost		V/High Gain

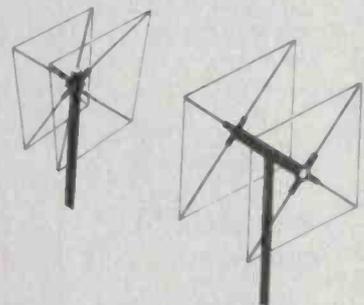
Phone the Specialists for your antenna problems, we will help you to receive good pictures or good sound.

ELECTROCRAFT PTY. LTD.

68 Whiting Street, Artarmon NSW
Telephone 438-4308 (ext. 4)
or 438-3266 (ext. 6)

30 years in the antenna business
Hours: 8am to 5pm
Prices subject to alteration without notice.

Are you into Quads yet?



BANDIT

UNIVERSAL QUAD HUBS

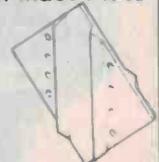
BANDIT	2" dia Boom
50	2"
45	1 3/4"
40	1 1/2"

\$20 ea.



new model

Boom-Mast Plate



\$8

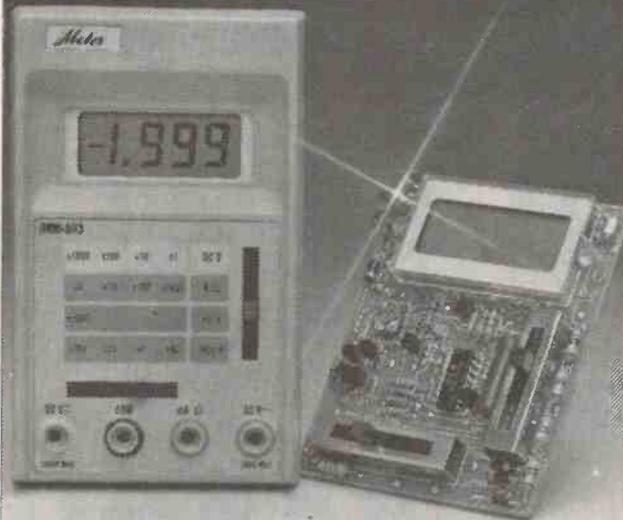


\$20

BANDIT SPYDER
for 2" BOOMS & MASTS

ASHPOINT INDUSTRIES PTY. LTD.
38 Birmingham Street, Alexandria, NSW 2015.

Mike Rychter (VK2NOW-YUX)



DIGITAL MULTIMETER DMM-803

KIT \$79.85 Inc. Tax

The DMM803 Digital Multimeter is a compact, hand-held instrument designed for both field and laboratory use. Measurement functions includes DC voltage, AC voltage, DC current and Resistance. All functions are protected by diodes and transistors against overload. The large LCD readout features easy-to-read numerals, polarity indication and low-battery warning. The kit contains all the parts necessary for making a finished Digital Multimeter and a detailed assembly manual to ensure easy assembly.

Feature

1. Measurement function: DCV, ACV, OHM & DCmA.
2. 0.5" 3½ digit liquid crystal display.
3. Overload protection.
4. Polarity indication.
5. Battery life: Approx. 250 hours (Alkaline battery).
6. Single 9V battery operation with low battery warning "LO-BAT" indicator in the last 20% of battery life.
7. Size: 8.4(W) x 14(L) x 3(H) cm.

Measurement Ranges

Function	Accuracy	Range	Resolution	Overload
DC V	± (0.8% of rdg + 1 dgt)	2 V	1 mV	DC 1000 V AC 1000 Vrms
		20 V	10 mV	
		200 V	100 mV	
		2000 V	1 V	
AC V	± (1% of rdg + 0.3% F.S. + 1 dgt)	500 V	1 V	AC 1000 Vrms
		2000 V	1 V	
OHM	± (0.5% of rdg + 1 dgt)	2 KΩ	1 Ω	DC 250 V AC 250 Vrms
		20 KΩ	10 Ω	
		200 KΩ	100 Ω	
		2 MΩ	1 KΩ	
DC mA	± (1% of rdg + 1 dgt)	200 μA	100 nA	1 A
		2 mA	1 μA	
		20 mA	10 μA	
		200 mA	100 μA	

Operating Temperature: 0° ~ 40°C

Storage Temperature: -20°C ~ 60°C

Accurate Temperature: 1 year warranty at 20°C ± 10°C

Order Information: Kit Form-DMM 803-K

\$79.85 Inc. Tax.

Addition to having a reliable Digital Multimeter, to learn the details of circuit structure and gain handy-experience in the assembly of your Digital Multimeter. Bankcard, Diners Club, Cheque or Postal Note. Post free within Australia.

RADIO PARTS GROUP

562 Spencer Street, West Melbourne

Phone (03) 329-7888

1103 Dandenong Road, East Malvern

Phone (03) 211-8122

TRADE ENQUIRIES WELCOME

LOOK AT THESE PRECISION INSTRUMENTS AT A HOBBYISTS PRICE FROM CHRISTIE RAND PTY. LTD.

sabtronics INTERNATIONAL INC.

600MHz FREQUENCY COUNTER 8610



SPECIFICATIONS

10Hz to 600MHz guaranteed (5Hz to 750MHz typical). Sensitivity ≤ 10mVRMS — 100MHz, 50mVRMS — for 100 to 450MHz, 70mVRMS, 70mVRMS 450 — 600MHz. Temperature stability 0.1ppm/C. Gate time .1 sec 1 sec 10 secs. Ageing rate ≤ ± 5ppm/year. Accuracy 1ppm + 1 digit. Protection: 90VRMS at 10KHz — 10VRMS at 600MHz

PRICE: KIT \$176 + TAX = \$202.40

Assembled: \$196 + TAX = \$225.40

DIGITAL MULTIMETER 2010



SPECIFICATIONS

A 0.1% Digital Led Multimeter for the price you would pay for a less accurate DMM. Just look at these ranges. DC & AC VOLTS from 100uV to 1000 VOLTS in 5 ranges each from 0.1% accuracy on DC & 0.5% accuracy on AC. DC & AC CURRENT from 100nA (0.1uA) to 10 Amps in 6 ranges each from 0.1% accuracy on DC & 0.5% accuracy on AC. RESISTANCE from 100 n ohm to 20 Mohm from 0.1% accuracy. DIODE TEST at 1mA, 10 micro Amp 0.1 micro amp. AC VOLT frequency range 40 Hz to 40KHz. Overload protection 1200VDC of peak AC except on ACV: 2V & .2V ranges & AC/DC current 250V DC or AC peak. 2A & 10A at max (unfused).

PRICE: KIT \$120 + TAX = \$138

Assembled: \$140 + TAX = \$161

FUNCTION GENERATOR 5020



SPECIFICATIONS

1Hz — 200KHz in 5 ranges sine, square & triangle wave. High 10Vpp 600. Low — 40db. TT1 out drive 10TT1 loads. DC Sweep Input gives 100:1 frequency range output & offset control.

PRICE: Assembled \$220 + TAX

= \$253

Batteries not supplied. P&P \$3

CHRISTIE RAND PTY. LTD

PO BOX 48 EPPING NSW 2121
PHONE (02) 477-5494

Please supply.....
KIT ASSEMBLED
AMOUNT \$..... inc \$3.00 P&P
NAME.....
ADDRESS.....
BANKCARD No.....
Expiry Date..... Signature.....

Join the people who have made the Air Force their life



"I've seen a lot of Australia. Now I'm looking forward to being posted overseas."



"I enjoy being a member of the team that keeps our F111's fully operational."



"You're trained to work on some of the most advanced equipment in the world."



"The opportunities for promotion with more pay and responsibility are there."



"You don't mind working hard if it's for a specific purpose like the country's security."



"At 23 I found myself promoted to Section Head. That kept me on my toes."



"It isn't all work I have time to relax and play my favourite sport."



"The training has set me up with a career for life — it's really professional."

The satisfaction and rewards are immense.

A new lifestyle. New friends. New interests. New qualifications. New places visited.

And you start on full adult pay too! After training we'll pay you even more! Then there's four weeks annual leave and the opportunity to continue studying for higher qualifications. So if you want to reach a higher rank, it's up to you.

It's not an easy life.

Success demands application. A disciplined approach to your work. What's more, you'll be part of a special team that's proud to wear the Air Force uniform.

Normally you'll work a five day week. But at times we expect you to do extra duties.

You must be prepared to join us for a minimum of six years and be prepared to live and work on any one of our bases.

Your future.

Is it in Flight Systems, Propulsion Systems, Air Frames, Telecommunications, Engineering, Administration, Weaponry, Supply or Motor Transport?

The choice is vast. The scope unrivalled.

So if you're aged between 17 and 34 years (17 and 43 years if no trade training is required), an Australian citizen or meet our nationality requirements, we would like to meet you. (People with civilian qualifications and experience are most welcome to apply.) Enquiries are also invited for Apprenticeships.

Today, walk into the Air Force Recruiting Office nearest you and have a chat with a Careers Adviser. The address is in the phone book. It could be your first important step to an exciting new career.

Alternatively send the coupon or phone for the facts:

Brisbane: 226 2626	Townsville: 71 3191	Sydney: 212 1011
Wollongong: 28 6294	Parramatta: 635 1511	Canberra: 82 2333
Hobart: 34 7077	Adelaide: 212 1455	Perth: 325 6222
Melbourne: 61 3731	Newcastle: 2 5476	



To:
RAAF CAREERS
ADVISER. G.P.O. Box XYZ
in the capital city nearest you
Yes! I am interested in an RAAF
career. Please send me full details.

Name _____
Mr/Miss _____
Address _____
State _____ Postcode _____
Date of Birth: _____ / _____ / _____

RG.417.FP.11ET

You're somebody in Today's Air Force

Authorised by Director-General Recruiting Dept. Defence

SAVE ON TEST GEAR!

DIRECT IMPORT NOW IS

LCD DIGITAL MULTIMETER

Cat. Q-1450

For the hobbyist, technician, engineer etc who wants a reliable Liquid Crystal Display multimeter for a low low price! Features highly legible display and overload protection — so you won't 'cook' it in case you make errors. Easy to use, and it will last you for years!

NORMALLY \$75

\$65

P&P \$4.00



SAVE \$10 THIS MONTH

Still only **\$49⁵⁰**

27MHz TX/RX TESTER



Cat. Q-1380 P&P \$3.00

This set has been specially developed for the servicemen to facilitate the location of faults in hand held transceivers etc. Now everyone can afford this luxury! This compact portable unit is a must for every amateur enthusiast. Call in and check out the tremendous features it has to offer!

RESISTANCE SUBSTITUTION WHEEL

Changes values of resistance in circuits.

Cat. Q-1410 **\$5⁹⁵**

LOGIC PROBE

A superb time-saving tool for the hobbyist, technician etc. Hooks onto the circuit under test for its power. Many other features.

\$2⁷⁵⁰

Cat. Q-1272 P&P \$3.00



AT LAST! An affordable FREQUENCY METER 600MHz — 7 Digit

Don't be confused by the size and weight of the unit — it is NOT a toy! In fact it is a sophisticated piece of test equipment that every hobbyist can afford. Consists of a full 7 digit counter, with variable gating times and 3 ranges — 6MHz, 60MHz and 600MHz. Battery operated so it's with you wherever you go. A must!

\$199

Cat. D-3000 P&P \$5.50

SUPERB VALUE!

100MHz PROBE SET

Normally used for CROs, but ideal for above counter on a x1 scale. At a bargain price compared to other probes.

\$34⁵⁰

Cat. Q-1245 P&P \$3.00



PRO QUALITY FOR THE KEEN AMATEUR!

Cat. Q-1340 P&P \$4.00

BUDGET METERS 20 kohm Multitester

This may be low budget — but this one gives a top performance for the price! An amazing 20,000 ohms per volt and it's under \$20.00!

\$19⁵⁰

P&P \$2.00



Pocket Multi-Tester \$12⁵⁰

A pocket multimeter for the beginner or the handyman. If you're just starting out in the world of electronics and you have a tight budget — look no further. Simple operation.

Cat. Q-1010 P&P \$2.00

LOOK AT THIS FANTASTIC Syringe action hook probe

With a 'syringe' action and a long shaft this probe makes connection in those tight corners a breeze! Suitable for all test work.

\$2⁵⁰

RED — W-4589
BLACK — W-4590



RED — W-4580
BLACK — W-4582

IC Test Clips 95¢

16 PIN IC TEST CLIP

Cat. W-4600



P&P \$1.00

Eliminate the danger of shorting out pins with this spring loaded Test Clip!

\$3⁵⁰



Cat. W-4572

IC Jumper Lead Set \$3⁸⁰

A pair of red and black leads, one metre long with matching IC test clip at each end.

MINI ALLIGATOR CLIPS Fully insulated with plastic shroud, easy to solder to. Two colours available. \$0¢ each.

RED — W-4550
BLACK — W-4552

OSKER BLOC This is a truly professional instrument that uses the Through-Line principle. Covers 3MHz to 200MHz. Each unit is individually calibrated with a chart attached to the instrument.

\$89⁵⁰



High Impedance Meter

Cat. Q-1200

\$69⁵⁰

P&P \$4.00

For the professional who wants the lowest circuit loading. Incredible 10M imp (DC) even has centre zero range!

PRICES & MONTHLY SPECIALS MEANS THAT THE TIME TO BUY!

AN EVEN
**BIGGER
SAVING!**

ON THIS TOP VALUE

CRO

6.5MHz

75mm

We still can't believe the incredible response we're having on this affordable CRO. We have literally sold thousands of them in the past 12 months — the sales speak for themselves. Suitable for any application — laboratory, classroom, field work, and of course the hobbyist.

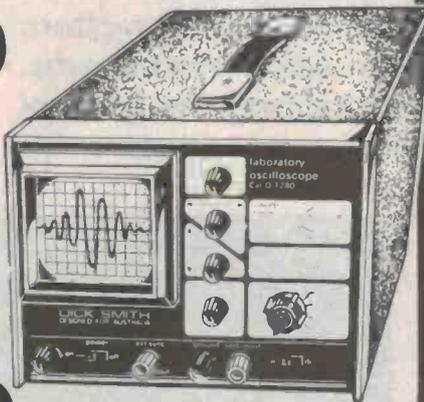
**SAVE
\$10!**

Normally
\$199

\$189

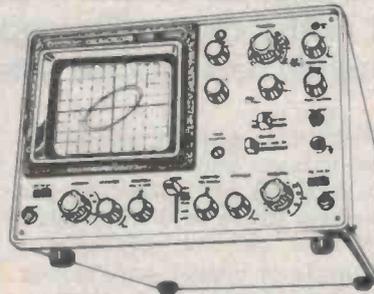
**THIS MONTH
ONLY**

Cat. Q-1280
P&P \$5.50



LOOK AT DICK'S PRICE
FOR A TOP NAME

HITACHI CRO



Cat. Q-1242 P&P \$5.50

18MHz Dual Trace

If you're after the very best, then look no further! We're offering this fantastic Hitachi V-152B Dual Trace CRO at a very affordable price.

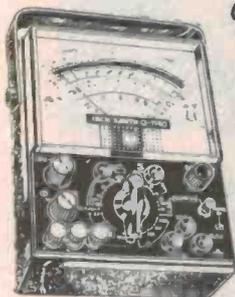
Check these features:

- Extra high sensitivity
- 5 display modes
- Trace rotation via front panel control
- Colour-coded panel layout for operating ease
- TV sync-separator circuit for rapid video measurement
- One touch wave-form shifting

ONLY \$638

**TWO TOP METERS
FROM DICK SMITH**

**Q-1140 PRO
QUALITY
METER**



\$72⁵⁰

Cat. Q-1140 P&P \$4.00

This handy little unit is virtually a test bench in one small package!

Not just a sensitive (100kV) multimeter.

This one checks transistors and measures capacitance etc. Fuse and diode protection of the movement. If you want a multimeter that will do just about anything.

— look no further! Complete with battery, test leads, and full instructions

**Q-1136
transistor
checker
multi-
meter**



\$57⁵⁰

This unit is similar to the one above except for a few minor differences. i.e. does not have capacitance checking facilities, nor does it have a 250mV DC position. But the really good news is that it's CHEAPER!!

Everything else is much the same, so it is up to you — the money or the best!

Cat. Q-1136
P&P \$4.00

**SUPERB
VALUE!**

**100MHz
CRO PROBE**

This incredibly versatile probe set is so good we thought we'd mention it twice. Ideal for any CRO and comes with an abundance of accessories!



Cat. Q-1245
P&P \$3.00

\$34⁵⁰

CRO Adaptor

Plugs into the Dick Smith CRO enabling accessories from more expensive sets to be used.

\$9⁵⁰

Cat. Q-1281



**HANDY METER
CARRY CASE**

This offers more than just protection for your valuable meter. Also keeps your leads and instructions tidy and gives you room to store notes etc. Suits models Q-1136, Q-1140 & Q-1024.



\$14⁵⁰

Cat. Q-1137 P&P \$2.00

Multimeter RF Probe

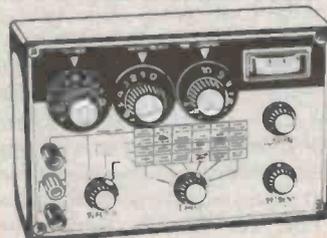
Extend the useful range of your multimeter with this neat probe. **\$17⁵⁰**

150kHz — 30MHz P&P \$2.00



Cat. Q-1138

**HIGH ACCURACY
AC BRIDGE**



Better than a multimeter... with this Bridge you can accurately and easily measure inductance, capacitance, resistance, compare unknown components etc. Easy to use and very affordable!

\$79⁵⁰

Cat. Q-1420 P&P \$4.00

**DICK SMITH
Electronics**

MAIL ORDER CENTRE: P.O. Box 321 North Ryde, NSW.
2113. Phone (02) 888 3200

SEE OUR OTHER ADS IN THIS MAGAZINE FOR
OUR FULL LIST OF STORE ADDRESSES



**UNBELIEVABLE
VALUE!!!**

Versatile electronic stethoscope

Design: Ray Marston

Development: Simon Campbell

This unusual device can be a very handy tool for those who work with mechanical contrivances — anything from tractor engines to drill presses to watch mechanisms. Thrill to the clatter of clagged-out tappets, the grind of graunched bearings, the tick-tock of escapements . . .

"DOCTORS DO IT with stethoscopes..." said the bumper sticker on the expensive imported car parked in the street near our offices. With this project, you can do it too! The purpose of a stethoscope is to enable you to hear what's happening inside an operating mechanism when it's difficult or impossible to see what's happening — in fact, listening may be better than seeing in some instances.

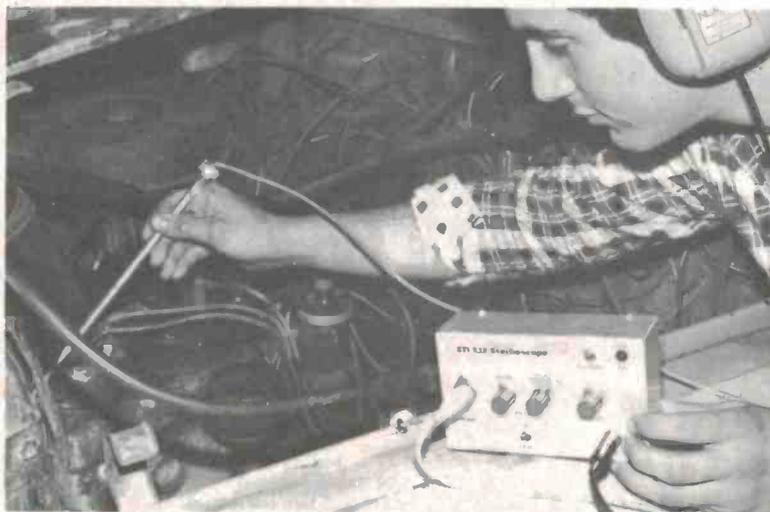
With this electronic stethoscope, you can effectively and effortlessly get right inside a car engine, for example, and listen to or locate all its internally generated sounds — the noise of bearings, pistons, tappets, etc. The various sounds produced by different parts of moving machinery have different characteristics, so this stethoscope incorporates a double filter network that can be used to pick out one set of sounds and attenuate others, thus facilitating fault-finding.

The stethoscope comprises an acoustic probe unit using some sort of microphone (several combinations are possible), the electronic 'clever bits' and a pair of standard stereo headphones. The probe unit is arranged to make mechanical contact with the machinery or object being examined and is coupled to the electronics, which are housed in a separate box, via flexible leads. The mechanical coupling provides an acoustic path to the microphone in the probe, and can be by direct contact or via a metal rod or tube.

Sound is readily transmitted through the housing of any machinery, be it the engine block of a petrol motor, the case of a watch or clock, etc. This can be further transmitted through an object, such as a metal rod or a screwdriver, brought in contact with the machinery.

The electronics

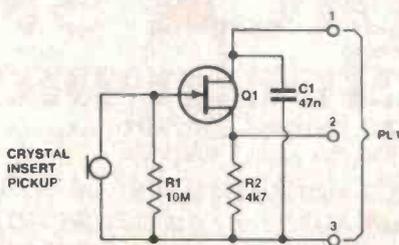
The circuitry used in this stethoscope comprises two filters, each of which has a variable cutoff, followed by a high



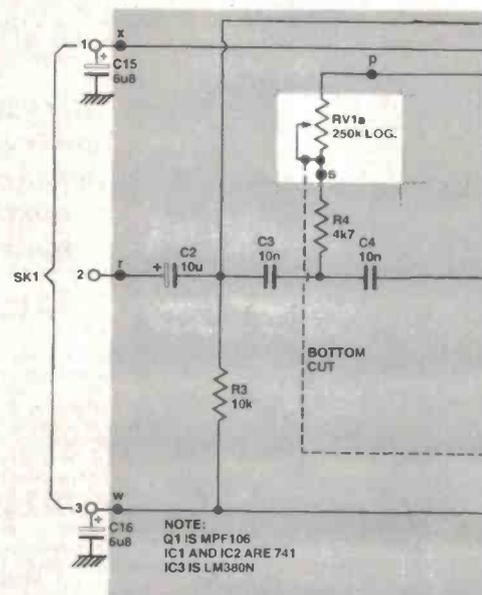
Using the stethoscope to listen to the tappets in a car engine.

gain IC power amplifier. The first filter is a *high-pass* type that attenuates frequencies *below* the cutoff frequency, which can be set anywhere between about 80 Hz and 3 kHz. The second filter is a *low-pass* type that attenuates frequencies *above* the cutoff frequency, which can be set anywhere between about 70 Hz and 15 kHz. The filters can thus be used to attenuate unwanted sounds, enabling you to pick out the desired sounds to a considerable extent in the right circumstances. The filter stages can be switched out if desired and the probe's microphone output coupled directly to the audio output stage. A common LM380 has been employed for the latter, principally for convenience, as it provides a considerable amount of

gain and requires few components. A volume control potentiometer has been placed at the input to the LM380, since a level control is a very necessary item — as no doubt you will discover!



CRYSTAL
INSERT
PICKUP



NOTE:
Q1 IS MPF105
IC1 AND IC2 ARE 741
IC3 IS LM380N

stethoscope

The unit is powered from two internal 9 V batteries as portability is a necessary requirement. Headphones were employed rather than having a loudspeaker output, as they reduce ambient sounds which in some situations make listening to a speaker impossible as well as enabling you to concentrate on the sounds picked up by the stethoscope. Only low-cost headphones are necessary and any type having an impedance between 8 ohms and 500 ohms or so will do the job nicely.

The input impedance of the electronics is relatively low and a buffer is necessary when using high impedance microphones on the probe. The low input impedance also serves to reduce

extraneous electrical noise pickup, to which high input impedance circuitry is prone. Crystal microphone inserts or earpieces are cheap, sensitive and effective for probe use, although we did try a rocking armature insert successfully, coupled directly to the high pass filter input. The buffer necessary with crystal microphones we mounted on the rear of the mics, as you can see from the photographs and drawings.

The stethoscope electronics are housed in a metal box — and for a very good reason. It provides shielding for the circuitry, preventing extraneous electrical noise pickup — which can be quite severe when using the project on a car engine. The ignition wiring radiates

a considerable amount of noise energy and, while it's not possible to completely eliminate it, we have reduced the problem by using a metal box, low impedance input and bypassing at the input socket.

Construction

It's probably best to commence with the mechanical work. We housed our unit in a K&W box, model C642, made by Ballarat Electronics Supplies and stocked by many retailers. It measures 150 mm wide by 95 mm deep by 55 mm high. Any metal box that will accommodate the pc board and major components may be used, however. Our Scotchcal front panel has been de-

HOW IT WORKS — ETI 332

Mechanical noises are coupled to a microphone or mic insert by a convenient means in a probe, the mic converting the mechanical noise to electrical signals. The resultant signal is passed to a filter/amplifier unit and converted to sound by headphones. Two active filters are employed. The first is a high-pass type employing a second-order RC network. This circuit has the advantage that the response rolls off below the cutoff frequency at a rate of 40 dB per decade. Thus, signals at one-tenth the cutoff frequency are attenuated by 40 dB. The R and C values may be designed to provide the cutoff at the desired frequency. The filter response is 3 dB down at the cutoff frequency. In our circuit, the resistors have been replaced by a combination of fixed and variable resistors to provide a variable cutoff frequency. The high-pass filter consists of IC1 and RV1, C3, C4, R4, R5. The filter has been designed to provide a cutoff that can be varied between a minimum frequency of 80 Hz up to a maximum of 3 kHz. Thus, with RV1 set to provide a cutoff of 1 kHz, signals at 100 Hz will be attenuated by about 40 dB.

The second filter, following the high-pass filter, is a low-pass type, again using a second-order RC network to provide a roll-off of 40 dB per decade, above the cutoff frequency. Again,

the filter response is 3 dB down at the cutoff frequency. In our circuit, the resistors have been replaced with a combination of fixed and variable resistors to provide a cutoff frequency which can be varied at will. The low-pass filter consists of IC2 and RV2, C6, C7, R6, R7. The cutoff may be varied between about 700 Hz minimum and 15 kHz maximum. When RV2 is set to provide a cutoff at about 1 kHz, for example, signals at 10 kHz will be attenuated by about 40 dB.

The filter stages provide no gain. The op-amps employed require a split supply and the 'virtual zero volt rail' is provided by ZD1, which is biased via the buffer amplifier involving Q1. Capacitor C8 provides an ac bypass for the virtual zero volt rail.

The output from IC2 is coupled to the audio output stage via SW1, which permits the filter stages to be switched out of circuit.

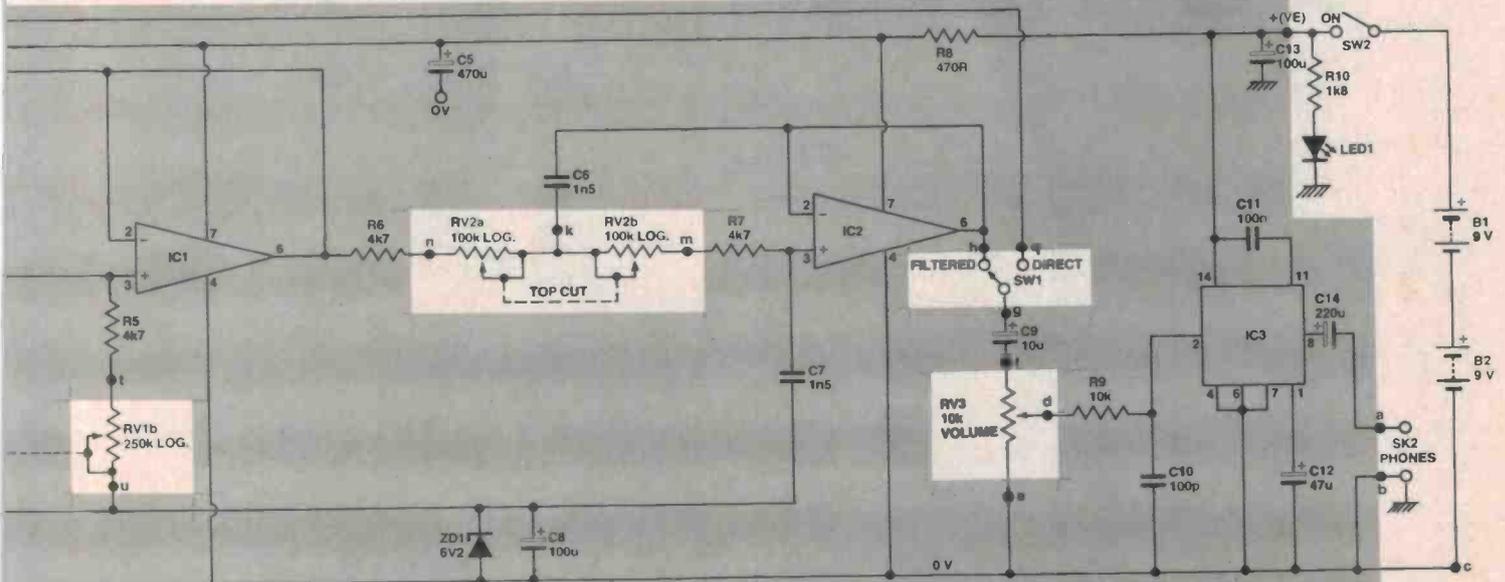
As stated earlier, high impedance crystal type mics require a high-to-low impedance buffer. This is the function of Q1 and associated components, R1, R2, C1. This is a simple source follower circuit, Q1 being a JFET device. Capacitor C1 provides a supply rail bypass.

Signals are passed either direct to the output stage or through the filters via SW1. Capacitor C9 provides dc blocking and couples signals to the volume control, RV3. The audio output stage employs an LM380 high gain preamp/power amp IC. Signals from the volume control are coupled to the input via R9/C10, which is a low-pass network with a cutoff around 150 kHz. This provides a measure of high frequency stability for the IC as well as reducing RF pickup that can upset the operation of the unit. Audio output is coupled via C14 to the headphones. Capacitors C11 and C12 are bypasses.

Power supply for the electronics is provided by two 9 V batteries connected in series. Supply rail bypassing is provided by C13 and R8/C5. LED1 and its associated current limiting resistor, R10, provide an 'on' indicator.

Capacitors C15 and C16 bypass any extraneous electrical noise induced onto the input cable. These are mounted directly at the input socket.

If a rocking armature insert is used for the probe, a 4k7 resistor should be connected between pins 1 and 3 of the input DIN plug to provide bias for the virtual zero volt line provided by ZD1.



Project 332



Completed stethoscope, ready for action! The probe here was made from a crystal earpiece, a length of 10 mm tubing being pushed over the ear plug.

signed to suit the K&W box. The artwork for this has been reproduced below, full size, and can be used as a template to mark out hole centres for drilling. The pots, switches, etc, all mount on the box lid. Use a centre-punch to locate hole centres before drilling as this stops the drill wandering. Once you've completed this, clean off any burrs with a small rat-tail file and see that the pots, switches, etc, fit properly. If all's well, carefully cut the Scotchcal panel to size (if you're using it) and apply it to the box lid. Then cut the holes on the Scotchcal panel where you drilled the lid.

Next, mount all the pots, switches and sockets, etc. Solder the input bypassing

capacitors, C15 and C16, to the DIN socket as shown in the wiring diagram. Note that the value of these two capacitors is not critical and may be anything between 1u and 10u. Solder R10 in place.

You can tackle the pc board next. This is fairly straightforward. We recommend you use our pc board, as the LM380 is prone to instability unless its surrounding circuitry is mounted in a particular fashion. Our pc board will avoid any instability problems with this stage. The ICs may be mounted first, noting they are all oriented the one way, followed by the resistors, greencaps, the ceramic capacitor (C11) and the zener diode (watch its polarity), leaving the

electrolytics until last. All the electrolytics are single-ended, pc mounting types, you'll notice. Take care you mount these the right way round.

Having completed the loading of the board, check everything *carefully*.

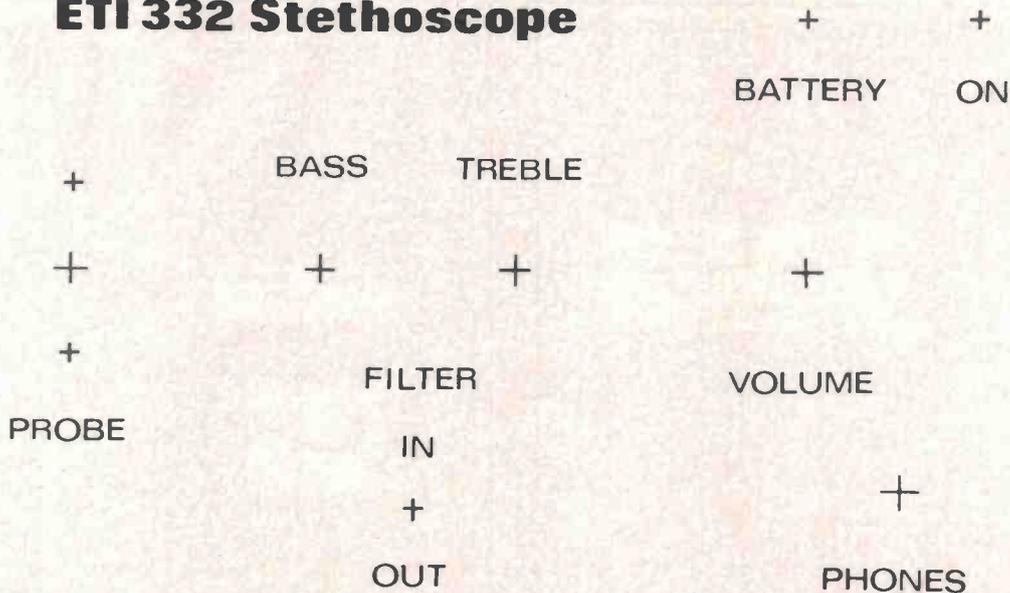
The wiring between the pc board and external components may be tackled next. Follow the wiring diagrams for this stage of the construction, checking each set of wires as you proceed.

You can make a preliminary check of the electronics once you've completed this stage. Check your wiring first, then connect the two batteries, turn the volume control to minimum, plug in your headphones and switch on. Some hiss should be evident; this is normal. With the filter switched in, turning the volume control fully up (do it slowly) should result in a slight increase in the noise level. Turn the volume control to minimum gain and switch the filter out. Touch your finger to pin 2 of the DIN socket and slowly advance the volume control. This should produce some audible noise and hum. The hum level will depend on the local hum field. If it is low, you may have to advance the volume control a fair way.

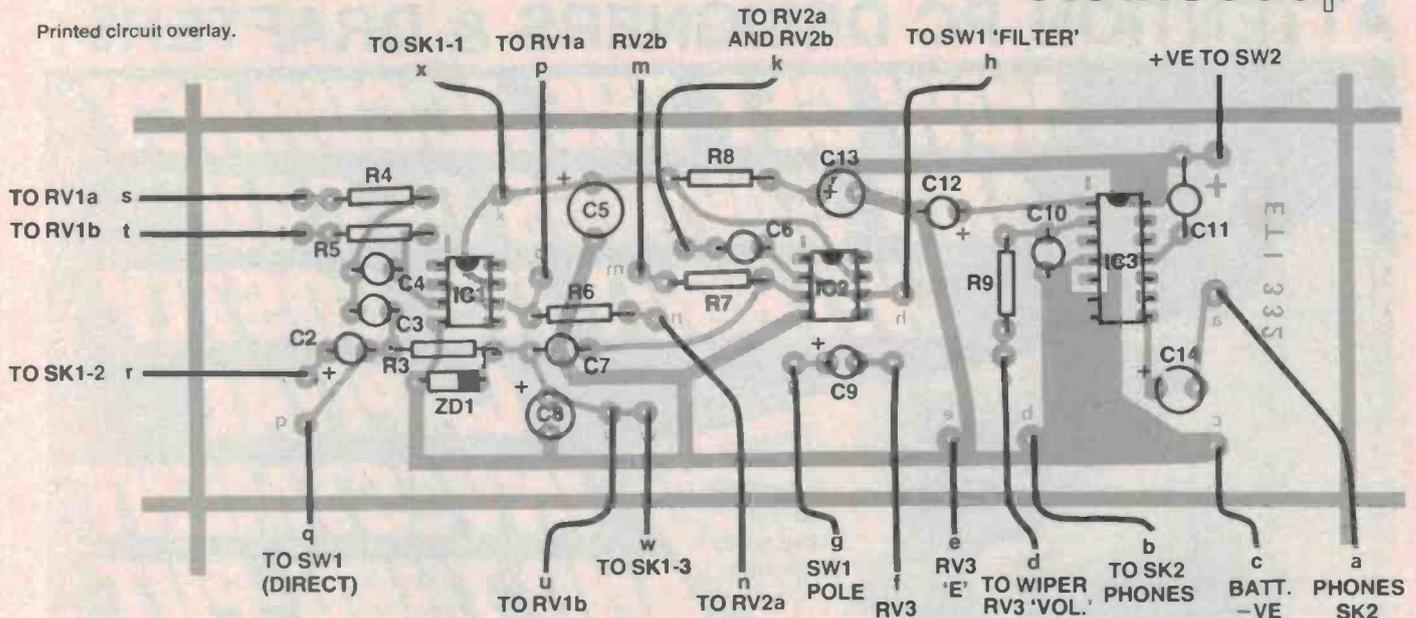
If all checks out well you can mount the pc board in the bottom part of the case, along with the batteries. We used double-sided sticky pads, as they're effective, convenient and save drilling!

Making the probe(s) comes next. Exactly how you go about this will depend on what you want to do. With crystal insert mics, the buffer is mounted on the rear of the mic terminals. The accompanying probe wiring diagram shows the general

ETI 332 Stethoscope



Printed circuit overlay.



technique. The buffer electronics is protected by encapsulating it in quick-setting epoxy. The mechanical coupling arrangement will depend very much on the particular mic insert employed and the application you have in mind. We made up several probes to suit different applications. If the mic has a metal case connect it to the probe cable's shield.

When you've finished your probe you can test it by simply coupling it to the speaker of a small portable transistor radio. Check that the filter controls function by varying them across the full range.

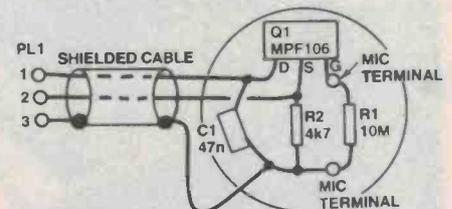
Using it

The best way to get to know how to use the instrument is to practise on a few things. Clocks are wonderful for this! The old-style mechanical wristwatch also provides an excellent signal source. You can hear your heartbeat by using a microphone insert without a mechanical probe, and we even discovered that the main bearing in our workshop drill

press was 'cactus' when trying out the stethoscope!

When working on a vehicle engine, watch out for fan blades. We found we could effectively sort out various engine sounds by judicious adjustment of the filter controls and careful placement of the probe.

Happy listening!



General construction for the buffer, mounted on the rear of a mic insert.

PARTS LIST — ETI 332

Resistors

R1	10M	all ½W, 5%
R2, 4, 5, 6, 7	4k7	
R3, R9	10k	
R8	470R	
R10	1k8	
RV1	250k/C dual log.	
RV2	100k/C dual log.	
RV3	10k/C log.	

Capacitors

C1	47n polycarbonate	(all electros single-ended)
C2, C9	10u/25 V electro.	
C3, C4	10n greencap	
C5	470u/25 V electro.	
C6, C7	1n5 greencap	

C8, C13	100u/25 V electro.
C10	100p ceramic
C11	100n greencap
C12	47u/25 V electro
C14	220u/25 V electro.
C15, C16	6u8/25 V tantalum.

Semiconductors

IC1, IC2	741
IC3	LM380
Q1	MPF106 or similar
LED1	TIL220R red LED, or sim.

Miscellaneous

SW1	SPDT toggle switch
SW2	SPST toggle switch
PL1	3-pin DIN plug
SK1	3-pin DIN socket
SK2	6.5 mm stereo headphone socket (or to suit plug-on headphones)
B1, B2	No. 216 9 V batteries and clips to suit

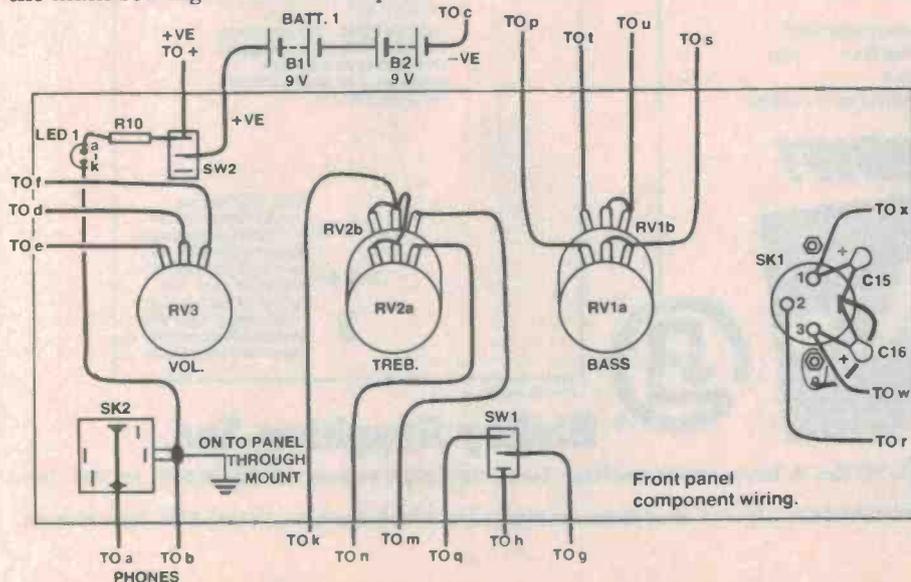
ETI-332 pc board; case — 150 x 95 x 55 mm or similar (we used a K&W model C642); three small collet knobs or similar; Scotchcal front panel; one crystal earpiece or crystal mic insert; rod or tube for probes; two-core shielded cable; one pair of 8 ohm headphones (higher impedance types will also be OK); wire, nuts, bolts, etc.

Price estimate

We estimate the cost of purchasing all the components for this project will be in the range:

\$35 - \$40

Note that this is an estimate only and not a recommended price. A variety of factors may affect the price of a project, such as — quality of components purchased, type of pc board (fibreglass or phenolic base), type of front panel supplied (if used), etc — whether bought as separate components or made up as a kit.



ATTENTION PC DESIGNERS & DRAFTERS!

**NOW GET THE ACCURACY
AND SAVINGS OF CAD*
WITHOUT ITS COSTLY
CAPITAL
INVESTMENT
AND THRU-PUT
DELAYS . . . Thanks to
Bishop's Unique New PC Pin
Registration, Overlay Drafting System**



Perfect PC
Artwork
Registration
Everytime

Bishop's new pin registration system is a fast, error-free mechanical method of achieving and maintaining the demanding accuracy and precise registration required for PC artwork . . . without the expense and scheduling bottlenecks of CAD. Before you invest in CAD, consider the accuracy, convenience, and cost savings of Bishop's unique overlay drafting pin registration system. Here are some of its time and money saving advantages:

- Precision registration and accuracy
 - Consistent locational accuracy of $\pm .002"$ (0,051mm) on any overlay sheet size
 - Insures absolute constant perpendicular registration
 - Prevents artwork film from buckling, stretching, or slipping due to temperature and humidity changes
- Cuts down man-hours required for registration, taping and production of PC artwork and associated documents
- Eliminates costly and time-consuming repetitive drawing and taping of common data
- Inexpensive and cost-effective . . . an easy, convenient and simple method to generate accurate PC artworks fast . . . you don't have to be a computer programmer to use it
- Speeds design changes — you only work on individual overlays affected

WE SHOW YOU HOW!

**FREE! Bishop
Technical Manual
No. 1022R**

Our "How To" Technical Manual No. 1022R includes special PC artwork step-by-step instructions and illustrations . . . Send now for your FREE copy.

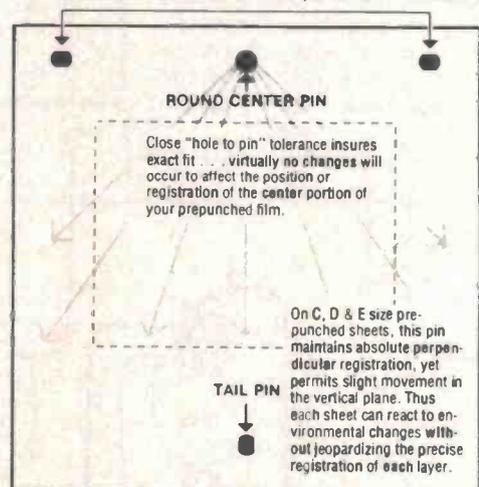


- Speeds and simplifies artwork checking by quickly and easily superimposing selected circuit overlays
- A complete "off-the-shelf" system including factory precision, PREPUNCHED grids and stable-based polyester ACCUFILM®
- Precision punching of sensitized materials . . . yours or ours

The SECRET To Precision Registration ... Bishop's Unique Pin Hole Pattern

TOP
UNIVERSAL
(SLOTTED)
PINS

Slotted shape provides tight "hole to pin" tolerance at top and bottom of universal metal pin, insuring perpendicular registration. Also provides "room" for film expansion and contraction (without buckling). Registration radiates from stable round center pin to keep film fluctuations to a bare minimum, insuring maximum registration in the most crucial area of your artwork — the center of the sheet.



The Innovators

Bishop Graphics, Inc.

NSW, ACT, NT, QLD — CIRCUIT COMPONENTS P/L, PO Box 70, Bexley, 383 Forrest Road, Bexley, NSW 2207, Australia. Tel: (02) 59-6550, 59-3720. Telex: CIRCOM AA27197.
VIC, SA, WA, TAS. — STEWART ELECTRONIC COMPONENTS PTY. LTD, 44 Stafford Street, Huntingdale, Vic. 3166, Australia. Tel: (03) 543-3733. Telex: AA36908.

ABCDEFGHIJKLMNOPQRSTUVWXYZBCDEFGHIJKLMN OPQRSTUVWXYZCDEFGHIJKL
 NO IJK' **THE MICRO METROPOLIS** YZFG
 NO IJK' ZIJKL
 NO STUVW
 YZNOPQRSTUVWXYZOPQRSTUVWXYZPQRSTUVWXYZRSTUVWXYZRSTUVWXYZST

**AUSTRALIA'S MOST POPULAR COMPUTER KIT -- SUPER INSTRUCTOR 80
 THE Z80/S100 MICROCOMPUTER**
AFFORDABLE
LOGICAL INVESTMENT
EXPANDABLE

INDIVIDUAL COMPONENT
 PRICES OVER \$500!!!!!!!

The new super "Instructor 80" uses the Z-80 micro-processor at its full speed (2 MHz). The VDU produces 64 characters per line including upper and lower case and graphics. It also uses only proven static memory. Software support includes BASIC, Assembler and Games with more support being added all the time. By adding additional cards you can match any ready made system such as the System 80, TRS-80, Sorcerer, PET or Apple at a fraction of their price. This new and improved model includes assembled and tested keyboard in case, assembled and tested VDU card, four slot mother board and provision for a modulator. What more could you ask for in a computer

**AND IT STILL COSTS ONLY \$399.00 IN KIT FORM
 OR ONLY \$459.00 ASSEMBLED AND TESTED**



NEW MICROWORLD BASIC

ONLY \$20.00
 IN CASSETTE
 OR EPROM
 FOR \$160!!!!

The long awaited MICROWORLD 12K LEVEL II BASIC for the DGZ80 is now available ONLY from APPLIED TECHNOLOGY. It is available in either cassette or EPROM (the EPROM on a newly released S-100 board). This new MICROWORLD LEVEL II BASIC has been written to contain more power in 12K than TANDY, SORCERER or APPLE.

New features include AUTO LINE NUMBERING and improved string handling. Every effort has been made to make MICROWORLD as close to standard BASIC as possible. Clever predefinition of integer or real variables makes this one of the fastest running BASICs available for the Z80 on the market today!

The MICROWORLD LEVEL II BASIC is available on either cassette or in EPROM. The cassette version costs only \$20.00 and includes a manual as well! The newly released S-100 ROM CARD supports the BASIC in ROM and is available for \$160.

MICROWORLD S100 MODULES and ASSOCIATED EQUIPMENT

DGZ80 single board CPU kit	\$199
MW640 64 char/16 line VDU	\$159
AT16K 16K STATIC RAM (ass/tested)	\$199
TCT16K Block locatable RAM kit	\$219
TCTPCG Programmable graphics generator	\$140
SBC2650 2650 CPU on the S100 bus (kit)	\$209
SCVT100 Serial terminal (EA Oct. 80)	\$195
DG750 I/O 2 serial, 24 parallel bits	\$175
MWWRP Wirewrap card	\$ 25
MW2516 EPROM card	\$ 99
MWEXT Extender card	\$ 30
MW1550 10 slot motherboard	\$ 49.50
MW S100 CF Card frame kit	\$ 49.50
MW S100 PS 8V @ 10A, 15-0-15 @ 2A	\$ 75
MW S100 EC Desk top cabinet	\$ 65
MW S100 FP Front Panel	\$ 15
MW USCII Cassette Interface	\$ 30
NT50 12" VIDEO MONITOR	\$139.50

SOFTWARE: (DGOS Format on cassette)

MICROWORLD LEVEL II BASIC with manual	\$19.75
MICROWORLD Z80 EDITOR/ASSEMBLER with manual	\$19.75
GAMES PAK #1 TARGET/TREK	\$14.75
GAMES PAK #2 MULTIPLE GAMES	\$14.75
MW-640 CHESS (two versions with/without PCG)	\$14.75
MW-INVAD MICROSPACE INVADERS the arcade game	\$14.75
MW-UTILITY Useful test and display programs	\$14.74

SOFTWARE: (EPROMS)

MICROWORLD LEVEL II 12K BASIC with manual	\$75
DGOS Monitor program for DGZ80	\$40

CATCH THE S-100 BUS TODAY!

Many people believe the S-100 BUS should be buried! Don't believe it - the S-100 BUS is alive and well. The proven quality of the Instructor 80 is indicative of the S-100's viability and remember you don't need to add \$500 worth of expansion, it's already there. Further proof is in August 1981 ETI - the brand new S-100 2650 SBC in kit form for only \$209 complete!



All items expected to be available and prices correct at time of going to press. Please phone for confirmation of price and availability.



OFFICE/SHOWROOM
 1a Pattison Avenue,
 Waiters 2077
 Hours: 9-5 Monday to
 Saturday. Ph. 487 2711

MAIL ORDERS TO:
 PO Box 311, Hornsby,
 2077.
 Please add \$2 per
 order towards cost of
 post and packaging.

AND NOW AT GOSFORD -
 1 Debenham Rd, W/Gosford (behind Pizza Hut) 043 24 2711

Check out these top value DICK SMITH KITS

The advantages of building a **DICK SMITH** kit



Everything you need is supplied — parts, solder, even nuts and bolts. And most kits include detailed instruction manuals, making construction a breeze!



It goes together so easily, you don't have to be an expert to build a kit. Just follow the instructions!



And it's finished. Sit back and enjoy your project. . . it looks so good and performs so well, your friends will never believe you built it!

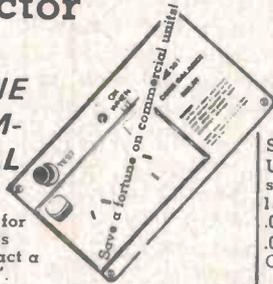
PLUS OUR UNIQUE 'SORRY DICK IT DOESN'T WORK' GUARANTEE

Just in case you run into trouble (unlikely!) many kits include a coupon enabling service on your kit for less-than-normal service fee! So you cannot lose with a **DICK SMITH** kit.

Earth leakage electronic circuit protector

SAVE A FORTUNE ON COMMERCIAL UNITS!

This is a must for every hobbyists workshop. In fact a real "lifesaver". Senses any leakage to earth from a mains appliance (eg. through your body) — shuts off the power before it has a chance to electrocute you!



\$49⁵⁰

Cat. K-3315 P&P \$3.00

INFRA RED REMOTE CONTROL

Uses remote control to switch on and off any appliance within 10 metre range. Controls appliances up to 1200 watts.

Cat. K-3380 P&P \$4.00

\$63⁹⁵

POOLS/LOTTO SELECTOR



P&P \$2.00
Picks numbers at random **\$19⁵⁰**

BENCHMATE



An indispensable tool for the bench. Combination 1W audio amplifier and 1.25 — 16V power supply @ up to 1A. **\$39⁵⁰**

Cat. K-3470

P&P \$3.00

SPEED SENTRY

Allows you to pre-set to a certain speed and gives a warning signal if you exceed the set speed.

\$11⁷⁵

Cat. K-3245 P&P \$2.00

LOOK AT THESE FANTASTIC SPECS!

DICK SMITHS' EXCLUSIVE SILK SCREENED FRONT PANEL

Cat. K-3467
P&P \$4.00



AUDIO OSCILLATOR

Super low distortion audio oscillator.

Uses the new VMOS for greater stability. Specs: Freq. range — 15KHz to 150KHz. Distortion .003% Mid band .011% @ 100KHz. .024% @ 20Hz. Amplitude stability ±1dB.

Comes with deluxe silk screened front panel!

\$65⁰⁰

Will negative ions improve your health? find out with this

ION GENERATOR

This easy to build kit breaks down dust and cigarette smoke particles, aids to a healthier and happier life. Comes complete with exclusive Dick Smith emitter head.



\$37⁵⁰

Cat. K-3335
P&P \$3.00

INFRA-RED BEAM RELAY

Pre-activated relay is set-off once beam is interrupted. Resets when beam is cleared. Ideal for burglar alarms, door minder etc. Use as camera trip, ideally suited to wildlife photography!

\$37⁵⁰

Cat. K-3375
P&P \$3.00



IMPROVE YOUR CAR SOUND

Stereo Booster

Add power & depth to your existing car stereo with this economical power package! 25 watts extra boost, and mounts easily under the dash!

\$29⁵⁰

P&P \$3.00

Cat. K-3493



\$34⁵⁰

Cat. K-3152 P&P \$3.00

DISCOSTROBE

This is a must for any party! special PCB which makes it really simple to assemble. Provision has been made on the PCB, so that extra parts can be added simply and economically. Turn your next party into a disco!



FIND YOUR FORTUNE!

AUTOCHIME

Doorbell with automatic selection of 24 tunes. Runs off 240V so no flat batteries. Plays each tune in sequence.

Cat. K-3502
P&P \$3.00

\$29⁷⁵



P&P \$3.00

\$35⁵⁰

METAL DETECTORS

An induction balance metal detector at a budget price. You build yourself and save/make a fortune!

Cat. K-3100

Simple circuitry means simple operation. Designed by E.A. using digital integrated circuitry.



K-3504

\$19⁵⁰

P&P \$2.00

PARTS FOR NEW KITS

Semiconductors

TLO 71 Bilet Op. Amp. Z-6030 95c
 TLO 74 Quad Bilet Op. Amp Z-6034 \$2.75
 CA 3080 Transconductance Amp Z-6024 \$2.45
 CA 3140 FET Op. Amp. Z-5417 \$1.48
 LM 380 Audio Amp Z-6080 \$1.48
 LM 394 Super Watched Transistor Pair Z-6083 \$4.50
 LM 317 Adjustable Regulator (TO-220) Z-6541 \$1.95
 XR-2206 Functions Generator Z-6820 \$5.95
 MOC 3020/21 OPTO-ISO-TRIAC Z-4516 \$2.75
 4016 CMOS Z-5616 49c
 4029 CMOS Z-5629 \$1.65
 4089 CMOS Z-5689 45c
 40194 CMOS Z-5694 \$3.50
 4511 CMOS Z-5730 \$1.55
 SN 76488 Complex Sound Generator Z-6823 \$4.95
 MM 5665N Universal Counter Chip Z-6816 \$9.75
 PND 5000isplay Z-4150 40c
 Rectangular LEDs - RED Z-4040 40c
 GREEN Z-4042 40c
 YELLOW Z-4044 40c

Printed Circuit Boards

Pavlovs Bagatelle H-8411 \$2.95
E.A. August
 Super 80 Computer H-8402 \$97.50
E.A. August
 Musicolor/Chaser H-8410 \$9.95
E.A. August
 Electrochune H-8404 \$11.50
E.A. July
 Probs/Lotto Selector H-8403 \$2.50
E.A. July
 Audio Oscillator H-8401 \$3.95
E.A. June
 Bench Mate H-8400 \$3.75
E.A. June
 Noise Meter H-8398 \$2.35
E.A. May
 Infra Red Remote Control H-8397 \$6.95
E.A. May
 P.C. Birdies H-8396 \$2.25
E.A. May
 Speed Sentry H-8399 \$1.95
E.A. May
 Infra Red Beam Relay H-8395 \$3.95
E.A. April
 Serial Interface H-8394 \$7.95
E.A. April
 Cylon Voice H-8387 \$2.50 **E.A. May**
 Universal Sound Synthesizer H-8640 \$2.50
ETI August
 Car Alarm H-8613 \$2.25
ETI July
 Universal Relay Driver H-8638 \$2.25
ETI May
 Humidity Sensor H-8636 \$2.25
ETI May
 Core Balance Relay H-8635 \$4.50
ETI May
 UHF to VHF Converter H-8637 \$2.95
ETI May
 Mosfet Amp. H-8633 \$9.95
ETI March
 Transformer for Super 80 M-2325 \$14.95
 2532 32K Eprom Z-9208 \$19.95

NEW KITS

ALL NEW INCREDIBLE MUSICOLOR/CHASER

Musicolor IV is a flexible light controller. It has all the features of the Mk III, plus lots more. Including 4 controlled channels, plus a light chaser with four chase patterns and a reverse switch for startling effects. Connects to speaker terminals of your amp. Completely safe — adds another amazing effect to your stereo — LIGHT!!



Cat. K-3143 P&P \$4.00

\$89⁰⁰

Includes our famous 'Sorry Dick It Doesn't Work' Guarantee

NOW AVAILABLE THE FANTASTIC SUPER 80 BUSINESS QUALITY KIT COMPUTER

Are you in the market for a fully functional computer for around half the price of competitive, built-up units??? If so — check out the fantastic features and price of the amazing Super 80.

See our Ad on Page 6

Information & prices on these kits is based on magazine's advance information. Details, prices and availability subject to change — please phone your store before coming in.

UNIVERSAL SOUND SYNTHESIZER

\$17⁵⁰

This kit allows you to build ONE ONLY of the projects mentioned.

THIS KIT COULD SAVE YOU \$1,000's!



CAR ALARM

New improved design. Without false triggering problems. Simple installation. Protect your valuable property from would-be thieves!

\$27⁵⁰

Cat. K-3253 P&P \$3.00

This kit consists of 5 projects based around a Texas Instrument IC. All dealing with sound effects! Projects include:
 Bomb drop and explosion
 Steam train and whistle
 Phasor woop-woop alarm
 Gunshot
 All five projects use the same PCB and IC, with a handfull of passive components.

Cat. K-3508

P&P \$3.00

ELECTROCHUNE Synthesizer



A versatile keyless monophonic organ that uses the circuitry of a synthesizer! It has variable attack/decay, tremolo, mixing control for an external input. Plus its own inbuilt amp and speaker with separate volume control. Touch sensitive keyboard. Ideal for experimenters!

HOT CANARY

An electronic bird whistle that sounds authentic. Keeps the kids amused for hours!

\$14⁹⁵

Cat. K-3396 P&P \$2.00

\$68

Cat. K-3506 P&P \$4.00

UHF TV Downconverter

This single channel kit converts transmission from the UHF band down to the VHF band for normal TV reception

\$32⁵⁰

Cat. K-3235 P&P \$3.00

DICK SMITH Electronics

Mail Order Centre: P.O. Box 321 Nth Ryde NSW 2113 (02) 888 3200

145 Parramatta Rd AUBURN 648 0558; 613 Princes Hwy BLAKEHURST 546 7744; 818 George St BROADWAY 211 3777; 531 Pittwater Rd BROOKVALE 93 0441; 147 Hume Hwy CHULLORA 642 9822; 162 Pacific Hwy GORE HILL 439 5311; 30 Grose St PARRAMATTA 683 1133; 125 York St SYDNEY 290 3377; 173 Maitland Rd NEWCASTLE 61 1896; 263 Keira St WOLLONGONG 28 3800; 96 Gladstone St FYSHWICK 80 4944; 166 Logan Rd BURANDA 391 6233; 842 Gympie Rd CHERMSIDE 59 6255; 60 Wright St ADELAIDE 212 1962; 399 Lonsdale St MELBOURNE 67 9834; 656 Bridge Rd RICHMOND 428 1614; Cnr Dandenong & Springvale Rds SPRINGVALE 547 0522; Cnr Wharf St & Albany Hwy CANNINGTON 451 8666; 414 William St PERTH 328 6944.



REMEMBER: They look so good your friends will never believe you built them!

An 'intelligent' battery charger

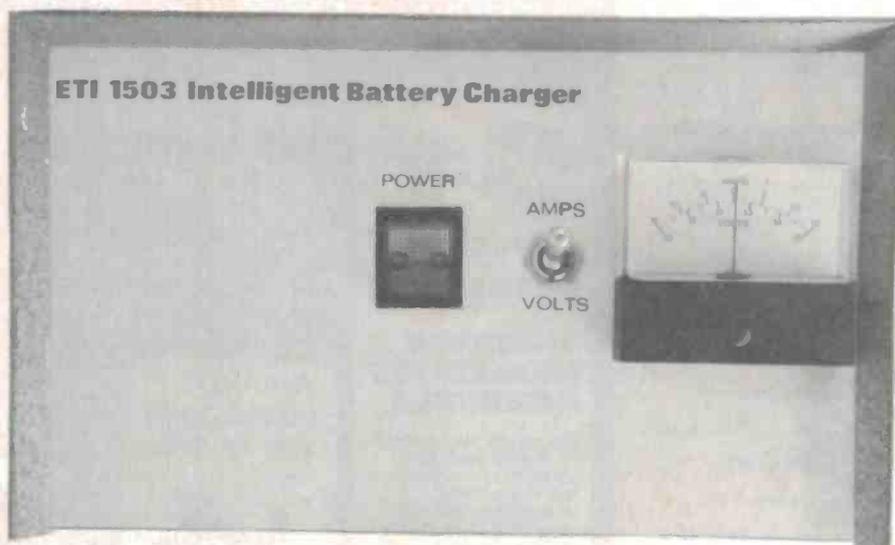
This is no ordinary battery charger. If you run a house alarm system, an amateur repeater or any electronic system with a 12 V battery 'back up' supply, this charger will keep that battery in a healthy state. It has other uses, too.

Jonathan Scott

IT IS PERHAPS too little known a fact that lead-acid batteries are not happy if left fully charged or discharged. They need to be used to stay in good condition. This is not, as a rule, a difficult situation when the battery is in a car, say, because it is called upon to run clocks or parking lights and to start the engine, and is charged when the engine is running. Some cars even arrange for the battery to be discharged to some extent when the engine is running and the lights are on (a mechanism into which we will not go just now). However, sad is the battery used as a burglar alarm power back-up system where it is continuously topped up, awaiting the moment when the mains fails. The battery fails too often before the mains supply!

As well as avoiding that situation, this charger maintains the 'spare' battery you keep in the garage for when that blighter of a P-plate driver son of yours borrows the Kingswood and leaves the lights on in the garage. Perhaps you charge it periodically at present, but the poor battery does not do any of the work that is necessary for its health and well-being.

Many amateur radio repeaters, popular on the VHF and UHF amateur bands for mobile operation with low power transceivers, employ (or should!) a battery back-up system. When a mains failure occurs the battery may be called upon to supply a pretty arduous load, cycling from a relatively low current in the listening mode to much higher currents when transmitting. To provide an operating time anywhere near the battery's rated capacity, the battery must be in 'good' condition. 'Float' or trickle charging will not ensure that.



The completed project was housed in an inexpensive yet attractive metal case, dressed up with a Scotchcal front panel label. A Scotchcal label could be used for the meter scale; however, University Graham Instruments will be supplying ready-made scales for these meters.

It is to overcome this sort of problem that we have designed this 'intelligent' battery charger.

This device monitors the state of charge and waits dormant until the battery is beginning to get flat. When it is low, but not in the deep discharge region, it turns itself on and charges the battery until it is full, whereupon it goes to sleep again until the battery is near exhausted, and so on. This has the disadvantage that there is an element of luck as to how charged the battery will be at any moment, but it is quite likely to be enough to start a car, for example, or to ring an alarm bell for quite a period. And it will be *just the same* in three months time.

In the burglar alarm back-up application this unit is ideal. It can also be used in conjunction with a load, such as the

ETI-147 (Oct. 1980), to 'recycle' a battery to restore lost capacity, or perform tests on a battery in a simulated load situation (how long will it run parking lights?). These last two are the original applications for which it was designed.

Although we have not specifically included it in the circuit, it is a good idea to have a small load on the battery when it is connected to the charger. We have provided terminals on the unit from which to draw power, as we expect the unit will be powering an alarm system or similar. If it is used to keep a spare battery healthy we recommend that a load such as a 180 R, 1 W resistor or a one-watt light globe be connected across the terminals to give a constant but small current drain.

Before we get into the construction,

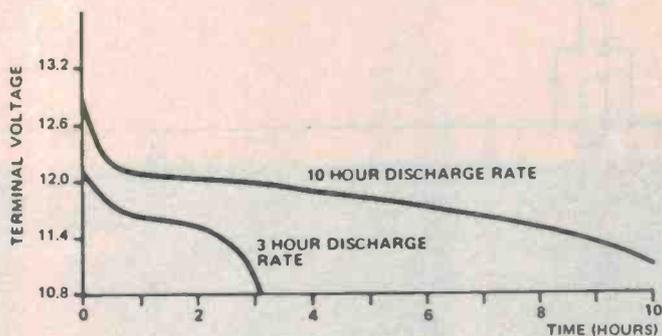


Figure 1. Typical discharge characteristics of a 12 V (nominal) lead-acid battery.

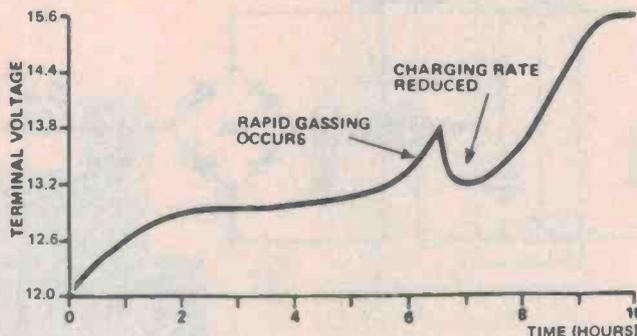


Figure 2. Charging characteristics of a 12 V (nominal) lead-acid battery. The 'kink' in the curve near six hours is explained in the text.

let's take a look at the characteristics of lead-acid batteries to gain an understanding of what happens when you discharge and charge them.

Lead-acid batteries

The fully-charged, no-load terminal voltage of a lead-acid cell is between 2.3-2.4 volts. This drops under load to about 2.0-2.2 volts. When discharged, the cell voltage is typically 1.85 volts. The amp-hour capacity is determined from a 10-hour discharge rate. The current required to discharge the battery to its end-point voltage of 1.85 V/cell is multiplied by this time; e.g. a 40 AH battery will provide four amps for 10 hours before requiring recharge. Note however that the amp-hour capacity varies with the discharge current. The same battery discharged at a rate of 10 amps will not last four hours; on the other hand if it is discharged at 1 amp it will last somewhat longer than 40 hours. The typical discharge characteristics of a (nominal) 12 V battery are shown in Figure 1.

The ideal initial charging current for the fully discharged battery (cell voltage under 2.0 V) should be about 20 amps per 100 amp-hours of capacity (i.e. 8 amps for a 40 AH battery). Once the electrolyte begins to gas rapidly, the terminal voltage will be around 13.8 volts and rising rapidly. At this point, the charging current should be reduced to somewhere between 4-8 amps per 100 AH until charging is complete.

At the end of charging, terminal voltage may rise to about 15.6 volts or more, but this decreases slowly after the charger is removed, the terminal voltage then usually reading around 14.0 to 14.4 volts (see Figure 2).

This project may be used with batteries having rated capacities from 4 AH to 100 AH, providing it is set up for the battery in use, according to the

set-up procedure given at the end of the article.

Construction

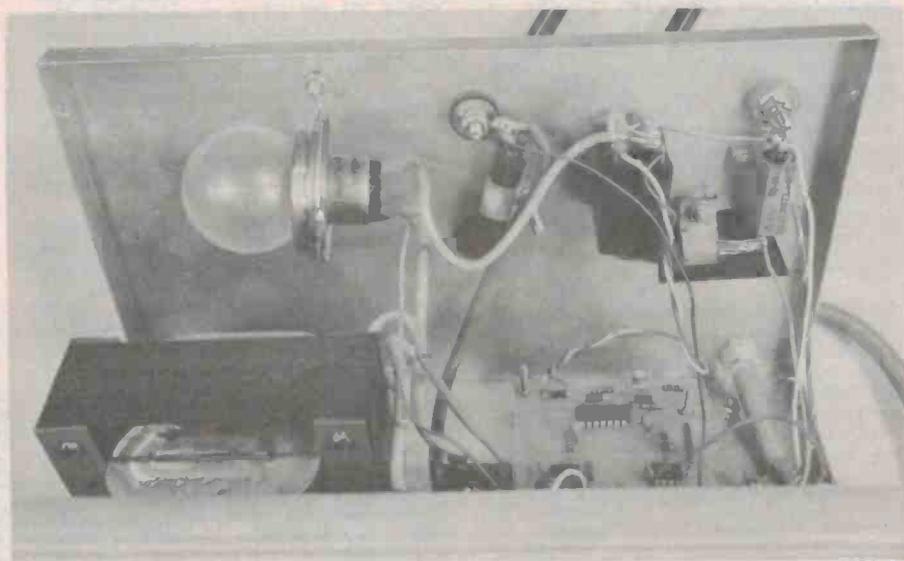
The component layout is not critical with this project, so there is no need to adhere strictly to the details which follow, provided you know roughly what you are about. The only constraint is that quite a lot of power (60-odd watts) is dissipated by the circuit as a whole and so the design needs to be fairly open and well ventilated.

We used a 'K&W' model C1066 box which allows plenty of room and has good ventilation slots in the sides and top. The first step in the construction is to set the major components out inside the box where you will want them and check that there is enough 'room to move' and that wiring will be easy. Mark the positions for mounting holes with a soft lead pencil, then remove the bits and pieces and drill the holes. We

used a 6 V headlight globe from Volkswagen for LP1, which we mounted by soldering some 18-gauge tinned copper wire to the metallic collar and forming bolt holes in the ends of the wire. This held it most satisfactorily about 10 mm from the rear panel of the case, just below a set of vent slots.

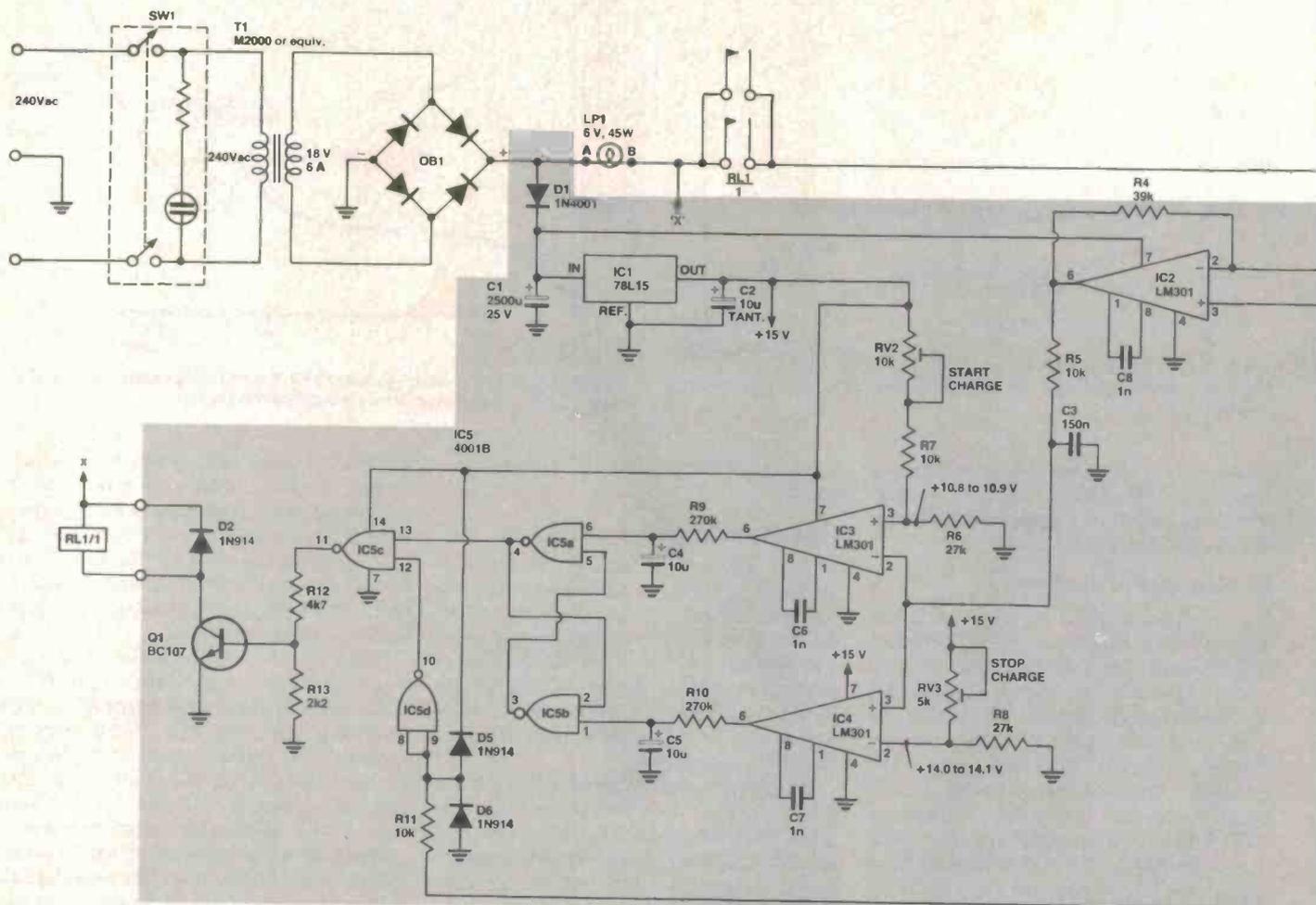
Next fit the components to the pc board as shown in the overlay, starting with the resistors and capacitors and finishing with the ICs. Take care to observe the correct polarity with the electrolytic capacitors, diodes and ICs. Attach adequate lengths of hookup wire, where applicable, to the pc board.

Next, fit and interconnect the various components in the box. The metal-clad power resistor, R1, will be carrying up to 15 A or so at maximum and thus should be connected to the battery and the output terminals by short lengths of the heaviest cable possible. We used 6 mm-thick automotive starter-type



View of the rear panel showing how we mounted the various major components. Note the 45 W lamp 'ballast'. The relay was glued in place between the two output terminals. The Arcol metal-clad resistor is mounted as close as possible to the positive output terminal.

Project 1503



HOW IT WORKS — ETI-1503

The overall function of the device is as follows: when the open-circuit potential of the battery falls to below about 10.8 volts the charger turns on, charging the battery until the potential rises to about 14 volts, whereupon it turns off the charging current and waits dormant until the cycle repeats.

Let us start by considering the conditions when a normal, partially charged battery is connected and the unit is dormant. IC2 in conjunction with R1 and the surrounding components are connected to determine the open-circuit voltage potential of the battery even though it may have a load drawing power. IC1's output is equal to the terminal voltage of the battery minus about 4 times the voltage across R1, times the reduction fraction of RV1; mathematically it is:

$$V_{out} = V_{\text{battery terminal}} - \frac{39k}{10k} \times V_{\text{across R1}} \times K$$

where K is the fraction between 0 and 1 determined by RV1

When a load current is drawn from the battery a voltage = $I_{\text{load}} \times R1$ is dropped across R1. With respect to the voltage at the junction of R1 and the battery (the reference for IC2) this potential is negative. By choosing K to be the correct value, which is:

$$K = \text{Internal Resistance of battery} \times \frac{1}{3.9} \times \frac{1}{R1}$$

$$V_{out} = V_{\text{battery terminal}} + I_{\text{load}} \times R1 \times \frac{V_{\text{open circuit}}}{V_{\text{battery}}}$$

Since K cannot, of course, exceed a value of one, the circuit will handle batteries with internal resistances up to 3.9 times R1, or about

85 milliohms. This should be adequate for all car batteries, but doubling R4 to, say, 82k, will enable batteries with up to 180 milliohms internal resistance to be used, and so on.

Having ascertained the function of IC2, let us now consider the action of the rest of the circuit. IC3 and IC4 act as comparators. The output of IC3 goes high when the battery open-circuit voltage falls to below 10.8 volts. This level is set by RV2, which compensates for offsets and component tolerances. The output of IC4 goes high when the open-circuit battery voltage rises to above 14 volts. This is set by RV3. These levels correspond to a battery at the ends of its healthy charge/discharge curve.

IC5 performs the logic necessary to control the relay. The first two gates (IC5a, IC5b) are coupled as a flip-flop. When the device is idle, the output of IC5a is high and the flip-flop is in the 'discharge' condition. The relay is held off by IC5c. If the battery is very flat, or if the wires are short-circuited, or the battery connected in reverse, IC5d holds the relay off irrespective of the flip-flop condition. When the battery is connected and is only normally discharged, and when the flip-flop is in the charge condition, IC5c turns Q1 on and the relay pulls in connecting the battery to the unregulated supply, again via R1 (permitting actual V_{out} to be measured) and via the light globe, which effectively regulates the current. (More on this in a moment).

IC1 simply provides a voltage reference of about 15 volts, as well as a regulated supply for IC3, IC4 and IC5. The meter and surround-

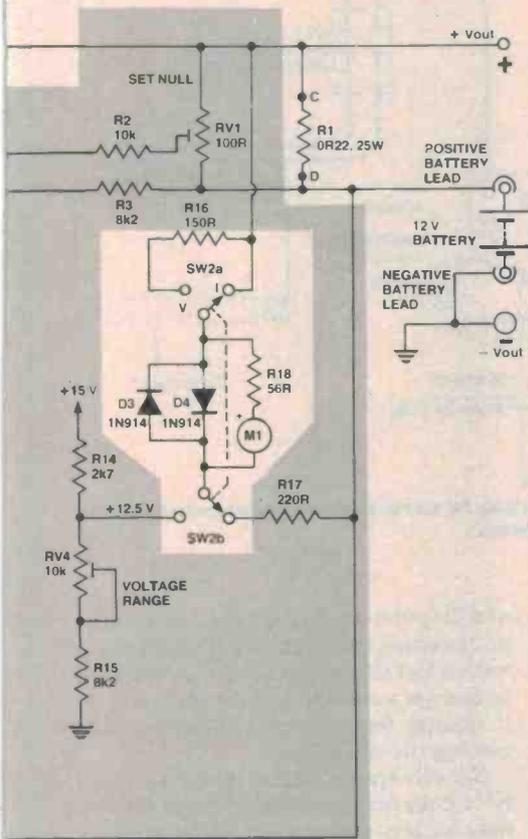
ing components provide a convenient 15-0-15 amp current meter and a 10-15 volt suppressed zero voltmeter, which reads the voltage delivered to the load.

When the battery open-circuit potential falls to below the preset limit (10.8 V), IC3 toggles the flip-flop and RL1 pulls in. The charge current flows until the output of IC4 goes high, toggling the flip-flop back to the original state and turning the relay off. While charging, the current is effectively regulated by LP1 (a 6 V, 45 W light globe). The globe exhibits a characteristic of $I \propto V^2$, which tends to hold the current at around 5-6 A after it warms up. Initial charging current will be higher. This method of current regulation is by far the cheapest, and causes no RFI, etc. In case anyone should experience trouble getting such a globe, such as might be the case if you do not have a Volkswagen parts place nearby (many old VWs have 6 V headlights), we have included a circuit which can be substituted. It is at once clear how much nicer is the globe approach!

LIGHT GLOBE SUBSTITUTE

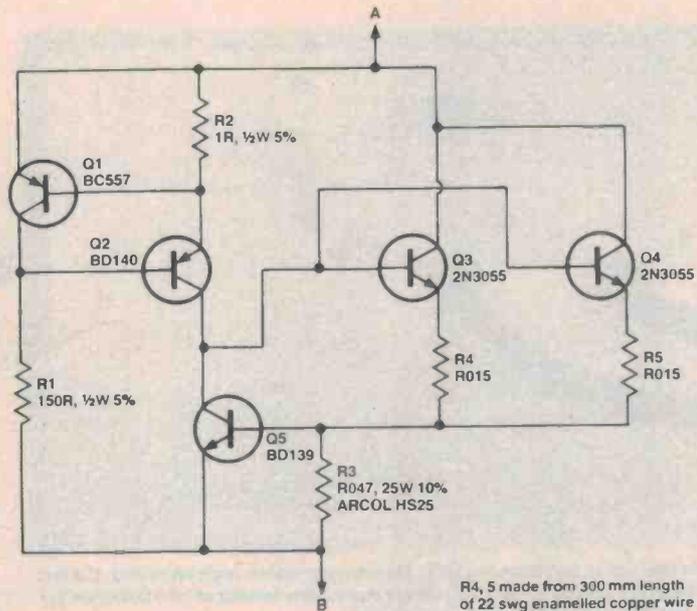
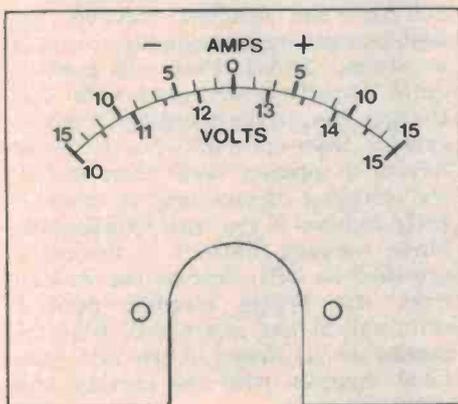
Transistors Q1 and Q2 form a current source, feeding about 600 mA out of the collector of Q2. This turns on Q3 and Q4 until 0.6 volts is dropped across the R047 resistor, R3. At this point, Q5 turns on and removes the excess drive current from Q3/4, regulating the current in this fashion. The two R015 resistors, formed by about 300 mm of 22 swg each, ensure that Q3 and Q4 share the load roughly equally. Q3 and Q4 must be mounted on a suitable heatsink.

battery charger



The circuit is fairly straightforward. The M-2000 transformer (T1) is rated to deliver 6 A at 18 V. However, it will deliver more than twice the output current for short periods, without distress, and we've taken advantage of that. The secondary voltage loads down somewhat, but that's been taken into account. Note that the relay has its contacts paralleled.

Full-scale artwork for the TD-66 1-0-1 mA meter. University Graham Instruments will be supplying meters for this project with this scale fitted.



R4, 5 made from 300 mm length of 22 swg enamelled copper wire

Circuit of the light globe substitute.

cables, which ran to the bolt-on battery terminals, rather than the alligator clips usually found on battery chargers and jumper leads. This minimised resistance and hence voltage drop with heavy load currents. The voltage sensing circuitry expects a low resistance path to the battery, so this arrangement is by far the best.

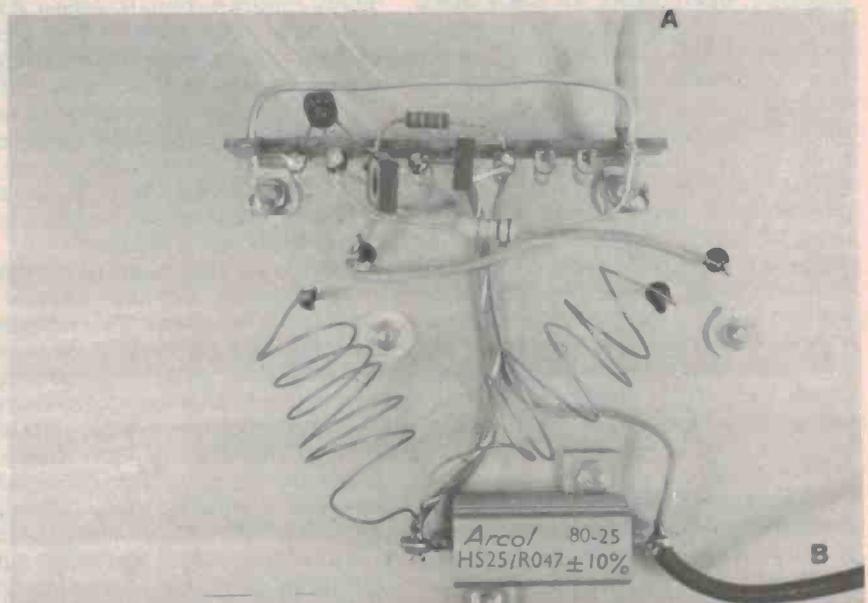
The leads connecting transformer, diode bridge, lamp and output terminals need to be fairly heavy, but not so heavy as the battery leads —

ordinary automotive hookup wire (32 x 0.2 mm) or 1.5 mm tinned copper wire in spaghetti is quite adequate.

Follow the interconnection diagram to complete the circuit. If you like, a large and chunky bezel can be fitted to an appropriate part of the front panel so that it is illuminated by the globe when the unit is charging.

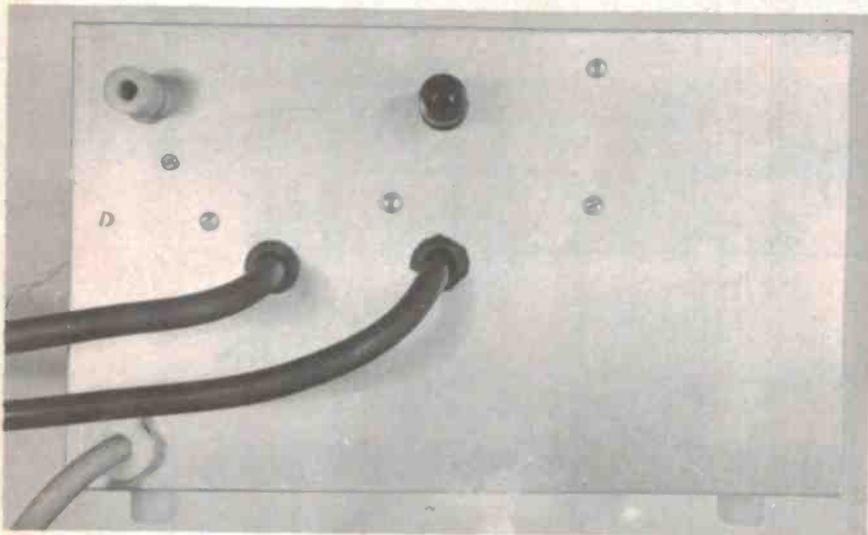
We felt this to be a little superfluous as light streams out of the ventilation slots!

The mains wiring should be installed ▶

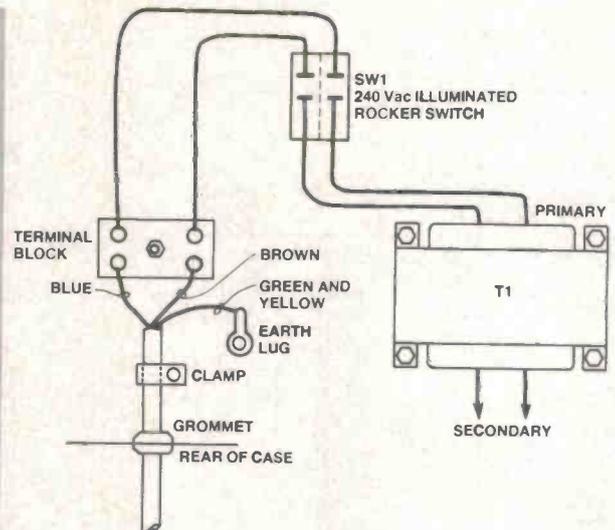


Construction of the light globe substitute circuit. Layout is not critical.

Project 1503



View of the rear panel (exciting, isn't it!), showing the mains cable entry and the two battery cables. The output terminals to supply equipment running off the batteries are at the top, positive on the left, negative on the right.



Mains cable wiring. Be sure to sleeve all exposed connections for your own protection.

with care, the mains input lead being physically 'shielded' from the pc board by a cardboard 'screen'.

For those people with no access to a VW dealer or other source of suitable 6 V globes, we have provided a tested current regulator circuit. We constructed ours using a tag strip which bolted neatly on to the power transistor collector connections (see pic, p. 41). This is a last resort, as it is more costly and less easy to install than a simple lamp, and demands some sort of careful heatsinking. We built ours on a separate small sheet of 1 mm thick aluminium, though there is no reason why you should not use a panel of the box if physically convenient. We mounted two pre-drilled heatsinks to the transistors to dissipate most of the heat. Be sure to fit the 2N3055s carefully, removing burrs which might puncture the insulating washers and using adequate thermal compound. The value of the two R015 resistors (R4, R5) is not critical, though care should be taken to ensure that they are equal in value as their function is to make the two transistors share the load. We made them with about 300 mm of 22 swg enamelled wire each.

Setting up

Once construction is completed, the unit may be set up for correct operation after you have carried out a *thorough* wiring check.

Fit a battery which is not very flat and turn the unit on. It may come on in the charge mode or it may be dormant,

depending on the actual battery terminal voltage. To set the charger up you will need a multimeter with a sensitivity of at least 20k/volt.

First, operate the meter switch so that the meter reads volts (V). Connect your multimeter across the output terminals on the rear of the case, set it to read volts, and adjust RV4 so that the front panel meter reads the same voltage as the multimeter. Once RV4 has been adjusted, connect your multimeter (still on the same range) between pin 2 of IC4 (multimeter positive lead) and 0 V (black output terminal). Adjust RV3 so that your multimeter reads 14.0 to 14.1 volts here. This adjusts the point where the charger turns off ('STOP CHARGE'). Next, connect your multimeter between pin 3 of IC3 (multimeter positive lead) and 0 V, and adjust RV2 to obtain about 10.8 to 10.9 volts here. This sets the point where the charger turns on ('START CHARGE').

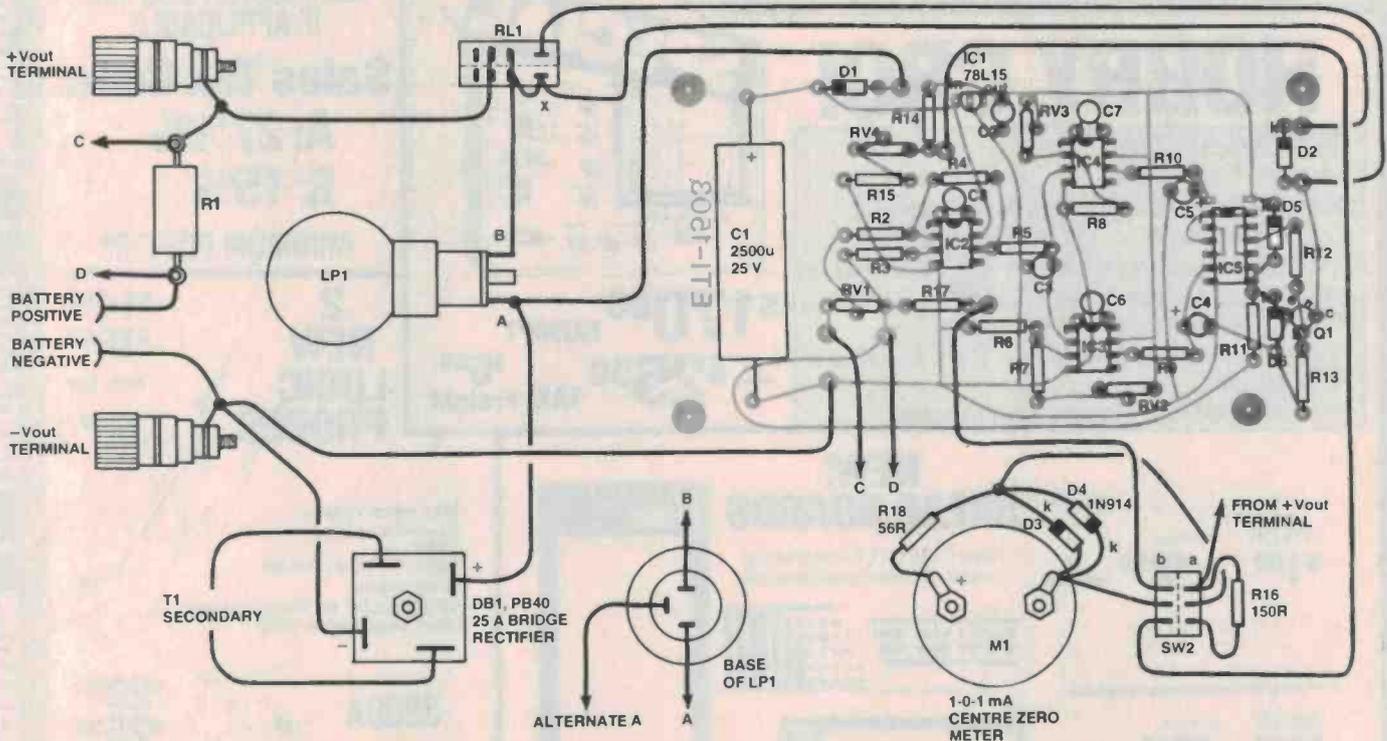
Finally, the unit needs to be adjusted to compensate for the internal resistance of the battery. This adjustment is simple, but will need to be done for each different battery with which the unit is used. If the unit is charging initially it may be best to toggle it off for convenience. This is most easily accomplished by momentarily connecting the positive end of C5 to the 15 V supply ('out' pin of IC1). Next, connect a load of a few amps to the charger's output terminals, either via a switch or flying leads so that you can connect and disconnect it. Then adjust RV1 so that no change in voltage occurs on the output

of IC2 (pin 6) when the load is connected or disconnected. This should not be done with a flat battery — i.e. if the unit goes to charge mode at initial switch-on, let it charge for a few hours before completing the calibration.

Strictly speaking, the recalibration of RV1 does not need to be redone for any new battery connected, especially if the battery is just going to be left alone and is not intended for back-up work, such as a burglar alarm battery. The internal positive lead resistance will be roughly similar for similar capacity batteries, so this can be neglected if you are only leaving the battery on for a short while, as might be the case if you transfer the car battery onto the charger for a day or a few days. However, RV1 should be recalibrated if the installation is to be considered permanent or if the batteries are very different in capacity.

The charger was designed to be used with batteries having a capacity up to 100 AH. The smallest capacity car batteries generally available are rated at around 32 AH. They will perform quite happily when used with this charger, though the charging current is greater than optimum. For batteries having a capacity lower than 40 AH, the charging current may be conveniently reduced if you wish by using the lower wattage filament in the globe specified for LP1. Connect the 'A' lead from the bridge rectifier positive terminal to the alternative filament connection as shown in the LP1 Base Lead diagram with the overlay and wiring diagram.

battery charger



COMPONENT PINOUTS

Capacitors

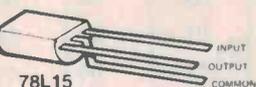
tantalum



electrolytic



Semiconductors



BC547, BC107 etc

PARTS LIST — ETI-1503

Resistors

	all 1/2W, 5% unless noted
R1	R022, 25 W (Arcol, metal clad type)
R2,R5,R7,R11	10k
R3,R15	8k2
R4	39k
R6, R8	27k
R9,R10	270k
R12	4k7
R13	2k2
R14	2k7
R16	150R
R17	220R
R18	56R

Capacitors

C1	2500u/25 V electro.
C2,C4,C5	10u/16 V tantalum or RBL
C3	150n
C6,C7,C8	1n ceramic

Semiconductors

D1	1N4001 or similar
D2-D6	1N914 or similar
DB1	25A bridge rectifier
IC1	78L15 3-terminal regulator
IC2,IC3,IC4	LM301
IC5	4001
Q1	BC107, BC547 etc

Miscellaneous

RV1	100R trimpot
RV2, RV4	10k trimpot
RV3	5k trimpot
M1	1-0-1 mA centre-zero panel meter
RL1	12 V SPST relay with 10 A contacts or DPST with 5 A contacts.

LP1	6V, 45 W or 50 W Volkswagen headlamp globe
T1	240 V to 17-18 V transformer, 6 A secondary (i.e. DSE M-2000)
SW1	Rocker switch, 240 Vac rated with neon illumination.
SW2	Spring-return action DPDT toggle switch

Case — 255 x 160 x 160 mm or similar (e.g. K&W Series C1066); ETI-1503 pc board; wire; mains cable clamp, mains lead and plug; battery cables and clamps; one red and one black heavy duty terminals.

Supplementary parts — substitute for LP1

Q1	BC557 etc.
Q2	BD140
Q3,Q4	2N3055
Q5	BD139
R1	1R, 1 W
R2	150R, 1/2 W
R3	R047, 25 W (Arcol, metal clad type)
R4,R5	see text.

Transistor Insulated mounting components, heatsinks, nuts, bolts, etc.

Price estimate

We estimate that the cost of purchasing all the components for this project will be in the range:

\$78 - \$86

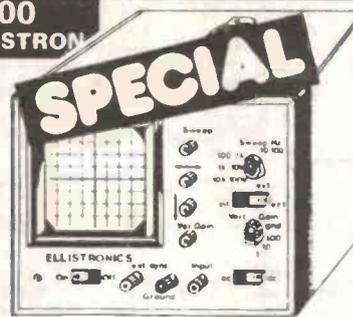
Note that this is an estimate only and not a recommended price. A variety of factors may affect the price of a project such as — quality of components purchased, type of pc board (fibre-glass or phenolic base), type of front panel (if used) supplied etc — whether bought as separate components or made up as a kit.

289 LATROBE ST., MELBOURNE 3000
 PHONE (03) 6023282 - 6023836 TELEX AA 37758 LSTRON

HOBBY CRO!

SPECIFICATIONS

Weight: About 3.8kg
 Size: 202mm(w) × 160mm(h) × 306mm(d)
 Usable Bandwidth: D.C. to 6.5 MHz plus.
 Vertical deflection sensitivity: 10mV per division
 Horizontal deflection sensitivity: 500mV per division
 Time base sweep frequency: 10Hz to 100kHz in 4 ranges
 Synchronisation: internal and external.



\$170⁰⁰ EXEMPT
 + **\$25⁵⁰** TAX **\$6⁰⁰** Freight

ALL PRICES PLUS TAX
 IF APPLICABLE

Sales Tax Code:

A: 27½%

B: 15%

MINIMUM POST: \$2

**2
 NEW
 LOGIC
 PROBES**

\$14⁰⁰

\$16⁰⁰

inc. tax

DLP-1



Max Input 1.5MHz
 Strong Aluminium case
 LEDs: HI - LOW - PULSE
 80cm leads
 KEY to LEDs on back of probe
 Input Impedance 300k



3800A

\$22⁰⁰

\$25³⁰

inc. tax

Max Input 10MHz
 Memory/Pulse Sw
 TTL/CMOS Sw
 Input Impedance 300k
 Smart black plastic case
 53cm leads

NEW! BREAD BOARDS

Now DIRECTLY Imported at
 ½ cost of other breadboards!

WB-DN 100 Holes
\$198 **\$228** INC. TAX



WB-TN 640 Holes
\$757 **\$870** INC. TAX



WB-2N 100 + 640 Holes
\$965 **\$1110** INC. TAX



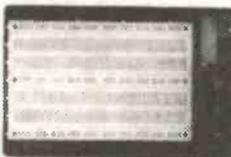
WB-2N 200 + 640 Holes
\$1121 **\$1290** INC. TAX



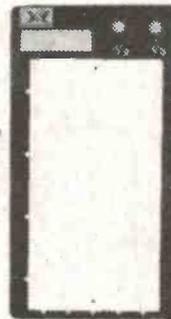
Cut away view



WB-4N 400 + 1280 Holes
\$2503 **\$2878** INC. TAX



WB-4N-1 300 + 1280 Holes
\$2350 **\$2703** INC. TAX



WB-4N-3 100 + 1280 Holes
\$1959 **\$2253** INC. TAX



WB-6N 500 + 1920 Holes
\$3558 **\$4092** INC. TAX

**Our lowest
 prices ever!
 While
 stocks last!**

	1-24	25-99	100 plus		1-24	25-99	100 plus
2708	4.50	3.55	3.25 B	BC547-8-9	.11	.09	.07 B
2716 5V	4.95	4.10	3.60 B	BC557-8-9	.11	.09	.07 B
2732 5V	11.50	9.50	8.25 B	RED LEDS 5mm	.12	.09	.07 B
2114 300NS	2.20	1.95	1.50 B	IN 4002	.05	.04	.035 B
4116 200NS	1.95	1.80	1.50 B	IN 4004	.07	.05	.04 B
8164 64 × 1K RAM	56.00	39.00	37.50 B	IN 4007	.12	.09	.07 B
8414 1K × 4 CMOS RAM	7.50	5.25	4.50 B	2N 3055	.65	.55	.49 B
Z80CPU 2 MEG	10.76	7.16	6.73 B	PACK & POST UP TO \$25 = \$2			
Z80ACPU 4 MEG	13.50	9.59	9.01 B	PACK & POST UP TO \$50 = \$3			
Z80 P10	6.95	5.17	4.86 B	PACK & POST UP TO \$100 = \$5			
Z80A P10	9.18	6.64	6.24 B	ALL COMPONENTS ARE PRIME SPEC AND ARE FULLY COVERED BY MANUFACTURERS GUARANTEE.			
Z80 CTC	6.95	5.19	4.88 B				
Z80A CTC	8.48	6.09	5.73 B				

→ JAYCAR'S FIRST EVER ← SALE!

We are stocked to the rafters with goodies but we need the cash to make new kits. Rush in now and take advantage of our predicament!!

Sorry! We haven't got time to draw pretty pictures of some of these products. Use your imagination and save a fortune!!

FERRIS IN-CAR SOUND GEAR

Ferris Coax Speakers 5¼" 10oz magnets
Save \$8.00 were \$37.50 NOW \$29.50
Ferris Twin Cone 5¼" 12 oz magnets
Save \$8.00 were \$27.50 NOW \$19.50
2 x 20 watt Car Power Booster Bargain
Save \$4.50 was \$29.50 NOW \$25.00
"Unisef" In-Dash AM-FM Stereo Cassette
Players — normally \$99 NOW \$79.00!!
UNBELIEVABLE!!
Ultra Slim Speakers 35mm thick 5¼" dia.
SAVE \$10.00 were \$29.50 NOW \$19.50
Car Quartz Clocks with magnificent green
fluoro display ONLY \$19 SAVE \$5!!!

MULTIMETER SALE!!!! FAMOUS 'SEW' BRAND

ST-5 Beginner's special 4000ohm/volt
Normally \$11.95 SALE PRICE \$9.95
Economy model SP-10D Diode protected
1000V AC/DC
Normally \$18.50 SALE PRICE \$16.50
Regular Model YN360TR Transistor
Tester — all features
Normally \$24.50 SALE PRICE \$22.50
Luxury Model ST303TR — Transistor
tester, mirror scale plus many features
Normally \$34.95 SALE PRICE \$32.50

ETI 3600 & 4600 Synthesisers

We stock the hard-to-get parts for these
impressive projects.
ETI 3600 front panel \$75.00
ETI 4600 front panel \$98.00
Call in to our showroom or send SAE for list of
other parts.

ETI 330 "Current Trip" Car Alarm

Refer ETI July 1981.
Phil Wait has done a great job on this one! Read
the article first and then rush in!!

Car Protection for
only \$ 24.50

ETI 5000 SERIES AMPLIFIER

We believe that Jaycar is the only company producing the 5000 Mosfet amplifier in the form as described by ETI. When you buy the Jaycar kit you get the square section chassis bars as shown in the article. Other kits use a cheaper folded steel chassis to save money! Remember the 5000 Mosfet is a "no-compromise" design — and you will get the best price in town from us anyway!

ONLY \$289 for the complete KIT!!

5000 PREAMP

And the price??

Ring us and ask!!

— Need we say more? Come and see it at our city showroom.

FERGUSON TRANSFORMERS

PCB MOUNT		
PL-9/5VA 9V @ 0.56A 4.5V @ 1.1A		\$4.95
PL-12/5VA 12V @ 0.42A 6V @ 0.83A		\$4.95
PL-15/5VA 15V @ 0.33A 7.5V @ 0.67A		\$4.95
PL-18/5VA 18V @ 0.28A 9V @ 0.56A		\$4.95
PL-24/5VA 24V @ 0.21A 12V @ 0.42A		\$4.95
PL-30/5VA 30V @ 0.17A 15V @ 0.33A		\$4.95
PL-40/5VA 40V @ 0.13A 20V @ 0.25A		\$4.95
PL-18/12VA 18V @ 0.67A 9V @ 1.33A		\$6.50
PL-24/12VA 24V @ 0.5A 12V @ 1.0A		\$6.50
PL-30/12VA 30V @ 0.4A 15V @ 0.8A		\$6.50
LOW PROFILE		
PL-12/20VA 12V @ 1.67A 6V @ 3.3A		\$8.50
PL-15/20VA 15V @ 1.33A 7.5V @ 2.67A		\$8.50
PL-18/20VA 18V @ 1.11A 9V @ 2.22A		\$8.50
PL-24/20VA 24V @ 0.83A 12V @ 1.67A		\$8.50
PL-30/20VA 30V @ 0.67A 15V @ 1.33A		\$8.50
PL-40/20VA 40V @ 0.5A 20V @ 1.0A		\$8.50
PL-12/40VA 12V @ 3.33A 6V @ 6.67A		\$9.75
PL-15/40VA 15V @ 2.67A 7.5V @ 5.33A		\$9.75
PL-18/40VA 18V @ 2.22A 9V @ 4.44A		\$9.75
PL-24/40VA 24V @ 1.67A 12V @ 3.3A		\$9.75
PL-30/40VA 30V @ 1.33A 15V @ 2.67A		\$9.75
PL-40/40VA 40V @ 1.0A 20V @ 2.0A		\$9.75
PL-12/60VA 12V @ 5.0A		\$11.50
PL-15/60VA 15V @ 4.0A		\$11.50
PL-18/60VA 18V @ 3.3A 9V @ 6.67A		\$11.50
PL-24/60VA 24V @ 2.5A 12V @ 5.0A		\$11.50
PL-30/60VA 30V @ 2.0A 15V @ 4.0A		\$11.50
PL-40/60VA 40V @ 1.5A 20V @ 3.0A		\$11.50

CONVENTIONAL CHASSIS MOUNTING		
PF 3577 56V CT 2 amp		\$15.25
PF 4361/1 70V CT 2.5 amp 30V CT 0.5 amp		\$34.50
PF 4362 70V CT 4 amp 30V CT 0.5 amp		\$39.50
PF 4363 94V CT 3 amp 30V CT 0.5 amp		\$39.50
PF 4403 9V 10 amp 1k 15V 1 amp		\$29.50
2155 multitap 1 amp		\$15.95
2156 multitap 2 amp		\$6.50
2851 12.6V CT 150mA		\$3.90
6672 multitap 1 amp		\$7.50
AC ADAPTORS		
PPB4/1000 4V AC 1 amp		\$9.50
PPB8/1000 8V AC 1 amp		\$9.50
PPB12/500 12V AC 0.5 amp		\$9.50
STEPDOWN		
TS-115/125B 115V AC 125VA		\$39.50

LESS 10%
AUGUST ONLY

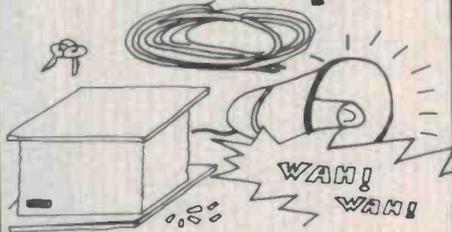
JUMBO PACKS

HUGE bag of PVC Spaghetti
sleeving, over 20 metres! \$3.50
Grommet pack, over 100
Delryn grommets from 6mm to
25mm \$3.50
Cable Lacing cord as used by
the Australian Navy. Mil. Spec.
10 metres only \$3.50

ARLEC HOME BURGLAR ALARM

Complete kit self contained and
featuring:
* Ultrasonic detection with 8 metre (26
feet) range
* Variable range control
* Mains and/or battery operation
* Automatic entry/exit delay
* Key switch on/off
* Ear-splitting
* Additional powerful horn speaker and
15m of cable no extra charge
* Incorporates circuitry for optional
external detectors
* Automatic reset

Normally \$115
THIS MONTH ONLY **\$99**



ARLEC CA-443 ELECTRONIC CAR BURGLAR ALARM

Fantastic design that is enviromentally
acceptable but gives you the comfort of
knowing your car is safe. Features:
* Red LED warning lamp (dash
mounted).
* Automatic exit/entry delay
* Siren (supplied) operates for 3 mins.
after triggering
* 12V DC, fuse protected via auto fuse
box.
* Includes 2 optional circuits for
protecting your car accessories
* 12 month guarantee



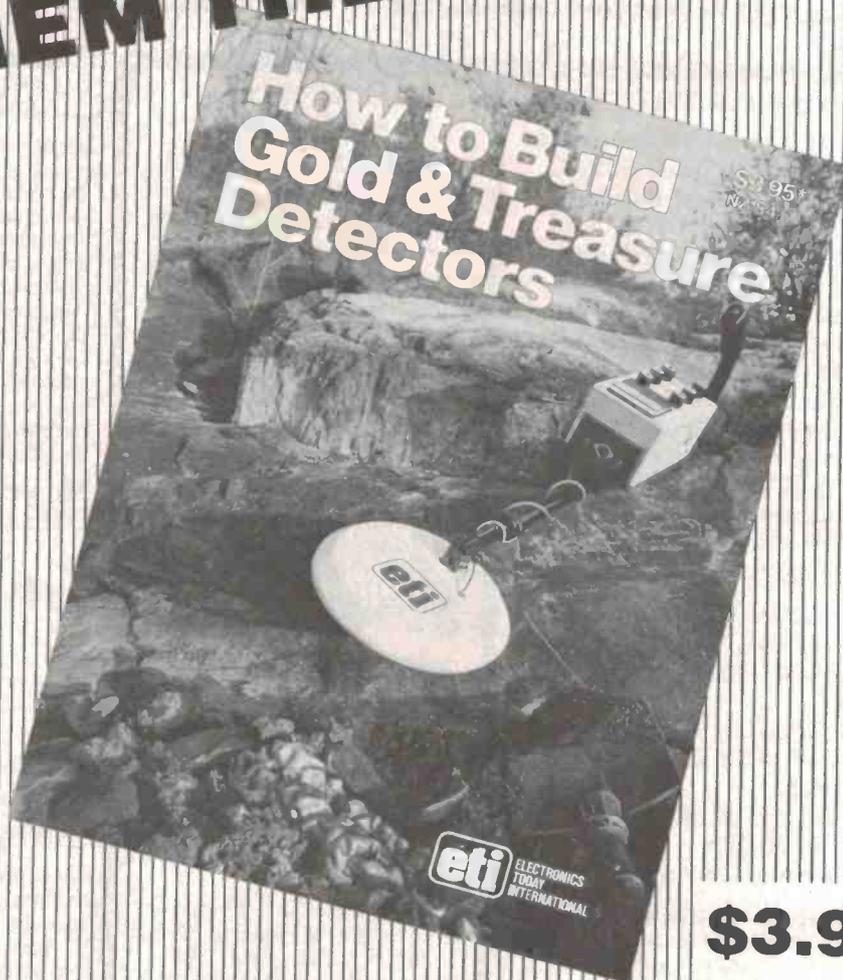
Staggering
Value at \$57

POST & PACKING CHARGES

Order Value	Charges
\$5-\$9.99	\$1.00
\$10-\$24.99	\$2.00
\$25-\$49.99	\$3.00
\$50-\$99.99	\$4.00
\$100 or more	\$5.50

See our other ads in this magazine for
our address

**THERE'S GOLD
IN THEM THERE HILLS!**



\$3.95

— and coins and rings and old treasures and uranium and . . .

YOU CAN DIG IT OUT

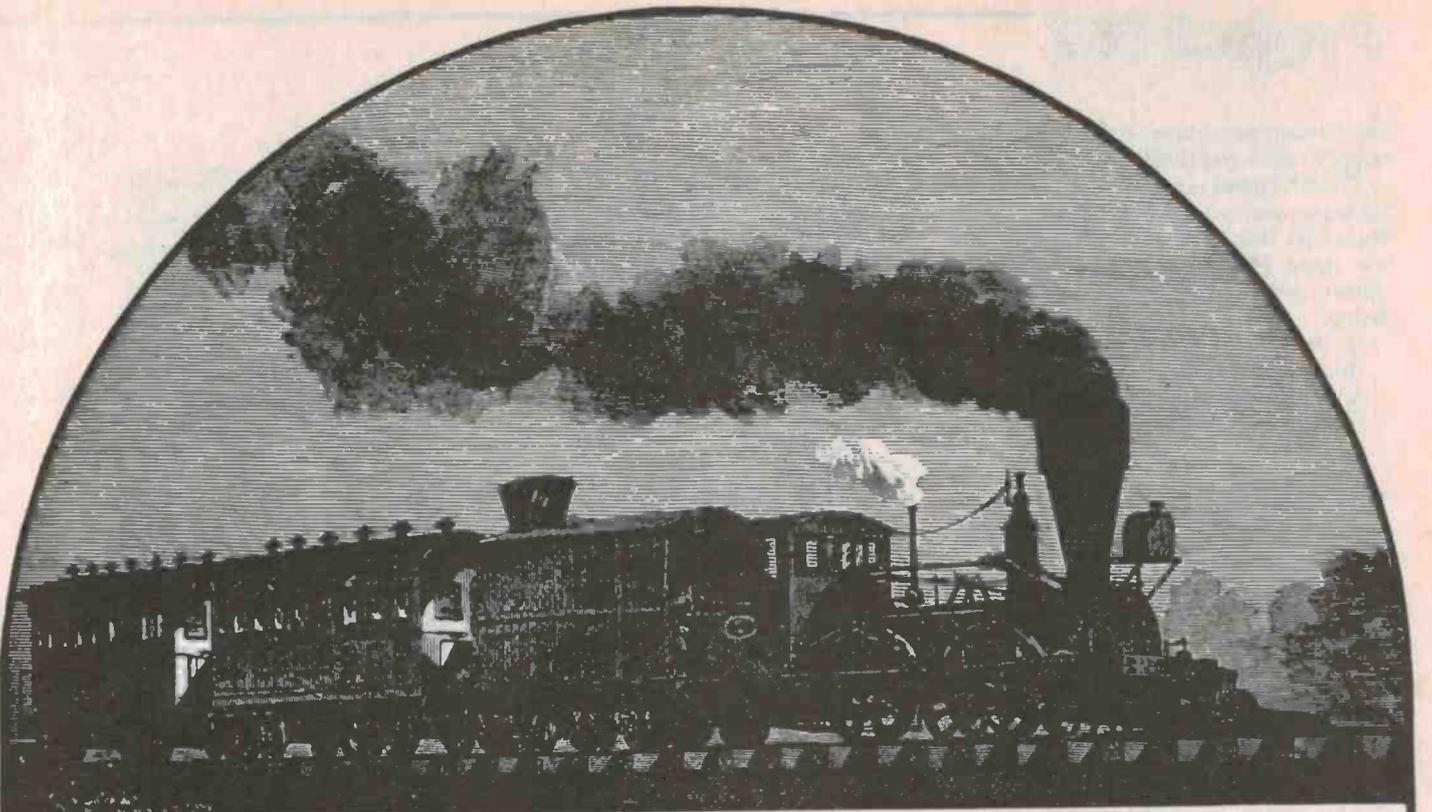
with a little help from some electronic detectors you can build yourself.

"How to Build Gold and Treasure Detectors" is a collection of projects and articles from Electronics Today International magazine describing how to build a variety of metal detectors and the techniques of how to use them.

PROJECTS include: ETI-561 Simple Sensitive Metal Detector, ETI-549 Induction Balance Metal Detector, ETI-1500 Discriminating Metal Detector, ETI-566 Deep-seeking Metal Detector, ETI-213 'Revealer', ETI-562 Geiger Counter and Earth Resistivity Meter. A 'Shoparound' guide is given telling you where kits and components can be obtained to build up the projects, as well as who sells metal detectors and related equipment.

At all newsagents and selected specialist outlets.

Or by mail order direct from ETI Magazine, 15 Boundary St, Rushcutters Bay NSW 2011. Please add 65 cents for post and handling.



Simple sound effects

Phil Wait

Part 1

One of the attractions of the more sophisticated video games seen in 'fun' arcades these days is the realistic array of sound effects that go with the action — gunshots, bomb whistles and explosions, etc. This simple group of projects employs just one IC that does all the hard work.

THOSE 'CANNON SHOTS' and explosions that go with the popular 'Space Invaders' video games and its variants add a measure of interest, feedback and stimulation to the action in which you participate on screen. Those sounds are electronically synthesised — that is, they consist of a complex mixture of waveforms that make up the required sound.

A 'bomb drop and explosion' is a remarkably complex sound when analysed carefully. Looking at it simply, there is a descending tone followed by a burst of noise that dies away in intensity. The descending tone starts at quite a high pitch and is not a 'pure' tone (i.e. a sine wave). The explosion is a burst of noise that commences suddenly and dies away

slowly in a recognisable way (usually exponentially). While it is possible to electronically produce very nearly an exact replica of a bomb drop and explosion, some compromises are acceptable to reduce the complexity and cost of the task and yet produce a recognisable replica of the sound.

To produce such sound using conventional components — transistors, diodes, op-amps, resistors and capacitors — would require a whole legion of components. Fortunately, the IC manufacturers can come to our rescue here and much of the circuitry can be incorporated into a complex integrated circuit requiring the addition of a minimum of external components and the appropriate interconnections to synthesise the required sound. Generating

a wide variety of sounds fortunately requires only a limited number of functional blocks, such as: a noise generator, voltage-controlled oscillators, multivibrators, envelope generators (a sort of modulator), mixers and amplifiers.

Texas Instruments, the giant US-based component and equipment manufacturer, have designed a series of complex function ICs for various applications and amongst them is the SN76488 Complex Sound Generator. This chip contains both linear and digital circuitry and is intended for use in applications requiring audio feedback to the user — video games, pinball, alarms, toys, etc, or industrial indicators, feedback controls and the like. Power consumption is quite low, allow-▶

Project 607

ing battery operation, and only a single supply rail is required.

The SN76488 is contained in a 28-pin package and can be purchased for less than \$10. It is quite a versatile chip, but we have chosen to describe how to obtain only five sounds effects, these being:

- (a) bomb drop and explosion
- (b) steam train and whistle
- (c) alarm ('phasor')
- (d) phasor and explosion
- (e) gunshot

The first three are described this month, the last two will follow next issue. Only one pc board is required for all five projects. Before going on to the general construction details, let us take a look at what's inside the SN76488 and what each function block does. Not every function block inside the IC is used to produce each sound, so it is necessary to learn what each does before you can understand how individual sounds are produced or how you can use the chip to synthesise sounds for your own requirements.

Inside the SN76488

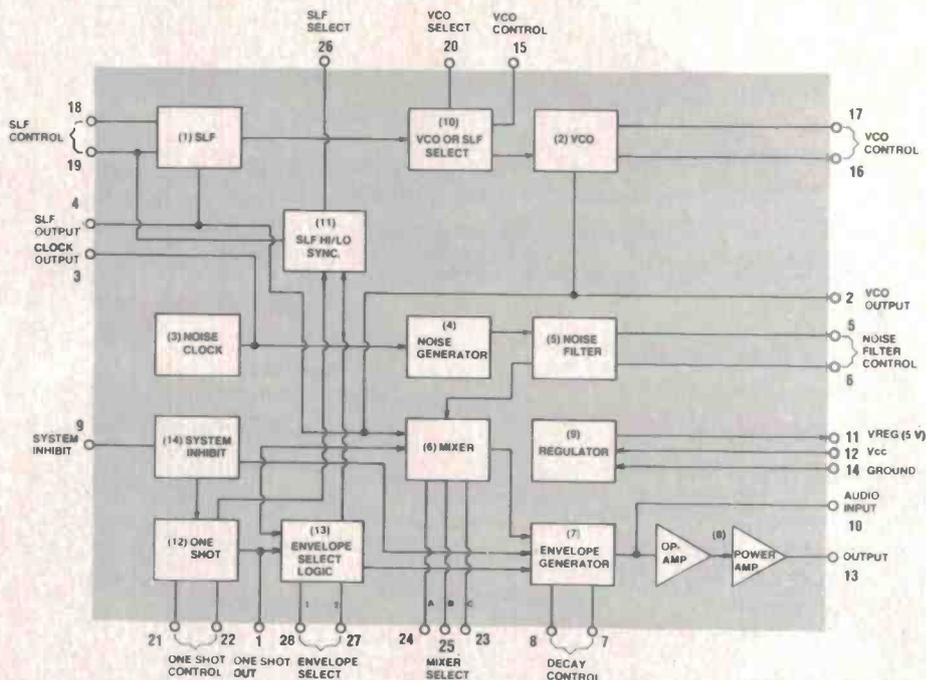
There are 14 functional circuit blocks contained within the IC.

- (1) super low frequency oscillator (SLF)
- (2) voltage-controlled oscillator (VCO)
- (3) noise clock
- (4) noise generator
- (5) noise filter
- (6) mixer
- (7) envelope generator
- (8) op-amp and power amp
- (9) regulator
- (10) VCO/SLF select
- (11) SLF hi/lo synchroniser
- (12) one shot
- (13) envelope select
- (14) system inhibit

Note that blocks one to four can be considered the *basic sound generators*, blocks five, six and seven are *sound modifiers*, while block eight provides the *output* and block nine distributes the power supply. Blocks 10 to 14 *control* the other functions.

(1) The SLF

This is an oscillator that can operate over the range from 0.1 Hz (one cycle every ten seconds) to 20 kHz, but it is not normally used at frequencies above about 30 Hz. The frequency of oscillation is determined by a resistor and capacitor, the resistor from pin 18 to 0 V, the capacitor from pin 19 to 0 V.



Internal block diagram of the SN76488.

The required frequency can be determined from the following formula:

$$SLF \text{ (Hz)} = \frac{0.66}{(9000 + R_s) C_s}$$

where: R_s is resistor on pin 18
 C_s is capacitor on pin 19

The SLF produces a square wave with a 50% duty cycle (high and low for equal periods) and a triangular wave. The square wave is internally connected to the mixer (6) and is available as an output on pin 4. The triangular wave goes to the VCO/SLF select block (10).

(2) The VCO

This is an oscillator which can be swept over a 10:1 frequency range by either the SLF output or an externally applied voltage (via pin 15 and the VCO/SLF select). Control of the VCO via the VCO/SLF select is discussed in (10).

The VCO can also be controlled by varying the voltage on pin 19 (SLF control, capacitor pin). The minimum frequency of the VCO is set by a resistor between pin 17 and 0 V and a capacitor between pin 16 and 0 V. The maximum frequency will always be 10 times the minimum frequency. The required minimum frequency can be derived from the following equation:

$$VCO_{\min} \text{ (Hz)} = \frac{0.6}{(9000 + R_1) C_1}$$

where: R_1 is resistor on pin 17
 C_1 is capacitor on pin 16

The output from the VCO is a square wave, available on pin 2. Internally, the VCO output is applied to one input of the mixer (6).

(3) Noise clock

This is an oscillator that feeds timing pulses to the noise generator (4), which generates pseudo-random noise digitally. The noise clock operates at a frequency of about 10 kHz and its output is available on pin 3. This output can be used for multiplexing.

(4) Noise generator

This is a digital circuit that produces pseudo-random white noise. The output is not directly available on one of the IC pins, being passed internally to the noise filter.

(5) Noise filter

This is a variable bandwidth low pass filter. The filter cutoff point is determined by an RC network consisting of a resistor between pin 5 and 0 V, and a capacitor between pin 6 and 0 V. The cutoff frequency is determined by:

$$F_c \text{ (Hz)} = \frac{0.43}{(9000 + R_c) C_c}$$

where: R_c is the resistor on pin 5
 C_c is the capacitor on pin 6

The output of the noise filter feeds an input to the mixer (6).

(6) Mixer

The mixer selects one or a combination of the inputs from the VCO, SLF or noise generator (via the filter), its output passing directly to the envelope generator. The mixer has three 'select' terminals, pins 23, 24 and 25, permitting eight output combinations according to Table 1. A 'low' (L) or a 'high' (H) on the appropriate pins

Mixer Select Inputs			Mixer Output
C (Pin 23)	B (Pin 25)	A (Pin 24)	
L	L	L	VCO
H	L	L	SLF
L	H	L	NOISE
H	H	L	VCO/NOISE
L	L	H	SLF/NOISE
H	L	H	SLF/VCO/NOISE
L	H	H	SLF/VCO
H	H	H	INHIBIT

Table 1. Mixer Select logic.

Envelope Select 1	Envelope Select 2	Selected Function
Pin 28	Pin 27	
L	L	VCO
L	H	Mixer Only
H	L	One-Shot
H	H	VCO with AC

Table 2. Envelope Select logic.

activates the selection. A low is 0 V, a high is +5 V.

The mixer performs as an AND gate, actually. To obtain two sounds simultaneously, multiplexing is required. This is accomplished by switching the mixer select lines at a sufficiently rapid rate that the two sounds seem to occur simultaneously. To prevent interaction with the sound output, the multiplexing rate is usually set above the human hearing frequency range. To provide equal amplitudes for both sounds the multiplexing drive signal must have a 1:1 duty cycle.

(7) Envelope generator

This block modulates the mixer output to give the sound the required 'decay' characteristics. The sound from the mixer can be made to die away (decay); the length of time it takes to do so is determined by an RC network connected to the 'decay control' pins — a resistor between pin 7 and 0 V and a capacitor between pin 8 and 0 V.

The decay is actually a ramp at the end of the sound. The approximate time it takes to ramp the sound amplitude to zero may be derived from:

$$\text{Decay (seconds)} = 1.5(9000 + R_d)C_d$$

where: R_d is resistor on pin 7.
 C_d is capacitor on pin 8.

The decay has no effect on the mixer-only function, but for the one shot, the VCO, and the VCO with alternating cycle envelopes, the decay ramp is triggered by each high-to-low transition of the envelope and prolongs the sound at a decaying volume.

(8) Op-amp and power amp

This provides the audio output. The op-amp brings the level out of the envelope generator up to that required by the power output stage, the latter providing 125 milliwatts maximum to an eight ohm speaker. A higher impedance speaker can be used, with reduced output power, but a four ohm speaker is not suitable.

The input to the op-amp is accessible on pin 10 and an externally produced audio signal may be mixed in at this point. Coupling to this input should be via a capacitor.

(9) The regulator

An internal 5 V regulator is provided and it can operate from a supply rail of between 7.5 and 10 volts, connected with the positive to pin 12, negative (0 V) to pin 14. This conveniently permits operation of the SN76488 chip from a 9 V battery. The 5 V regulator output is accessible on pin 11 and can supply up to 5 mA current.

(10) VCO/SLF select

The VCO can be swept by the SLF or an external signal applied to pin 15 (VCO control). Pin 20 controls the operation of this logic block, which is in effect a switch. A high on pin 20 permits the VCO to be controlled by the SLF, a low permits the VCO to be controlled by the external voltage or signal, applied to pin 15.

The frequency of the VCO is inversely proportional to the voltage on pin 15. The higher the voltage, the lower the VCO frequency. Voltages above 2.35 V applied to pin 15 will produce an inaudible frequency from the VCO's output.

(11) SLF hi/lo synchroniser

This block permits control of the SLF by the one shot (12) and the envelope select (13). The SLF can be inhibited at any time by applying a logic low to pin 26.

(12) One shot

A high-to-low transition on pin 9 triggers 'one shot' sounds such as a gunshot or explosion. The maximum duration of a one shot sound is about 10 seconds and is determined by an RC network; a capacitor between pin 21 and 0 V and a resistor between pin 22 and 0 V. The duration can be determined from the formula:

$$\text{Duration (seconds)} = 0.91 (R_d + 9000) C_d$$

where: R_d is the resistor on pin 22
 C_d is the capacitor on pin 21.

If the one shot is terminated early by taking the system inhibit high, the one shot timing must be allowed to end so that an internal latch will be reset before another one shot can be triggered. The one shot may also be controlled by

external logic eliminating the need for the one shot resistor and capacitor. This is done by triggering the one shot in the normal way with the system inhibit input, and terminating it by taking pin 21 (one shot capacitor) high.

The output of the one shot is fed through the envelope select logic to the envelope generator, and is therefore operable only when the one shot envelope is selected by the envelope select inputs. The one shot does not generate sound as such, but provides an envelope for the sound supplied to the envelope generator by the mixer.

A one shot output pulse is available at pin 1. In the one shot mode, the SLF ramp can be started either high or low by placing a high or low on the SLF Sync Select, pin 26.

(13) Envelope select

This block determines how the envelope of sound is formed, whether directly from the signals applied to the mixer or from the one shot. Pins 27 and 28 control the operation of this block, and a combination of highs and lows determines which function is selected according to Table 2. The VCO output to the mixer can be selected (SLF inhibited), mixer only output (one shot inhibited), one shot and VCO plus other (ac) signals.

(14) System inhibit

The system inhibit logic provides inhibit/select control for the sound output of the system: a high logic level at the system inhibit terminal (pin 9) inhibits the sound output, a low logic level (or open) enables it. This input also triggers the one shot circuit for momentary sounds such as gunshots, bells, or explosions. The one shot logic is triggered on the negative-going edge of the system inhibit input. This may be accomplished by means of a momentary switch or by a square wave input to system inhibit. The system inhibit input must be held low for the entire duration of the one shot sound, including attack and decay periods if the sound is to be completed. Taking the system inhibit input high early terminates the sound. Note that the one shot is operable only when the proper envelope select logic is selected. ▶

ELISTRONICS

ELISTRONICS • ELISTRONICS • ELISTRONICS •

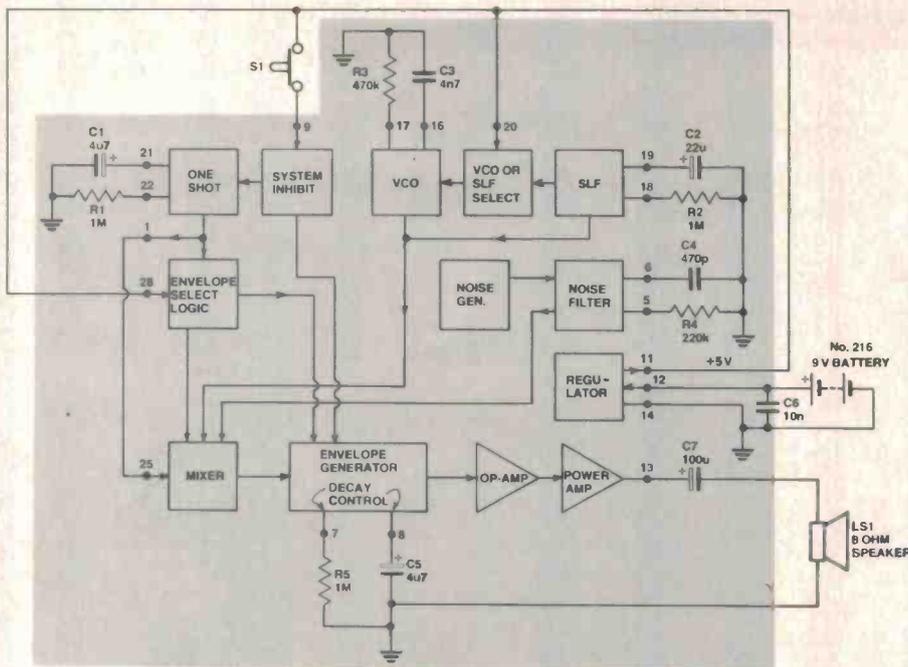
289 LATROBE ST., MELBOURNE 3000
PHONE (03) 602 3282 - 602 3836 TELEX AA 37758 LSTRON

DS8820	1.98 B	2N4354	20 A
DS8833	2.39 B	2N4355	20 A
DS8836	1.35 B	2N4356	16 A
DS8837	2.55 B	2N4360	33 A
DS8881	5.88 B	2N4398	4.38 A
S9900	49.00 B	2N4401	14 A
MC10116L	90 B	2N4404	23 A
LM13088	1.15 B	2N4416	20 A
LM13600	1.22 B	2N4888	1.20 A
LF13741N	52 A	2N4906	40 A
LF13741H	61 A	2N5060	2.45 A
SS020P	5.35 B	2N5086	70 A
AY-50-2376	19.00 B	2N5088	22 A
MM53200	4.46 B	2N5088	20 A
MM58167N	12.53 B	2N5089	21 A
MM58174	10.12 B	2N5179	1.50 A
DS75107	1.55 B	2N5190	1.15 A
DS75450	.87 B	2N5191	1.32 A
DS75451	.57 B	2N5195	1.67 A
DS75452	.46 B	2N5245	.65 A
DS75453	.45 B	2N5303	2.84 A
DS75454	.45 B	2N5320	.68 A
DS75459IN	.70 B	2N5401	.19 A
DS75492	.80 B	2N5408	.34 A
SN7600IN	1.50 A	2N5459	.41 A
76477	3.28 B	2N5461	.59 A
SFF96364	41.76 B	2N5484	.48 A
91428	.46 B	2N5486	.42 A
MH0009CG	23.40 B	2N5550	.29 A
2N301	3.05 A	2N5589	5.62 B
2N657	1.14 A	2N5590	7.50 B
2N930	51 A	2N5591	8.57 B
2N1613	90 A	2N5796	.23 A
2N1711	81 A	2N5770	.28 A
2N2218	49 A	2N5771	.26 A
2N2219	49 A	2N5772	.26 A
2N2222	18 A	2N5777	.75 A
2N2224	42 A	2N5830	.22 A
PN2369A	48 A	2N5831	.25 A
2N2483	30 A	2N5856	.27 A
2N2484	54 A	2N5873	.94 A
2N2646	60 A	2N5874	1.13 A
2N2647	1.03 A	2N5885	2.68 A
2N2894	68 A	2N5944	10.28 B
2N2904	43 A	2N5946	17.19 B
2N2905	52 A	2N5961	.24 A
2N2906	39 A	2N5963	.90 A
2N2907	38 A	2N6027	.38 A
2N2913	1.00 A	2N6028	.80 A
2N3019	59 A	2N6084	.14 A
2N3053	42 A	2N6121	.61 A
2N3054	1.20 A	2N6122	.62 A
2N3055	.65 A	2N6123	.59 A
2N3301	25 A	2N6124	.62 A
2N3440	.86 A	2N6126	.75 A
2N3441	1.95 A	LN26129	.63 A
2N3442	1.57 A	2N6130	.70 A
2N3502	.60 A	2N6131	.77 A
2N3503	.60 A	2N6133	1.20 A
2N3563	23 A	2N6256	9.56 A
2N3564	20 A	2SA353	.16 A
PN3565	20 A	2SA354	.16 A
PN3566	19 A	2SB187	1.00 A
2N3569	14 A	2SC1060	1.45 A
2N3568	18 A	2SC1061	1.45 A
2N3568A	20 A	2SC2166	1.59 A
2N3569	19 A	2SK133	5.69 A
2N3638	18 A	2SJ48	5.69 A
2N3638A	20 A	2SK134	7.34 A
2N3639A	18 A	2SJ49	7.34 A
2N3639	18 A	3N201	.86 A
2N3640	18 A	AC126	.51 A
2N3641	18 A	AC127	.75 A
PN3642	15 A	AC128	.67 A
PN3643	14 A	AC187	.88 A
PN3644	18 A	AC188	.88 A
PN3645	20 A	AD149	1.96 A
2N3646	24 A	AD161	1.16 A
2N3692	28 A	AD162	1.16 A
2N3693	30 A	AY6102	.50 A
PN3694	20 A	AY6112	.50 A
2N3702	26 A	AY6118	.50 A
2N3704	18 A	AY6119	.50 A
2N3705	18 A	AY6121	.50 A
2N3709	1.86 A	AY8139	.64 A
2N3713	5.76 A	AY9139	.64 A
2N3771	3.53 A	B12-12	13.10 B
2N3772	1.85 A	BC107	.23 A
2N3773	3.45 A	BC107B	.28 A
2N3819	68 A	BC108	.26 A
2N3866	1.70 A	BC108C	.30 A
2N3904	20 A	BC109	.25 A
2N3906	20 A	BC109C	.27 A
2N4030	88 A	BC147	.14 A
2N4032	78 A	BC177	.27 A
2N4033	88 A	BC178	.31 A
2N4036	82 A	BC179	.31 A
2N4037	.73 A	BC182A	.14 A
2N4092	1.30 A	BC182L	.20 A
PN4121	18 A	BC183L	.20 A
2N4233	1.88 A	BC184L	.22 A
2N4235	1.55 A	BC186	.47 A
2N4236	1.80 A	BC204	.14 A
2N4248	16 A	BC205	.14 A
2N4249	26 A	BC206	.14 A
2N4250	20 A	BC209	.14 A
2N4258	19 A	BC212A	.14 A
2N4292	60 A	BC212L	20 A
2N4342	76 A		

BC214L	20 A	MJ802	2.99 A
BC213L	20 A	MJ1001	1.90 A
BC287	14 A	MJE1091	2.45 A
BC309	16 A	MJ2955	.78 A
BC317	18 A	MJ4032	7.20 A
BC318	14 A	MJ4035	6.30 A
BC319	15 A	MJ4502	3.20 A
BC321	14 A	MJ15003	3.66 A
BC322	14 A	MJ15004	3.76 A
BC327	12 A	MJE340	.81 A
BC328	13 A	MJE350	1.52 A
BC328B	13 A	MJE320	.75 A
BC337	11 A	MJE721	.94 A
BC338	16 A	MJE700	1.10 A
BC546B	26 A	MJE800	1.02 A
BC547	11 A	MJE1100	1.84 A
BC547A	11 A	MJE1101	2.10 A
BC547B	14 A	MJE2955	.92 A
BC547C	15 A	MJE3055	.92 A
BC548	11 A	MPE102	.45 A
BC548C	15 A	MPE103	.57 A
BC549	11 A	MFE131	.93 A
BC549C	15 A	MPSA05	.20 A
BC550	12 A	MPSA14	.24 A
BC557	11 A	MPSA42	.39 A
BC558	11 A	MPSA64	.45 A
BC558B	14 A	MPSA70	.27 A
BC559	11 A	MPSA92	.43 A
BC559C	14 A	MPSA356	.45 A
BC637	28 A	MPS6531	.45 A
BC638	28 A	MRF237	2.68 B
BC639	35 A	MRF238	12.27 B
BC640	24 A	MRF450A	13.77 B
BCY70	71 A	MRF454	29.50 B
BD115	1.22 A	MRF475	3.34 B
BD135	.48 A	MRF901	1.88 B
BD136	.45 A	TIP29A	.63 A
BD137	.45 A	TIP29B	.63 A
BD138	.49 A	TIP30A	.60 A
BD139	.43 A	TIP30B	.63 A
BD140	.43 A	TIP30C	.84 A
BD233	.48 A	TIP31A	.56 A
BD234	.45 A	TIP31B	.60 A
BD235	.48 A	TIP31C	.56 A
BD237	.57 A	TIP32A	.56 A
BD238	.53 A	TIP32B	.79 A
BD262	.68 A	TIP32C	.79 A
BD263	.66 A	TIP33A	.90 A
BD301	.60 A	TIP33C	1.48 A
BD302	.60 A	TIP34A	1.15 A
BD433	.42 A	TIP34B	1.20 A
BD434	.44 A	TIP34C	1.73 A
BD435	.44 A	TIP41A	1.04 A
BD436	.46 A	TIP41C	1.28 A
BD437	.48 A	TIP42A	1.04 A
BD438	.48 A	TIP42B	1.04 A
BD439	.48 A	TIP42C	1.43 A
BD646	1.35 A	TIP110	.90 A
BD647	1.69 A	TIP115	.90 A
BD675A	.65 A	TIP120	1.17 A
BD678	.60 A	TIP125	1.20 A
BD679	.16 A	TIP127	1.18 A
BD680	.64 A	TIP2955	1.06 A
BD681	.66 A	TIP3055	.85 A
BD682	.68 A	TT641	.12 A
BDV648	2.72 A	U310	1.84 B
BDV658	2.72 A	VN10KM	1.98 B
BDX64A	3.58 A	VN65AF	2.65 B
BDX64B	4.18 A	VN88AF	2.75 B
BDX65A	3.58 A	VMP4	24.90 B
BDX66	4.18 A		
BDX66-P	8.64 A		
BDX67B	9.50 A		
BF173	51 A		
BF179	70 A		
BF180	60 A		
BF184	50 A		
BF195	27 A		
BF198	22 A		
BF199	22 A		
BF336	68 A		
BF337	68 A		
BF458	82 A		
BF469	75 A		
BF470	87 A		
BF494	18 A		
BFX29	1.02 A		
BFX85	.63 A		
BFX89	.98 A		
BFY50	.78 A		
BFY51	.78 A		
BFY52	.69 A		
BFY90	1.10 A		
BSS68	.24 A		
BSV17	.80 A		
BSX20	.51 A		
BU126	1.68 A		
BU208	2.18 A		
BU326A	1.92 A		
BU426	3.54 A		
BUX80	3.37 A		
DX542CF	27.27 B		
FT50	1.02 A		
FT402	4.55 A		
FT430	3.90 A		
FT2955	1.22 A		
FT3055	.96 A		
MEL12	.70 A		
MJ413	2.59 A		

IN4001	50V	1A	06 B
IN4002	100V	1A	05 B
IN4004	400V	1A	07 B
IN4007	1000V	1A	12 B
IN4148			04 B
IN5060			25 B
IN5404	400V	3A	24 B
IN5408	1000V	3A	28 B
STG/GT32			22 B
G.L.M.	AVALANCHE		25 B
G.L.M.	AVALANCHE		45 B
0A626-800			52 B
BYX21L	400V	25A	1.80 B
BYX21R	400V	25A	1.80 B
BYX21L	200V	25A	1.70 B
IN60			08 B
IN914			04 B
IS426			10 B
ITT210			10 B
BA102			54 B
BA217			.04 B
BAV			30 B
MV104	V.CAP		95 B
0A47	GOLD BOND		30 B
0A90			15 B
0A91			16 B
0A95			15 B
0A645	200V	15A	14 B
MDA1010			1.00 B
BPW34			3.00 B
BPW50			1.50 B
VOLTAGE REGULATOR			
78L05	+5v	100mA	38 B
79L05	-5v	100mA	70 B
7805	+5v	1.5A	86 B
LM309K	+5v	1.5A	1.76 B
7805K	+5v	1.5A	1.76 B
7905K	-5v	1.5A	3.22 B
7905	-5v	1.5A	1.54 B
LM323K	+5v	3A	5.42 B
78H05	+5v	5A	7.10 B
78P05	+5v	10A	13.19 B
78L06	-6v	100mA	38 B
7806	-6v	1.5A	90 B
7806KC	+6v	1.5A	1.87 B
7906	-6v	1.5A	1.70 B
78L08	-8v	100mA	38 B
7808	-8v	1.5A	1.05 B
7908	-8v	1.5A	1.54 B
7808K	-8v	1.5A	2.45 B
78L09	-9v	100mA	38 B
78L12	+12v	100mA	.38 B
79L12	-12v	100mA	.30 B
LM342-P12	+12	25A	.67 B
LM341-P12	+12	5A	.75 B
78L12	-12v	1.5A	7.20 B
79L12	-12v	1.5A	1.28 B
78L12K	-12v	1.5A	1.87 B
79L12K	-12v	1.5A	2.39 B
78H12	-12v	5A	6.10 B
78CBUC	+13.8v	2A	1.38 B
78CBK	+13.8v	2A	4.90 B
78L15	+15v	100mA	38 B
78L15	-15v	100mA	38 B
79L15	-15v	25A	.67 B
LM342-P15	+15v	25A	.67 B
LM341-P15	+15v	5A	.75 B
78L15	+15v	1.5A	9.0 B
78L15K	+15v	1.5A	2.97 B
79L15	-15v	1.5A	1.70 B
79L15K	-15v	1.5A	2.82 B
78L15	+15v	5A	6.10 B
78L18	+18v	100mA	38 B
78L18	+18v	1.5A	9.0 B
79L18	-18v	1.5A	1.70 B
78L18K	+18v	1.5A	2.95 B
78L24	+24v	100mA	38 B
79L24	-24v	100mA	.70 B
7824	+24v	1.5A	1.30 B
7924	-24v	1.5A	1.70 B
LM317T	+var	1.5A	1.45 B
LM337T	-var	1.5A	1.75 B
LM317K	+var	1.5A	2.66 B
LM337K	-var	1.5A	3.13 B
LM317L	+var	100mm	.68 B
LM317	Hi-var	1.5A	5.20 B
LM337	Hi-var	1.5A	8.

Project 607



Circuit for the ETI-607A Bomb Drop & Explosion. The pushbutton is held down for the duration of the event. Release it and press again to repeat.

General construction

All the projects described use the one pc board design. As the SN76488 is available in two packages of different sizes and pin spacings — the A package, a conventional 28-pin package with 15.24 mm spacing between the pin rows and 2.54 mm pin spacing, and the smaller NF package having 10.16 mm spacing between the pin rows and 1.52 mm pin spacing — we have had to provide two pc board designs to accommodate the different packages. Each board is marked accordingly. Make sure you purchase the correct board to suit the device package you have. All the component pads and holes are in exactly the same position on each board and the overlay diagrams given in these articles apply to either board.

The SN76488 dominates the pc board. Only the required components are assembled into the board according to each overlay diagram to obtain the required sound generator. Naturally enough, the polarity of the IC should be noted as well as the polarity of electrolytic and tantalum capacitors used. Commence construction by assembling the passive components, followed by the IC. This is not a CMOS device and no special care is required, apart from being careful not to bend any pins under the device when inserting it. If you wish, a socket may be used for the IC. This way, you can assemble the five projects and purchase only one IC, swapping between the boards as you need to use them!

Wiring to the switches, the speaker

and the supply should be attached last. The unit may be mounted in any convenient-sized box and the speaker mounted on the front. Alternatively, it may be wired into an existing piece of equipment. We'll have to leave these arrangements up to you.

PARTS LIST — ETI 607A BOMB DROP + EXPLOSION

Resistors	all ½W, 5%
R1, R2, R5	1M
R3	470k
R4	220k
Capacitors	
C1, C5	4u7/16 V electro.
C2	22u/16 V tant. or RBL
C3	4n7 green cap
C4	470p ceramic
C6	10n green cap
C7	100u/16 V electro.
Semiconductors	
IC1	SN76488
Miscellaneous	
S1	SPST push-to-make pushbutton switch

ETI-607 pc board; 50 mm diameter 8 ohm speaker; No. 216 9 V battery and clip.

Price estimate

We estimate the cost of purchasing all the components for this project will be in the range:

\$16 - \$19

Note that this is an estimate only and not a recommended price. A variety of factors may affect the price of a project, such as — quality of components purchased, type of pc board (fibreglass or phenolic base), type of front panel supplied (if used), etc — whether bought as separate components or made up as a kit.

HOW IT WORKS — ETI 607A BOMB DROP AND EXPLOSION

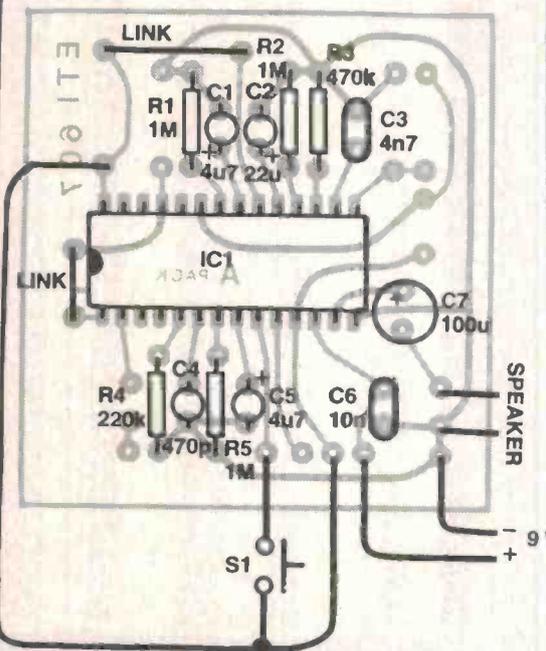
This unit employs most of the function block in the SN76488. The SLF provides a linearly increasing voltage waveform, or ramp, to the VCO, taking several seconds for the ramp voltage to rise from zero to maximum value. This causes the VCO to produce a tone which 'glides' down in pitch, making the 'bomb drop' effect. The explosion is generated by the Noise Generator/Filter and the Envelope Generator. It starts with a burst of noise, which dies away in intensity exponentially in a few seconds.

The whole sequence is triggered by operating the pushbutton, S1. This applies a high (+5 V) to the input of the System Inhibit block, pin 9. This in turn triggers the One Shot and the Envelope Generator. At the commencement of the One Shot timing period, the One Shot triggers the SLF HI/LO Sync. (see SN76488 block diagram), starting the SLF, and the VCO does its thing. At the end of the One Shot timing period the Envelope Select Logic becomes operative, the SLF is disabled and the Envelope Generator commences to do its thing. The Mixer selects the VCO output at the start of the One Shot timing period and the Noise Generator/Filter output at the end of the One Shot timing period. Thus the two sounds are switched through to the audio output stage in sequence, the Envelope Generator modifying the noise so that it dies away, the time it takes to do so being controlled by the time constant of R5, C5.

The starting pitch of the VCO is determined by R3 and C3, the rate of rise of the voltage ramp produced by the SLF is determined by C2 and R2, while the One Shot timing period is determined by the time constant of C1 and R1. The frequency characteristics of the broadband noise produced by the Noise Generator are modified by R4 and C4 connected to the noise filter control pins (5 and 6).

Audio output is coupled to the loudspeaker via C7, a 100u electrolytic capacitor.

Component overlay for the ETI-607A Bomb Drop & Explosion.



PARTS LIST — ETI 607B STEAM ENGINE + WHISTLE

Resistors all 1/2W, 5%

R1	330k
R2	470k
R3	56k
R4	100k
R5	1k

Capacitors

C1	1u/16 V tant. or RBLL
C2, C3	470p ceramic
C4	10n greencap
C5	100u/16 V electro.

Semiconductors

IC1	SN76488
-----	---------

Miscellaneous

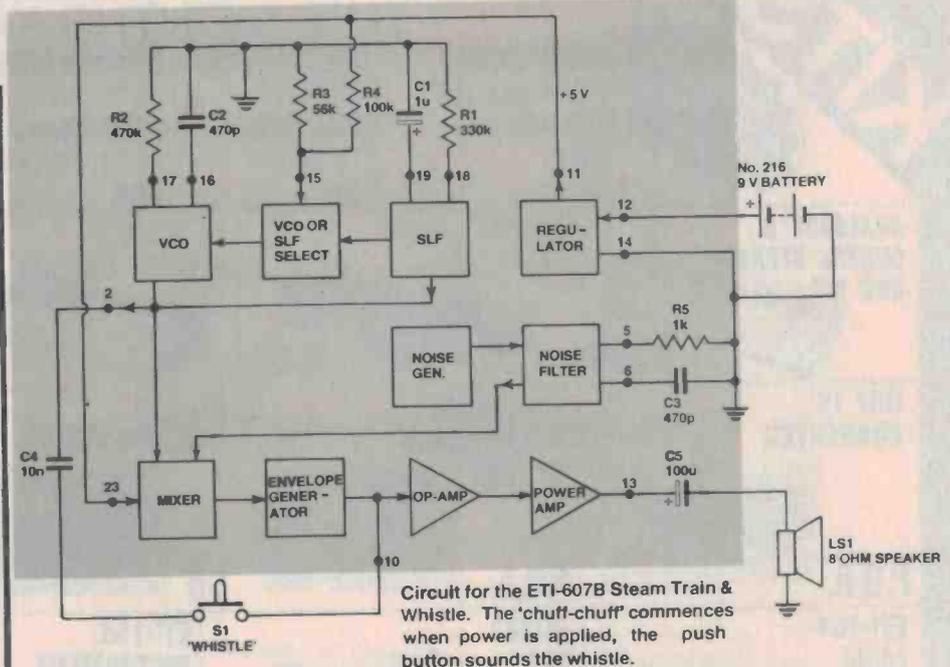
S1 SPST push-to-make pushbutton switch;
ETI-607 pc board; 50 mm diameter 8 ohm speaker; No. 216 9 V battery and clip.

Price estimate

We estimate the cost of purchasing all the components for this project will be in the range:

\$14 - \$17

Note that this is an estimate only and not a recommended price. A variety of factors may affect the price of a project, such as — quality of components purchased, type of pc board (fibre-glass or phenolic base), type of front panel supplied (if used), etc — whether bought as separate components or made up as a kit.



Circuit for the ETI-607B Steam Train & Whistle. The 'chuff-chuff' commences when power is applied, the push button sounds the whistle.

HOW IT WORKS — ETI 607B — STEAM TRAIN AND WHISTLE

In this unit the Noise Generator/Filter is employed to produce the basic 'steam engine' sound, this being modulated by the SLF to produce the 'chuff-chuff' so characteristic of steam locomotives. The whistle is produced by the VCO, which is set to a particular non-varying pitch, and the output is switched into the audio input pin to produce the whistle.

The broadband noise from the Noise Generator is modified by the Noise Filter, the frequency characteristics being determined by R5 and C3 connected to the Noise Filter Control pins (5 and 6). The Noise Filter Output is fed via the Mixer and the Envelope Generator (which doesn't function here) to the audio output stages. The SLF square wave output effectively modulates the noise to

produce a noise burst followed by a silent period, then another noise burst. Thus the chuff-chuff sound is produced. This sound is continuous whilst power is applied to the unit.

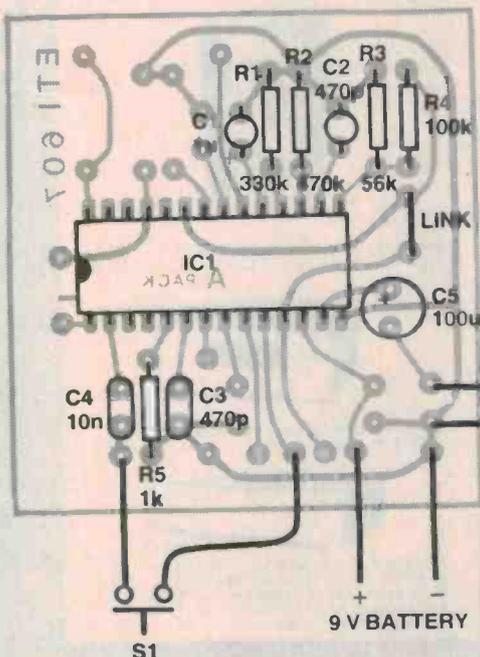
A resistive divider, R3/R4, provides about 1.8 volts at the VCO programming input, pin 15. This sets the VCO frequency to a convenient pitch within its range, providing a suitable pitch for the whistle. The VCO output is coupled to the audio input (pin 10) via C4 and the pushbutton, S1. When S1 is pressed, the whistle is heard over the chuff-chuff sound.

The SLF frequency is determined by C1 and R1, while the combination of R2/C2 and the voltage on pin 15 determines the VCO frequency. Output to the loudspeaker is coupled via C5, a 100u electrolytic capacitor.

ETI-607A

This produces a 'bomb drop and explosion' sound at the press of a button. Alternatively, the pushbutton, S1,

Component overlay for the ETI-607B Steam Train and Whistle.



could be replaced by a pair of relay contacts operated by a piece of equipment or a transistor (emitter to pin 9, collector to other side of S1) that is turned on by a logic high applied to its base via a resistor.

This project is one of the most complex, using almost every functional block within the SN76488. Varying R3 and C3 a little will vary the pitch range of the 'bomb drop' (descending whistle), while varying R4 or C4 a little will vary the characteristics of the explosion. Note that it is generally easier to 'fine tune' things by varying the resistor values. The duration of the event can be varied by varying the value of either C1 or R1 and the decay of the explosion can be changed by varying R5 (varying C5 produces quite gross changes in the decay period).

Watch that you insert the link on the pc board in this one, located at the 'notch' end of the IC.

ETI-607B

Aahh, the nostalgia! Clive Robertson (*), this is for you — a steam train (chuff-chuff) and whistle. For that *authentic* touch, deft constructors can fashion a cow-catcher out of tinned copper wire to attach to the unit!

The chuff-chuff runs continuously once power is applied and the whistle sounds when the pushbutton is pressed. The VCO is used to provide the whistle while the SLF modulates the noise generator/filter output to produce the steam train's chuff-chuff sound. The chuff-chuff rate may be varied by changing the values of R1 and C1, while the chuff-chuff sound may be varied by altering the values of R5 and C3. The pitch of the whistle may be varied by changing the values of R2 and C2. For a special effect, you can control the chuff-chuff rate manually by replacing R1 with a 1M potentiometer.

*(In)famous breakfast announcer on ABC second network station 2BL in Sydney.

ROD IRVING ELECTRONICS

425 HIGH STREET, NORTHCOE 3070. MELBOURNE. PH (03) 489-8131

KITS

Please phone
or write for full
list of kits
available

THIS MONTHS KITS

**ELECTRONIC
STETHOSCOPE**
ETI 332
POA

**INTELLIGENT
BATTERY
CHARGER**
ETI 1503
POA

SOUND EFFECTS UNITS ETI 607
607A Bomb drop & explosion
607B Steam train & whistle
607C "WOOP WOOP" Alarm
POA



**ANALOGUE &
DIGITAL STORAGE
CRO KIT**



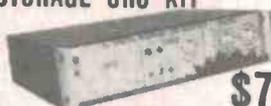
\$169

**EA LIGHT BEAM
RELAY**



\$39

**EA DIGITAL
STORAGE CRO KIT**



\$78

**ETI 256
HUMIDITY METER**



**UHF TV
CONVERTER**



**UNIVERSAL
RELAY BOARD**
ETI 257



**ETI 258
MINI DRILL CONTROL**



\$8

**\$100 PROM
BOARD**



P.O.A.

P.O.A.

P.O.A.

**ETI-154
LOGIC
PULSAR**



\$11.00

**ETI330
CAR
ALARM**



\$32.00

**ETI-156
INSTRUMENT
PROBE**



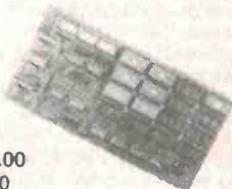
P.O.A.

**ETI 458
LED LEVEL
METER**



\$38.00

**\$100
Prom
Board**



ETI 682
KITS \$115.00
PCB \$65.00

**ETI 572
Digital
PH Meter**



\$97.50

**ETI 568 Light & Sound
Flash Kit**



\$25.00

**ETI 476
Series 3000**
\$84.00

ETI 475 AM Tuner



\$89.00

**ETI 329
Expanded
Scale Vehicle
Ammeter**



\$17.00

**ETI 567 Core-Balance
Relay**



\$48.00

KITS

Playmaster Graphic Analyser kit \$99.50
EA 79SF9 Sound Flash Trigger \$15.00
ETI 585R Ultra Sonic RX \$15.95
ETI 585T Ultra Sonic TX \$8.95
ETI 576 Electromyogram kit \$89.00



Series 5000 Mosfet \$275.00



ETI 477 Series 5000 Mosfet Power Amp
All parts individually available
\$58.00

**ETI 599 Infra-Red
Remote Control**



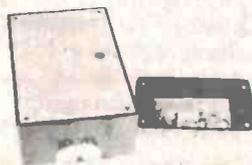
\$76.00

ETI 147 Oct 80 Electronic Load kit parts \$75.00
ETI 327 Turn Hazard Unit kit parts \$22.00



EA Digital Engine Analyser Oct 80 80TMBa 10 Kit parts inc. front panel \$44.95

**ETI 729
UHF TV
Masthead**



\$34.00

**ETI1501
Negative Ion
Generator**



\$42.00

EA Car Battery Voltage Monitor Oct EA kit parts \$6.50
EA Bipolar Train Controller Nov 80 kit parts \$26.00
EA Digital Storage CRO Adaptor Nov 80 kit parts \$78.00
EA Light Beam Relay Nov 80 kit parts \$13.00
EA RS232 Printer Interface Nov 80 kit parts \$15.00

ROD IRVING ELECTRONICS

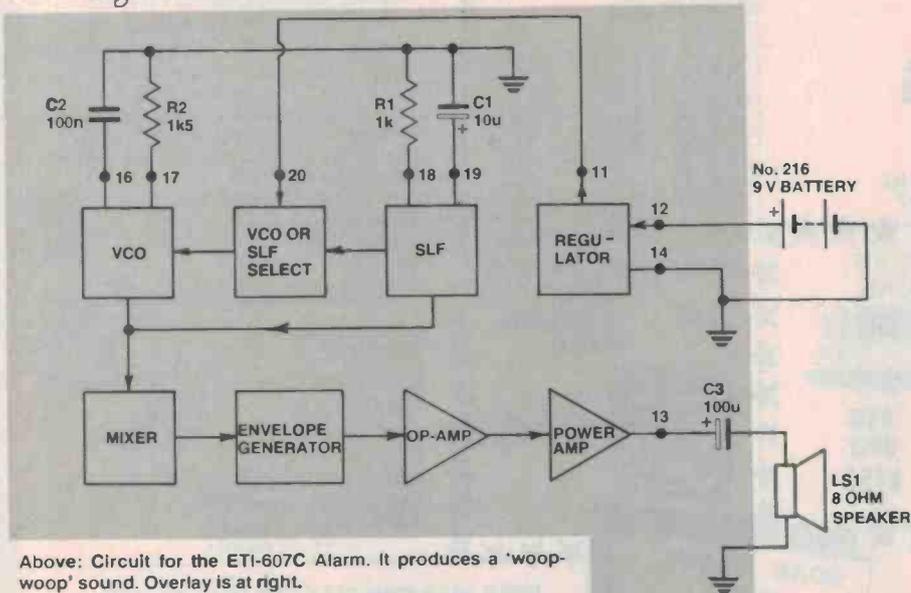
425 HIGH STREET, NORTHCOE 3070. MELBOURNE. PH (03) 489-8131

425 HIGH STREET, NORTHCOE 3070. MELBOURNE. PH (03) 489-8131

ROD IRVING ELECTRONICS

TO ORDER: Heavy Items sent Comet Freight on Mail Order phone 481-1436. Wholesale Customers phone: RITRONICS WHOLESale 489-7099 or 489-1923. Mail Orders to P.O. 235 Northcote 3070. Minimum mail order \$2. Add extra for heavy items and registration, certified mail. Prices, spec. subject to change without notice.

Project 607



Above: Circuit for the ETI-607C Alarm. It produces a 'woop-woop' sound. Overlay is at right.

ETI-607C

The Texas Instruments' application notes include a 'phasor' circuit that produces a sound rather like a 'woop-woop' alarm. It's about the simplest project of the lot! The SLF is simply employed to sweep the VCO over a convenient range at a suitable speed. Turning the power supply on and off by inserting a switch or relay contacts in series with either the positive or negative battery leads serves to trigger the alarm. The VCO pitch may be varied to suit your requirements by changing the values of either C2 or R2, while the rate at which the VCO is swept may be varied by altering the value of either R1 or C1.

HOW IT WORKS — ETI 607C ALARM ('PHASOR')

This produces an alarm sound that's a real attention-getter! Operation is simplicity itself. The SLF is set to operate at a few cycles per second, determined by R1/C1. The ramp output of the SLF is selected to sweep the VCO by applying a high (+5 V) to the control input of the VCO/SLF Select block (pin 20). The VCO is thus swept across its range several times per second. Maximum frequency of the VCO is determined by R2/C2. Output from the VCO is coupled to the audio output stages via the Mixer and Envelope Generator (inoperative here). The speaker is connected via the obligatory 100u electrolytic capacitor, C3.

PARTS LIST — ETI 607C

Resistors all 1/2W, 5%
 R1 1k
 R2 1k5

Capacitors
 C1 10u/16 V electro.
 C2 100n greencap
 C3 100u/16 V electro.

Semiconductors
 IC1 SN76488

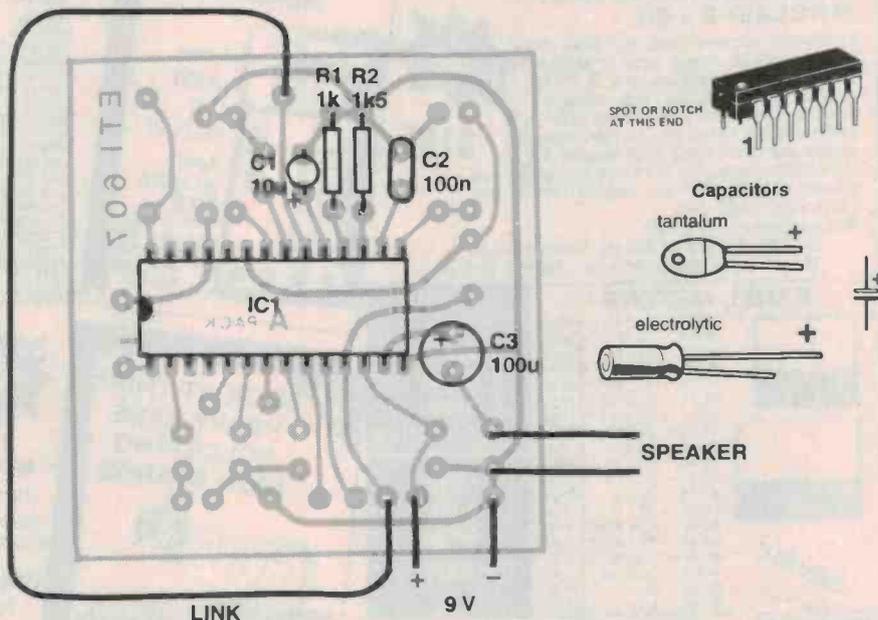
Miscellaneous
 ETI-607 pc board; 50 mm diameter 8 ohm speaker; No. 216 9 V battery and clip; switch (if needed).

Price estimate

We estimate the cost of purchasing all the components for this project will be in the range:

\$14 - \$17

Note that this is an estimate only and not a recommended price. A variety of factors may affect the price of a project, such as — quality of components purchased, type of pc board (fibreglass or phenolic base), type of front panel supplied (if used), etc — whether bought as separate components or made up as a kit.



This photograph shows the Steam Train & Whistle built up. We leave the housing to you as individual requirements will vary.



Lab Notes

to the input of the 4017 and trigger signals to the input of the IC2b-IC2c monostable multivibrator. In any given clock cycle, the period of the monostable is determined by C2-R4 and by the resistance value in series with the relevant 'high' output of the 4017. In clock cycles '0' to '7' the pulse widths are determined by the settings of RV1 to RV8 respectively. In the '8' clock cycle the pulse has a width equal to the clock cycle period (2 ms), and in the '9' clock cycle the pulse is fixed at about 1 ms, thus giving a composite 3 ms sync pulse from the eighth and ninth cycles. The system is designed to give a fixed 20 ms frame width.

Note that, in conformance with normal practice, only one third (or less) of the sweep ranges of RV1 to RV8 are utilised. In practice, component values may have to be altered slightly to give precise ranges of coded output pulse widths.

An 8-channel proportional control decoder

Figure 2 shows the circuit of a decoder for use with the above system. The

incoming 'coded' waveform is fed simultaneously to the clock terminal of the 4017 and to the trigger terminal (via C1-R1-D1) of the IC2c-IC2d monostable. IC2c of this monostable produces a negative-going pulse with a period slightly less than the 2 ms clock period (about 1.8 ms), and this negative pulse is ANDed with the positive clock signal by IC2a and IC2b to produce a reset output signal from the 3 ms input sync pulse, but not from the 'control' pulses, which all have periods significantly less than the 1.8 ms reference value.

Note that the value of R3 may have to be adjusted on test to set the correct reference period.

Outputs 1 to 8 of the 4017 are sequentially ANDed with the coded clock input signal once the counter has been reset by the sync pulse, so that each individual code pulse is routed to its own designated output terminal or channel. The individual outputs, which take the form of 0.5 ms to 1.5 ms pulses with repetition periods of 20 ms, can then be fed to suitable servos, etc, to convert the pulses into proportional mechanical movements.

An 8-channel simultaneous on/off encoder

Multi-channel simultaneous on/off coder/decoder systems are technically no easier to implement than full proportional systems. In fact they are often more difficult. Figure 3 shows a practical example of a simultaneous 8-channel on/off control encoder.

Here, astable multivibrator IC2a simultaneously feeds 500 Hz clock signals to the 4017, to the IC3a-IC3b 200 μ s monostable multi, and to one input terminal of the IC2b-IC2c AND gate. The other input of the AND gate is sequentially taken from the '0' to '7' outputs of the 4017 via any of the PB0 to PB7 switches that are closed, and directly from the '9' output. The outputs of the AND gate and the 200 μ s monostable, plus the direct '8' output of the 4017, are all ORed to produce the final serial coded output across R4.

The final output waveform comprises 200 μ s pulses and 1 ms pulses to represent off and on switch states respectively, plus a 3 ms sync pulse spanning the eighth and ninth clock cycles.

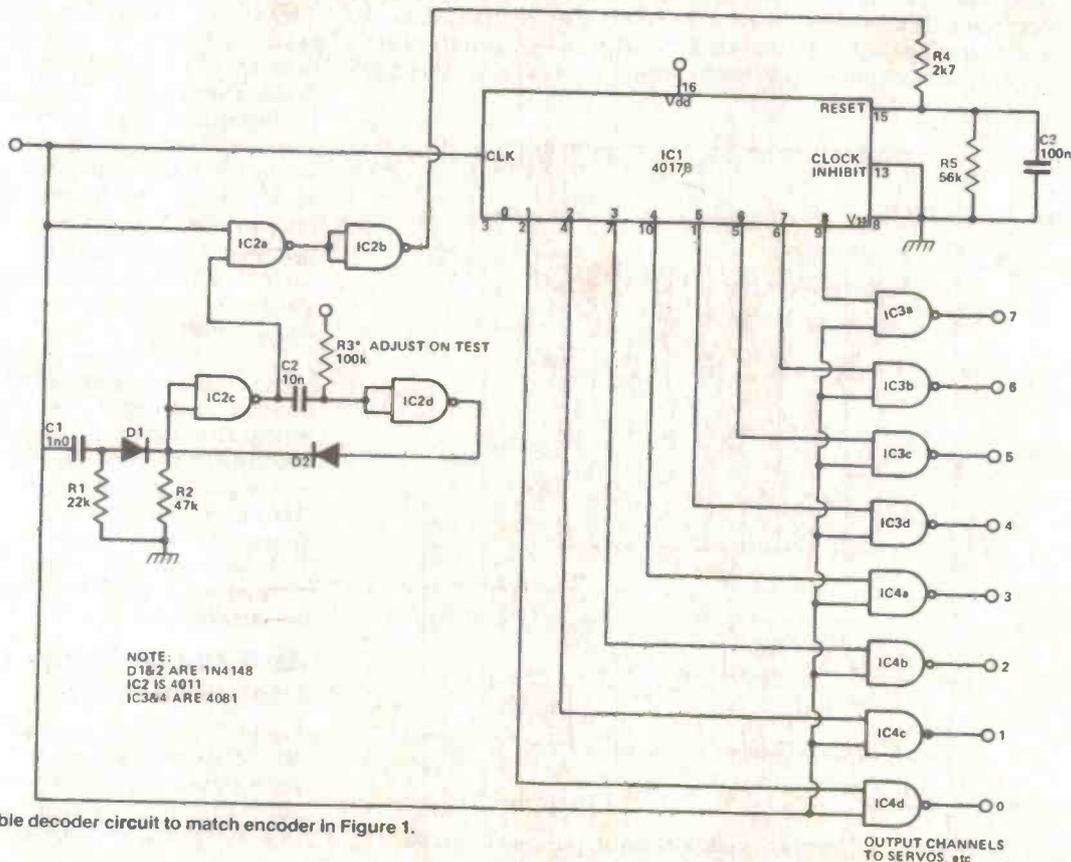


Figure 2. Suitable decoder circuit to match encoder in Figure 1.

2804 4017

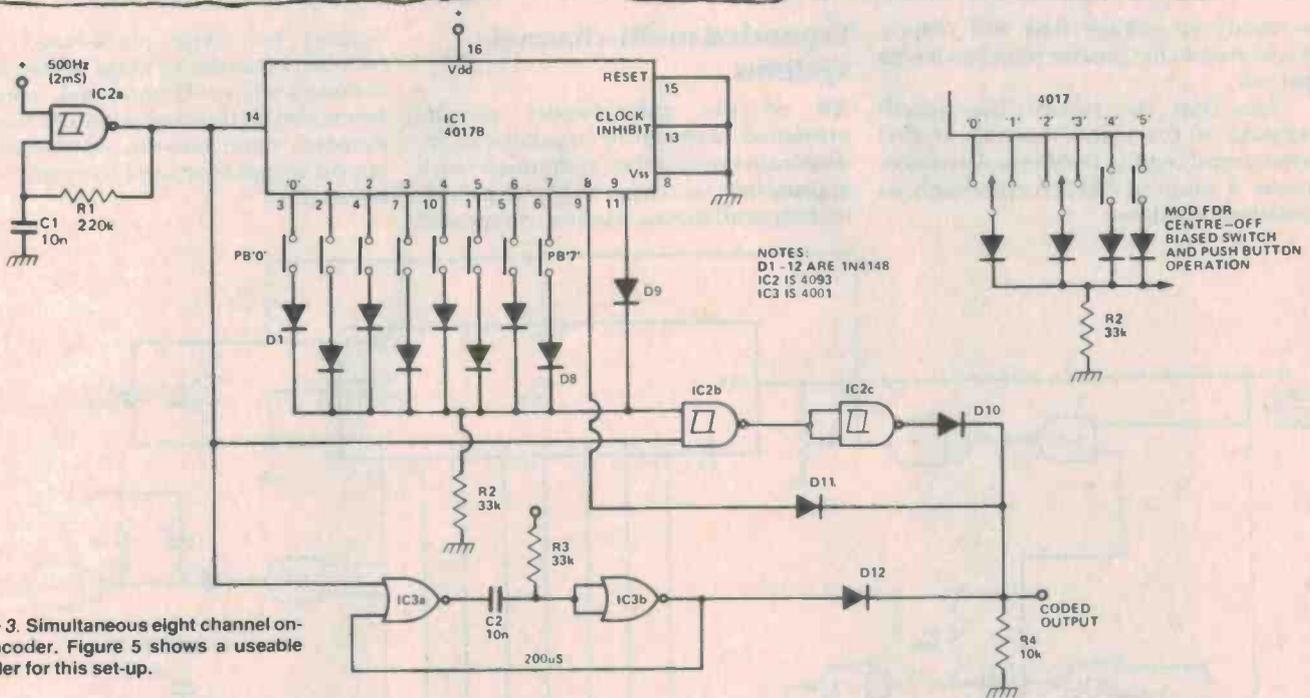


Figure 3. Simultaneous eight channel on-off encoder. Figure 5 shows a useable decoder for this set-up.

An 8-channel simultaneous on/off decoder

Figure 5 shows a decoder circuit that is suitable for use with the above encoder. Here, the IC3a-IC3b-IC2a-IC2b net-

work detects the input sync pulse and then resets the counter, and the IC3c-IC3d-IC2c-IC2d network detects 'wide' (1 ms) or 'on' code pulses and then ANDs the selected output of the 4017

via the IC4-IC7 array to produce a high potential on the appropriate output channel. Note that the purpose of the D-R-C network in each output channel is to convert a detected 'wide' pulse into ▶

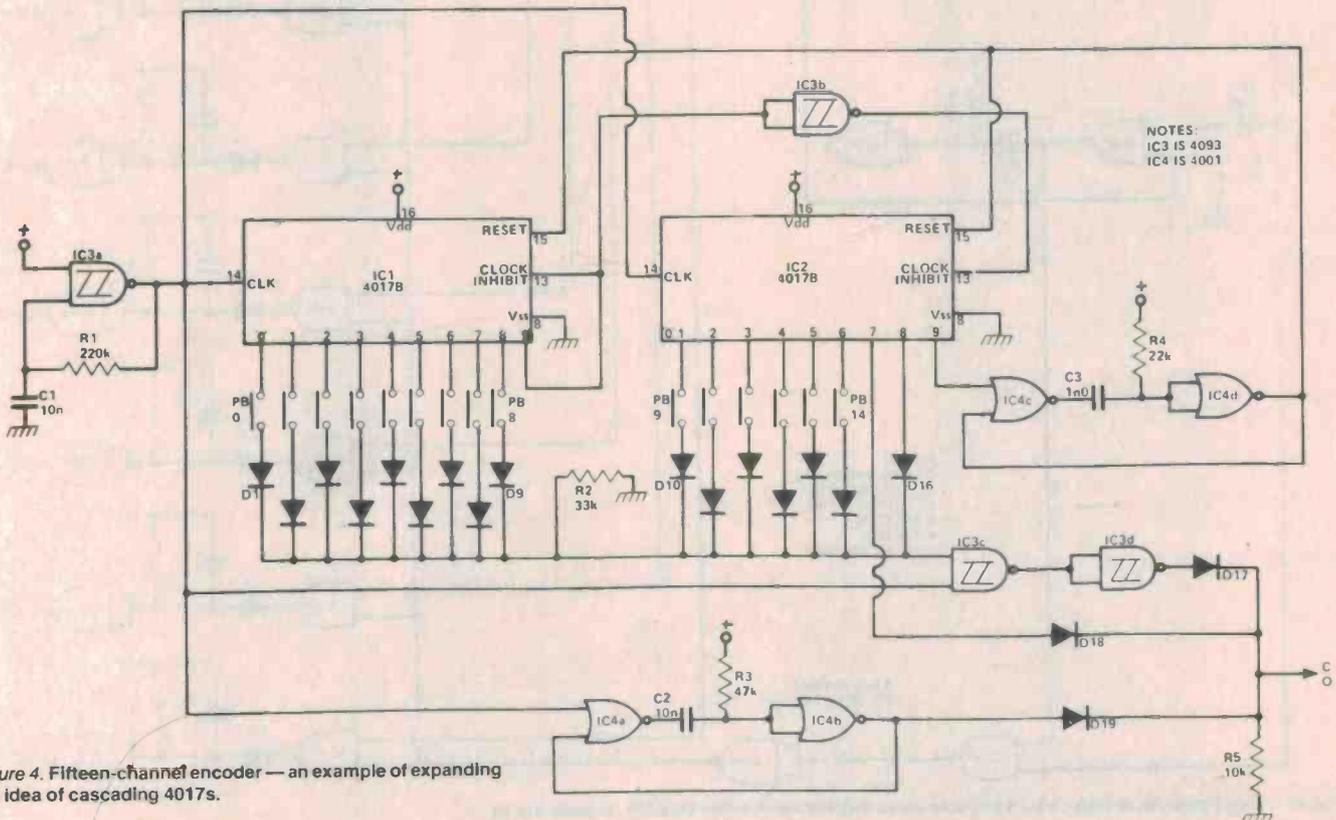


Figure 4. Fifteen-channel encoder — an example of expanding the idea of cascading 4017s.

Lab Notes

a steady dc voltage that will remain high (or low) for greater than one frame period.

Note that the steady (non-pulsed) outputs of the eight channels of this system can readily be binary decoded to make a total of 256 non-simultaneous channels available.

Expanded multi-channel systems

All of the coder/decoder circuits presented here can be expanded to incorporate any number of channels (with appropriate increases in frame periods and miscellaneous timing component

values) by using multi-stage 4017 counter networks in place of the single counters shown. If you want more information on this circuit and its brother decoder, you'll have to wait until the circuit reappears in an ETI project some time later!

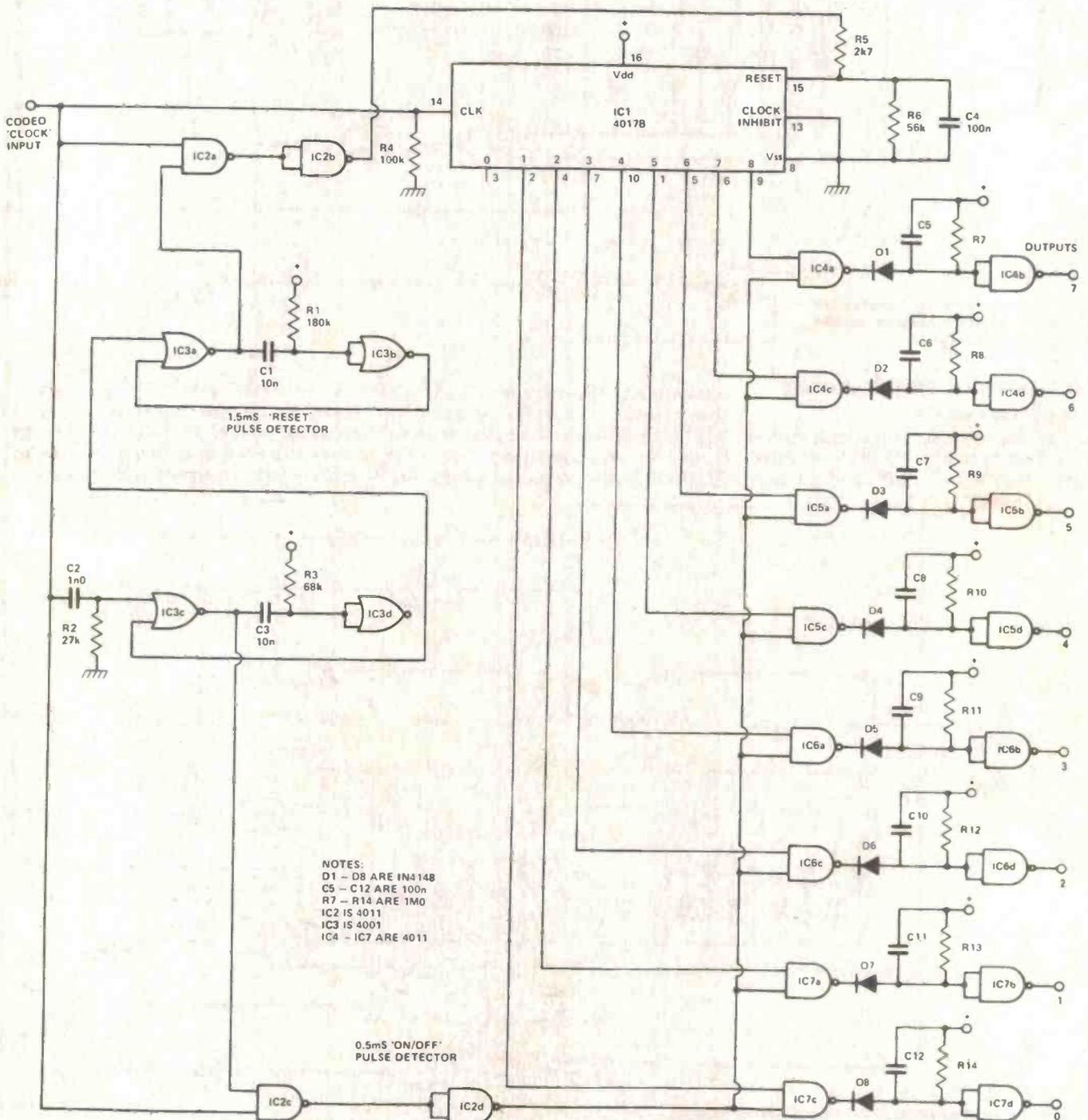


Figure 5. Eight-channel decoder which will operate as a system with either encoder (Figures 3 or 4).

ELECTROMARK PTY. LTD.

Australian Suppliers of

Toroidal Transformers



Using advanced winding technology, ILP Toroidal Transformers have only half the weight and height of their laminated equivalents and are appreciably more efficient. Induced hum is reduced by a factor of ten. Supplied with rigid mounting kit with centre bolt, steel and neoprene washers.

30 VA	\$18.49	\$2.08 S.T.
50 VA	\$23.27	\$2.62 S.T.
80 VA	\$25.04	\$2.82 S.T.
120 VA	\$29.39	\$3.31 S.T.
160 VA	\$40.00	\$4.50 S.T.
225 VA	\$47.99	\$5.40 S.T.
300 VA	\$55.89	\$6.29 S.T.
500 VA	\$77.36	\$8.70 S.T.

Send stamped, addressed envelope for a list of secondary windings available.

ELECTROMARK PTY. LTD.

40 Barry Avenue, Mortdale, NSW 2223
SA: Sonics Sound, Holden Hill, SA 5088



MEASURING AND TEST INSTRUMENTS

BEST OSCILLOSCOPE VALUE IN '81

For lab, school & W/shop
GOS-955 (\$216 plus S.T.)

- CRT-5" (130mm)
- B/width 6.5MHz
- Sensitivity 10mV/div.
- H/sweep 10Hz-100KHz
- Internal voltage and freq. calibration



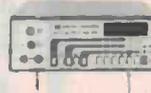
AC MILLIVOLT METER (\$146 plus S.T.)

GDM-706A • 1mV-300V, -60 ~ +50dB

DIGITAL MULTIMETER

GDM-8035

- AC/DC, V, A, OHM • 3 1/2 digit
- 0.5" LED
- 200mV-1200V
- 5 ranges • Acc. 0.1% rdg. + 1 digit • Imp. 10Mohm



AUDIO SIGNAL GENERATOR (\$164 plus S.T.)

GAG-808A

- 10Hz-1MHz • Sine/Square Wave
- ### FREQUENCY COUNTERS
- GFC-8025A, 10Hz-250MHz (\$250 plus S.T.)
GFC-8055A, 10Hz-550MHz (\$366 plus S.T.)
- Sens. 10mV
 - Imp. 1Mohm
 - 30pF and 50ohm



OTHER GW INSTRUMENTS

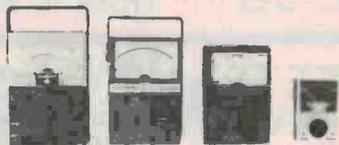
Function Generator, 0.2Hz-2MHz; Sine, Square, Triangle, Pulse and Ramp (\$160 plus S.T.)

REGULATED DC POWER SUPPLIES

GPS-3020, 30V/2A (\$113 plus S.T.) GPS-1820, 18V/2A (\$100 plus S.T.) GPS-3060, 30V/6A (\$244 plus S.T.) GPD-3020, Dual Tracking, 30V/2A (\$263 plus S.T.) GPD-1820, Dual Tracking, 18V/2A (\$249 plus S.T.)

- Milliohm Meter • AF/RF Attenuator • Capacitance Meter
- Leakage Current Meter • Line filter • Puncture/Insulation Tester

"STANDARD" MULTIMETERS



ST-303TR \$30.39 + S.T. YN-360TR \$21.70 + S.T. SP-100 \$16.09 + S.T. ST-5 \$10.39 + S.T.

ST-303TR, 20Kohm/V, Cc1 protec. Trans. Test. 12ADC. YN-360TR, 20Kohm/V, Cc1 protec. Trans. Test. SP-100, 4Kohm/V, 0.25-1000V AC/DC, 0.25-0.5A, 0-1M ST-5, Pocket Type. Up to 1000V AC/500V DC, 0.25A, 600Kohm.

ALSO — Bench meters, portable meters, clamp testers, switchboard instruments panel meters and VU-meters.
ADD 15 PERCENT SALES TAX TO ALL ABOVE PRICES.



Sole Australian Agent: EMONA ENTERPRISES PTY. LTD.

CBC Bank Bldg, 661 George Street,
Haymarket, Sydney. (02) 212-4815.

Available from:

NSW: Radio Despatch Service, 211-0191. Emtronics 211-0531. David Reid Electronics 29-6601. Pre Pack Electronics 569-9797. Martin de Launay (Wollongong) 28-6020, (Newcastle) 24-741. VIC: Radio Parts 329-7888. SA: Int. Communication Systems P/L 47-3688. WA: Letco Trading Co. 387-4966. ACT: Electronic Components P/L 80-4654. TAS: D&I Agencies 23-2842.

Bill Edge's ELECTRONIC AGENCIES

115-117 Parramatta Road Concord 2137
NEW PO BOX 185 Concord 2137
Phone (02) 745 3077 (2 lines)

ETI 5000 POWER AMP

The best amplifier ever produced in kit form in Australia. This kit is absolutely complete down to the last nut and bolt. Full instructions have been specially prepared for us by Phil Walt (technical writer for ETI). Cat KE3555 ETI 477 MOSFET modules only: \$59.90 Cat KE3545

ONLY \$295

Case & heatsink: \$39.50

Case & heatsink: \$95.00

PRE AMP

The companion pre amp for the 5000 amp should be available in September—and it looks as though it's been worth the wait. Please phone for more up to date information.

COMING SOON!

ETI 660 ★ ★ ★ COMPUTER

The ETI660 Learners' Computer is now scheduled for September. We are sorry about the delay, but it's been out of our hands. Look out for it in next month's catalogue.

NEW SOUND EFFECTS KITS BY ETI

All kits come complete with parts as per ETI

August—includes solder & instructions.

ETI607A Bomb drop & explosion \$11.95

ETI607B Steam train & whistle \$10.95

ETI607C Phaser (woop-woop alarm) \$9.95

SOUND EFFECTS IC

SN76488 TI sound Generator IC only

(as used in above kits)

\$5.95

GREAT KIT ★ BUYS ★

These very economical kits are ideal for the beginner or for school projects. Or just for fun! These are complete kits—you end up with a complete project, not a bunch of parts soldered or screwed together. No more pulling them apart to build something new!

KE2301 EA7/81 Lotto/pools	\$25.00
KE2310 EA5/81 PC Birdies	\$14.95
KE2311 EA7/81 Steam train whistle	\$18.00
KE2340 ETI568 Light/sound flash	\$26.95
KE2350 EA2/81 Fuzzbox	\$19.50
KE2360 EA5/81 Speed sentry	\$12.00
KE2370 ETI724 Microwave oven detector	\$14.95

Our apologies to all of you who expected to find the Electronic Agencies Catalogue in this month's ETI. There were so many new products that we wanted to get in that we just couldn't get it ready in time. But, as you read this, the Catalogue should be on the presses—and will be in the September 1981 issue of ETI.

CATALOGUE NEXT MONTH IN ETI

ALL ELECTRONIC COMPONENTS

That's our name . . . that's our game!!!

MAJOR STOCKISTS OF ALL GENERAL RADIO AND ELECTRONIC COMPONENTS

Only "recognised brands" and top-quality components stocked. Resistors (incl. large industrial types) capacitors, semi-conductor devices, switches, meters, valves, metalwork, front panels, plugs, sockets, cable connectors, transformers, speakers, etc. Prompt and efficient attention through our mail order department. Major stockist of all ETI & EA kits — you name it — we will quote.

ETI AND EA KITSET SPECIALISTS (LARGEST RANGE IN AUSTRALIA) — TOP QUALITY, LOW PRICES

LEARN WHILE YOU BUILD

STEREO UNITS

- S1 ETI 484 Compressor Expander
- S2 ETI 482 50 watt per channel Amplifier
- S3 ETI 482A Preamp Board
- S4 ETI 482B Tone Control Board
- S5 ETI 485 Graphic Equalizer
- S6 ETI 480 50 watt Amplifier less H/S & bracket
- S7 ETI 480 100 watt Amplifier less H/S & bracket
- S8 ETI 490 Power Supply for above
- S9 ETI 443 Expander Compressor
- S10 ETI 444 Five watt stereo
- S11 ETI 422B Booster Amplifier including metalwork
- S12 ETI 438 Audio Level Meter
- S13 ETI 440 25 watt Stereo Amplifier including metalwork
- S17 ETI 422 50 watt per channel Amplifier*
- S18 ETI 426 Rumble Filter
- S19 ETI 429 Simple Stereo Amplifier
- S21 ETI 417 Over LED Distortion Monitor
- S24 ETI 427 Graphic Equalizer*
- S28 E.A. Playmaster 136 13 watt
- S30 E.A. Playmaster 143 12.5 watt
- S32 E.A. Musicolour II 1000 w/ch
- S33 E.A. Musicolour III 1000 w/ch
- S34 E.A. Stereo Dynamic Noise Filter
- S35 ETI 470 60 watt audio amplifier module
- S36 ETI 4000 Series 60 watt stereo amplifier
- S37 ETI 451 Hum Filter for Hi-Fi systems
- S38 E.A. Stereo Infrared Remote Switch
- S39 ETI 455 Stereo Loudspeaker Protector
- S40 E.A. Super-Bass Filter Less Power Pack
- S42 E.A. Stylus Timer
- S43 ETI Series 3000 Amplifier 25w/ch
- S44 ETI 477 Mosfet power amp module inc. brackets
- S45 ETI 457 Scratch/Rumble Filter

PRE-AMPLIFIERS AND MIXERS

- P1 ETI 445 Stereo Pre-Amplifier
- P2 ETI 448 Balance Mic Pre-Amplifier
- P5 ETI 414 Master Mixer 8 channel
- P6 ETI 419 Mixer Pre-amplifier — 4 ch. Mixer Pre-amplifier — 2 ch.
- P7 ETI 401 F.E.T. 4 Input Mixer
- P10 E.A. Playmaster 145 Mixer
- P11 ETI 446 Audio Limiter
- P12 ETI 471 High Performance Stereo Pre-amplifier
- P13 ETI 477 Moving Coil Cartridge Pre-Amp
- P14 ETI 474 High to low Impedance Interface
- P15 ETI 467 4 Input Guitar/Mic. Pre-amp Suits ETI 466

TUNERS

- T1 ETI 062 A.M. Tuner
- T2 ETI 740 F.M. Tuner*

*Wooden cabinet not included

GUITAR UNITS

- G1 ETI 447 Audio Phaser
- G2 ETI 413 2 x 100 watt Bridge Amplifier
- G5 ETI 413 100 watt Guitar Amplifier
- G6 ETI 410 A.D.U. for your Guitar
- G8 E.A. PM 134 21 watt Guitar Amplifier
- G9 E.A. PM 138 20 watt Guitar Amplifier
- G14 ETI 452 Guitar Practice Amplifier
- G15 ETI 466 300 watt Amp module — less H/S & Transformer
- G16 ETI 454 Fuzz-Sustain less foot switch

AUDIO TEST UNITS

- AT1 ETI 441 Audio Noise Generator
- AT2 ETI 128 Audio Millivolt Meter
- AT4 ETI 102 Audio Signal Generator
- AT5 E.A. A.F. Tone Burst Generator
- AT7 ETI 137 Audio Oscillator
- AT8 ETI 138 Audio Power Meter

POWER SUPPLIES

- PS1 ETI 132 Experimenters Power Supply
- PS2 ETI 581 Dual Power Supply (High Powered Version)
- PS3 ETI 712 CB Power Supply
- PS4 ETI 131 Power Supply
- PS6 ETI 105 Laboratory Power Supply
- PS7 ETI 111 I/C Power Supply
- PS9 E.A. 1976 Regulated Power Supply
- PS10 E.A. Dual 30-2.0-30V at 2A or 0-60V at 2A or Dual Pos and Neg 30V at 2A
- PS11 E.A. C.B. Power Supply
- PS12 ETI 142 Power Supply 0-30 V 0-15 A (fully protected)
- PS13 ETI 472 Power Supply
- PS14 E.A. Power Supply for Dream 6800
- PS15 ETI 577 Dual 12V supply
- PS16 E.A. Power Saver

COMPUTER AND DIGITAL UNITS

- C1 ETI 633 Video Synchronizer
- C2 ETI 632M Part 1 Memory Board V.D.U.*
- C3 ETI 632P Part 1 Power Supply V.D.U.*
- C4 ETI 632A Part 2 Control Logic V.D.U.*
- C5 ETI 632B Part 2 Control Logic V.D.U.*
- C6 ETI 632C Part 2 Character Generator V.D.U.*
- C8 ETI 632 U.A.R.T. Board*
- C9 ETI 631-2 Keyboard Encoder*
- C10 ETI 631 A/Sch. Keyboard (less keyboard)*
- C12 E.A. Educ-8 Computer
- C13 E.A. Cassette-Tape Interface
- C14 ETI 638 Eprom Programmer
- C15 ETI 637 Cuts Cassette Interface
- C16 ETI 651 Binary to Hex Number Converter
- C17 ETI 730 Getting Going On Radio Teletype
- C18 E.A. Dream 6800 Computer for Beginners less keyboard and cover
- C19 ETI 731 R.T.Y. Modulator
- C20 ETI 450A Bucket Brigade
- C21 ETI 450B Mixer for above

TEST EQUIPMENT

- Klt TE2 ETI 133 Phase Meter
- TE3 ETI 533C Digital Display
- TE4 ETI 129 R.F. Signal Generator
- TE5 ETI 130 Temperature Meter
- TE6 ETI 706 Marker Generator
- TE8 ETI 122 Logic Tester
- TE9 ETI 124 Tone Burst Generator
- TE10 ETI 123 C Mos Tester
- TE11 ETI 118 Impedance Meter
- TE12 ETI 533 Digital Display
- TE13 ETI 117 Digital Voltmeter 1975 Display
- TE14 ETI 117 Digital Voltmeter 1976 Display
- TE15 ETI 704 Cross Hatch Dot Generator
- TE16 ETI 120 Logic Probe
- TE17 ETI 121 Logic Pulser
- TE18 ETI 118 Digital Frequency Meter 1975 Display
- TE19 ETI 118 Digital Frequency Meter 1976 Display
- TE23 E.A. Simple Function Generator
- TE34 ETI 487 Real Time Audio Analyser
- TE35 ETI 483 Sound Level Meter
- TE36 ETI 489 Real Time Audio Analyser
- TE37 ETI 717 Cross Hatch Generator
- TE38 E.A. 3 Mhz Frequency Counter
- TE41 E.A. Function Generator
- TE42 E.A. Transistor Tester incl. BiPolar & F.E.T.S.
- TE43 ETI 591 Up Down Pre-settable Counter
- TE44 ETI 550 Digital Dial (less case) includes ETI 591
- TE45 ETI 144 Expanded Scale R.M.S. Voltmeter
- TE46 ETI 148 Versatile Logic Probe
- TE47 ETI 724 Microwave Oven Leak Detector
- TE48 ETI 150 Simple Analog Frequency Meter
- TE49 ETI 151 Linear Scale Ohm Meter

TE50 ETI 152 Linear Scale Capacitance Meter

- TE51 E.A. Digital Capacitance Meter
- TE52 ETI 589 Digital Temp. Meter
- TE53 E.A. T.V. C.R.O. Adaptor less Power Pack
- TE54 E.A. XTAL Locked Pattern Generator
- TE55 E.A. Decade Resistance Sub Box
- TE56 E.A. Capacitance Sub Box
- TE57 E.A. Decade Capacitance Sub Box
- TE58 E.A. Tantalum Capacitance Sub Box
- TE59 ETI 140 1 GHZ Frequency Meter /Timer
- TE60 ETI 572 PH Meter
- TE61 ETI 135 Panel Meter

WARNING SYSTEMS

- WS1 ETI 583 Gas Alarm
- WS3 ETI 528 Home Burglar Alarm
- WS4 ETI 702 Radar Intruder Alarm
- WS7 ETI 313 Car Alarm
- WS12 ETI 582 House Alarm
- WS14 E.A. 1976 Car Alarm
- WS15 E.A. 10 Ghz Radar Alarm
- WS16 E.A. Light Beam Relay
- WS17 ETI 247 Soil Moisture Indicator

MODEL TRAIN UNITS

- MT1 ETI 541 Model Train Control
- MT2 E.A. 1974 Model Train Control
- MT6 E.A. 1978 Train Control

AUTOMOTIVE UNITS

- A1 ETI 317 Rev. Monitor
- A2 ETI 081 Tachometer
- A3 ETI 316 Transistor Assisted Ignition
- A4 ETI 240 High Power Emergency Flasher
- A6 ETI 312 Electronic Ignition System
- A7 ETI 301 Vari-Wiper
- A14 E.A. Dwell Meter
- A15 E.A. Variwiper
- A16 E.A. Tacho for Tune-ups
- A17 E.A. Ignition Analyser and Tachometer
- A18 E.A. Strobe Adaptor for Ignition Analyser
- A19 E.A. 1975 C.D.I. Capacitor Discharge Ignition
- A22 ETI 318 Digital Car Tachometer (less Metalwork)
- A23 ETI 319A Variwiper Mk. 2 (no dynamic braking)
- A24 ETI 319B Variwiper Mk. 2 (for dynamic braking)
- A25 ETI 555 Light Activated Tacho
- A26 ETI 320 Battery Condition Indicator
- A27 E.A. Transistor Assisted Ignition
- A28 ETI 324 Twin Range Tacho less case
- A29 ETI 328 LED Oil Temp Meter less V.D.D. probe

PHOTOGRAPHIC

- PH1 ETI 586 Shutter Speed Trigger
- PH3 ETI 514B Sound Light Flash Trigger
- PH4 ETI 532 Photo Timer
- PH7 ETI 513 Tape Slide Synchronizer
- PH10 ETI 540 Universal Timer
- PH12 E.A. Sync-a-Slide
- PH14 ETI 558 Mast Head Strobe
- PH15 ETI 553 Tape Slide Synchronizer
- PH16 E.A. Digital Photo Timer
- PH17 ETI 594 Development Timer
- PH18 ETI 568 Sound or light operated Flash Trigger inc. optional parts

RECEIVERS/TRANSMITTERS

- R1 ETI 711 Remote Control Transmitter Switch
- R2 ETI 711R Remote Control Receiver
- R3 ETI 711D Remote Control Decoder
- R4 ETI 711B Single Control
- R5 ETI 711C Double Control
- R6 ETI 711P Power Supply
- R7 ETI 707A 144 Mhz Converter
- R8 ETI 707B 52 Mhz Converter
- R9 ETI 708 Active Antenna

- R11 ETI 780 Novice Transmitter
- R12 ETI 703 Antenna Matching Unit
- R15 E.A. 110 Communications Receiver
- R17 E.A. 130 Communications Receiver
- R18 E.A. All Wave I/C 2
- R20 E.A. Fremodyne 4 Complete Kit
- R21 E.A. Fremodyne 4 RF Section
- R29 E.A. Short Wave Converter for 27 Mhz
- R31 E.A. 27 Mhz Pre-amp
- R32 E.A. 10-30 Mhz Pre-amp
- R33 ETI 718 Shortwave Radio
- R34 ETI 490 Audio Compressor
- R35 ETI 721 Aircraft Band Converter (less XTALS)

- R36 ETI 726 6 or 10 metre Power Amp
- R37 ETI 475 Wide Band A.M. Tuner
- R38 ETI 585 Ultrasonic Switch

VOLTAGE/CURRENT CONTROLS

- V1 ETI 481 12 volt to -40V D.C. 100 watt Inverter
- V2 ETI 525 Drill Speed Controller
- V3 E.A. S.C.R. Speed Controller
- V6 E.A. 1976 Speed Control
- V7 ETI 592 Light Show Controller (3 ch.) (1000 w/ch)
- V8 E.A. Inverter 12V D/C input 230V 50Hz 300VA output
- V9 ETI 593 Colour Sequencer (for use with ETI 592)

MISCELLANEOUS KITS

- M1 ETI 604 Accented Beat Metronome
- M2 ETI 546 G.S.R. Monitor (less probes)
- M3 ETI 549 Induction Balance Metal Detector includes wire for search head
- M4 ETI 547 Telephone Bell Extender
- M5 ETI 602 Mini Organ (less case)
- M6 ETI 544 Heart Rate Monitor
- M7 ETI 044 Two Tone Doorbell
- M8 ETI 043 Heads and Tails
- M9 ETI 068 L.E.D. Dice Circuit
- M10 ETI 539 Touch Switch
- M14 ETI 701 Masthead Amplifier
- M23 E.A. Electronic Roulette Wheel
- M25 E.A. Digital Metronome
- M26 E.A. Sound Operated Relay
- M29 E.A. Sound Effects Generator
- M30 ETI 551 Light Chaser 3 channel 1000 watt/ch
- M32 E.A. Remote TV Headphone
- M34 ETI 650 STAC Timer
- M36 ETI 557 Reaction Timer
- M37 ETI 249 Combination lock (less lock)
- M38 ETI 814 Dinky Die
- M39 E.A. Electronic Combination lock (Including lock)
- M40 E.A. Mast Head Amplifier
- M41 ETI 578 Electromyogram
- M42 E.A. Prospector Metal Locator including headphone
- M43 ETI 561 Metal Locator less dowel and tubing potplant stand
- M44 E.A. Musical Tone Generator
- M45 E.A. Light Chaser 3 channel
- M46 E.A. Power saver for induction motors
- M47 E.A. Twin Tremelo for Organs/Stage Amps
- M48 E.A. Lissajous Pattern Generator
- M49 E.A. Selectalot
- M50 ETI 1500 Discriminating Metal Locator
- M51 E.A. Light Chaser
- M52 E.A. Cylon Voice

E. D. & E. (SALES) PTY. LTD., NOW

ALL ELECTRONIC COMPONENTS

118 LONSDALE STREET, MELBOURNE, VIC. 3000. TEL: 662-3506.

Babani Books

NEW TITLES!

FIRST BOOK OF PRACTICAL ELECTRONIC PROJECTS

Full constructional data, circuits, components lists for many practical projects including audio distortion meter, super FET receiver, guitar amp, metronome, etc. etc.

BP23 \$2.75

GIANT CHART — RADIO, ELECTRONICS, SEMI-CONDUCTOR & LOGIC SYMBOLS

Identify those symbols at a glance. A must for beginners and advanced enthusiasts alike. Professionals can always hide it in their desks! A steal at only...

BP27 \$2.20

FUN AND GAMES WITH YOUR CALCULATOR

Amazing collection of 101 jokes and riddles, several quite mind-boggling games for two or more players and a dictionary of numbers which are words if the calc. is read upside down.

BP38 \$2.75

RADIO STATIONS GUIDE

Eight sections covering: European LW/AM; European, Near East and N. African MW/AM; World-wide SW/AM; European FM/VHF; Broadcast band USA; Broadcast band Canada; Local UK; Wavelength/frequency conversion. Book shows station site, country, frequency, wavelength, effective radiated power and, in some cases, call sign.

BP55 \$6.45

COUNTER DRIVER AND NUMERAL DISPLAY PROJECTS

Well-known author F.G. Rayer features applications and projects using various types of numerical displays, popular counter and driver ICs, etc.

BP67 \$6.10

TRANSISTOR RADIO FAULT-FINDING CHART

How to trace most common faults quickly. Top of chart indicates faults — users then follow arrows indicating checks in correct sequence until fault is cleared. Clever one!

BP70 \$1.85

PRACTICAL COMPUTER EXPERIMENTS

How to build typical computer circuits using discrete logic. This book is a useful intro to devices such as adders and storers as well as a general source book of logic circuits.

BP78 \$6.50

ELECTRONIC PROJECTS USING SOLAR CELLS

Well-known author Owen Bishop has designed a number of projects that benefit from solar power and obviate the problems encountered with batteries, such as weight and bulk, frequency of replacement, and failure when batteries are exhausted.

BP82 \$7.15

AN INTRO TO BASIC PROGRAMMING TECHNIQUES

Ideal for beginners seeking to understand and program in BASIC. Book includes program library for biorhythms, graphing Y against X, standard deviations, regressions, generating musical note sequences, and a card game.

BP86 \$7.15

SIMPLE LED CIRCUITS — BOOK 2

Sequel to BP42. Further light-emitting diode circuits. If you liked BP42 you'll love this one. If you don't know either it's well worth buying both!

BP87 \$5.50

HOW TO USE OP-AMPS

Source book of op-amp circuits. Design notes and applications including basic theory for amps, power supplies, audio circuits, oscs, filters, computers and control engineering. Book is written around the 741 but includes design notes for most common op-amps and comparators. Essential reference for amateur and professional alike.

BP88 \$8.25

HI-FI LOUDSPEAKER ENCLOSURES

Data for building corner reflex, bass reflex, exponential horn, folded horn, tuned port, Klipschorn labyrinth, tuned column, loaded port and multi speaker panoramics. Clear dimensioned diagrams included.

205 \$3.50

PRACTICAL ELECTRONIC SCIENCE PROJECTS

Unusual projects including laser, electronic gas detector, ultra high voltage generator, digital clock, reaction timer, gelger monitor, ultrasonic receiver and transmitter, electroscopes etc.

207 \$2.75

DIODE CHARACTERISTICS, EQUIVALENTS & SUBSTITUTES

Includes signal, zener, rectifier diodes etc. Full interchangeability data and characteristics of thousands of diodes of all types with every possible alternative. Includes UK, USA, European, Russian, and Far Eastern devices.

211 \$4.60

ELECTRONIC CIRCUITS FOR MODEL RAILWAYS

Constructional details of a simple model train controller; a controller with simulated inertia, a high-power controller, an electronic steam whistle and a 'chuff generator'. Signal systems and train lighting and RF suppression also covered.

213 \$3.65

BUILD YOUR OWN ELECTRONIC EXPERIMENTER'S LAB USING ICs.

Includes many circuits and designs for constructing test and measuring instruments mostly using modern ICs. Includes AF osc, TTL pulse detector, hi-impedance Vm, square-wave osc/pulse gen, logic probe, lo-range ohmmeter, bridge, signal tracer etc.

218 \$3.10

BUILD YOUR OWN HI-FI & AUDIO ACCESSORIES

Essential for keen hi-fi & audio enthusiasts. Projects include stereo decoder, three channel mixer, FET pre-amp for ceramic p.u.s, mic pre-amp with adj. bass, stereo dynamic noise limiter, loudspeaker protector, voice operated relay etc.

220 \$3.10

28 TESTED TRANSISTOR PROJECTS

Some circuits are new, others are familiar designs. Projects can be split and/or combined for specialised needs.

221 \$4.60

SOLID STATE SHORT WAVE RECEIVERS FOR BEGINNERS

Design and construction of several solid-state short-wave receivers giving high level of performance yet utilising relatively few inexpensive components. See also 226.

222 \$4.60

50 PROJECTS USING CA 3130 ICs.

The CA 3130 is an advanced operational amplifier capable of higher performance than many others: circuits often need fewer ancillary components. Interesting and useful projects in five groups. Audio projects. RF projects. Test equipment. Household projects. Misc. projects

223 \$4.60

50 CMOS IC PROJECTS

Many interesting and useful projects — multivibrators; amplifiers and oscillators; trigger devices; special devices.

224 \$4.60

PRACTICAL INTRO TO DIGITAL ICs

Introduction to digital ICs (mainly TTL 7400). Besides simple projects, includes logic test set to identify and test digital ICs. Also includes digital counter-timer.

225 \$4.60

Babani Books

HOW TO BUILD ADVANCED SHORTWAVE RECEIVERS

Full practical constructional details of receivers with performance equal to commercial units. Also 'add-on' circuits of Q meter, S meter, noise limiter etc.

226 \$4.60

BEGINNERS' GUIDE TO BUILDING ELECTRONIC PROJECTS

Enables total beginners to tackle electronic projects. Includes component identification, tools, soldering, building methods, cases, legends etc etc. Practical basic projects are included.

227 \$4.60

ESSENTIAL THEORY FOR THE ELECTRONICS HOBBYIST

This book supplies hobbyists with background knowledge, tailored for his or her specific requirements and presented in a readable manner with minimum maths. Purpose-designed examples illustrate applications.

228 \$4.60

1ST BOOK OF TRANSISTOR EQUIVALENTS & SUBSTITUTES

Complete transistor equivalents. Plus 25 000 transistors with alternatives and equivalents. Covers devices from UK, USA, Germany, France, Europe, Hong Kong etc. See also 211 and BP14.

BP1 \$2.25

HANDBOOK OF RADIO, TV, INDUSTRIAL & TRANSMITTING TUBE & VALVE EQUIVALENTS

Equivalents book for amateurs and serviceman. More than 18 000 old and new valves from UK, USA, Europe, Japan et al. CV (military) listings with commercial equivalents included.

BP2 \$2.25

2ND BOOK OF TRANSISTOR EQUIVALENTS & SUBSTITUTES

Data on devices not included in BP1. This book supplements BP1, i.e. no data is duplicated.

BP14 \$4.05

52 PROJECTS USING IC 741

A must for those interested in any way in this inexpensive and versatile IC. European best seller!

BP24 \$3.50

ELECTRONIC CALCULATOR USERS' HANDBOOK

Invaluable for all calculator users. Presents formulae, data, methods of calculation, conversion factors etc, often with examples. Includes way to use simple calculator for trig functions (sin, cos, tan); hyperbolic functions (sinh, cosh, tanh); logs; square roots, and powers.

BP33 \$4.60

50 CIRCUITS USING GERMANIUM, SILICON & ZENER DIODES

Contains 50 interesting and useful circuits and applications in many different branches of electronics.

BP36 \$2.75

50 PROJECTS USING RELAYS, SCRs & TRIACS

Relays, SCRs and Triacs are used in motor speed control, dimming, heating, timers, light sensitive devices, warning circuits, light modulators, priority indicators, circuit breakers etc. Book gives tried and proven circuits allowing easy modification to suit special needs.

BP37 \$4.60

DIGITAL ICs & PIN CONNECTIONS

Equivalents and pin connections of popular user-orientated digital ICs. Details of packaging, families, functions, manufacturer, and countries of origin. Includes Fairchild, Ferranti, Harris, ITT, Motorola, National, Philips, RCA, Signetics, Sescocem, SGS-Ates, Siemens, SSSI, Stewart Warner, AEG-Telefunken, Texas, Teledyne. Companion volume to BP41.

BP40 \$9.00

LINEAR IC EQUIVALENTS & PIN CONNECTIONS

Similar to BP40 but deals with linear ICs.

BP41 \$10.00

HOW TO MAKE WALKIE-TALKIES

Practical circuitry and construction of transmitters, receivers and antennas. A book of great interest to the licenced operator especially. This book was written with the UK licencing regulations in mind. Some parts may not accord with local regulations.

BP43 \$5.50

IC555 PROJECTS

One wonders how life went on before the 555! Included are basic and general circuits, motor car and model railway circuits, alarms and noise makers plus section on subsequent 556, 558 and 559s.

BP44 \$6.45

PROJECTS IN OPTO-ELECTRONICS

Included are simple circuits using LEDs as well as sophisticated designs such as Infra-red transmitters & receivers, modulated light transmission and photo projects.

BP45 \$4.95

LM 3900 IC PROJECTS

Unlike conventional op-amps, the LM 3900 can be used for all the usual applications as well as many new ones. It's one of the most versatile, freely obtainable and inexpensive devices around. This book provides the groundwork for simple and advanced uses — it's much more than a collection of projects. Very thoroughly recommended.

BP50 \$4.95

ELECTRONIC MUSIC & TAPE RECORDING

Shows how electronic music can be made at home with simple and inexpensive equipment. Describes how sounds are created and recorded to build up final compositions. Includes how to build a small studio including mixer and effects units

BP51 \$4.60

LONG DISTANCE TV RECEPTION (TV-DX).

Written by UK authority, the book includes many units and devices made by active enthusiasts. A practical and authoritative intro to this unusual aspect of electronics.

BP52 \$4.60

PRACTICAL ELECTRONIC CALCULATIONS & FORMULAE

For the practical person's workbench. Bridges gap between technical theory and cut-and-dried methods which work but leave the experimenter unfulfilled. There's a strong practical bias. Tedious and higher maths avoided where possible. Many tables included. This one's a beauty!

BP53 \$8.25

ELECTRONIC SECURITY DEVICES

Simple and also sophisticated alarms using light, infra-red and sonics; also gas and smoke detectors, flood alarms, doorphone and baby alarms etc.

BP56 \$5.35

HOW TO BUILD YOUR OWN SOLID-STATE OSCILLOSCOPE

Project divided into sections for builder individually to construct and test — then assemble into complete instrument. Includes short section on 'scope usage.

BP57 \$5.50

50 CIRCUITS USING 7400 SERIES ICs

7400 ICs are freely obtainable, inexpensive and very versatile. Here's 50 interesting and useful circuits using this IC.

BP58 \$4.95

Babani Books

PRACTICAL CONSTRUCTION OF PRE-AMPS, TONE CONTROLS, FILTERS, & ATTENUATORS

How to construct a variety of magnetic tape recording, microphone, and disc pre-amps; plus tone controls, rumble & scratch filters, attenuators and pads etc etc.

BP60 \$5.30

BEGINNERS' GUIDE TO DIGITAL ELECTRONICS

Covers all essential areas including number systems, codes, constructional and sequential logic, analog/digital/analog conversion.

BP61 \$3.50

BEGINNERS' GUIDE TO MICROPROCESSORS & COMPUTING

Introduction to basic theory and concepts of binary arithmetic, microprocessor operation and machine language programming. Only prior knowledge assumed is very basic arithmetic and an understanding of indices.

BP66 \$6.40

ELECTRONIC GAMES

How to build many interesting electronic games using modern ICs. Covers both simple and complex circuits for beginner and advanced builder alike. Good one!

BP69 \$6.40

A MICROPROCESSOR PRIMER

This small book takes the mystery out of microprocessors. It starts with a design for a simple computer described in language easy to learn and follow. The shortcomings of this basic machine are then discussed and the reader is shown how these are overcome by changes to the instruction set. Relative addressing, index registers follow as logical progressions.

An interesting and unusual approach.

BP72 \$6.40

REMOTE CONTROL PROJECTS

Covers radio, infra-red, visible light, ultrasonic controls. Full explanations are provided so that the reader can adapt the projects for domestic and industrial as well as model use.

BP73 \$7.15

ELECTRONIC TEST EQUIPMENT CONSTRUCTION

Describes construction of wide range of test gear including FET amplified voltmeter, resistance bridge, field strength indicator, heterodyne frequency meter etc.

BP75 \$6.40

POWER SUPPLY PROJECTS

Designs for many power supplies including simple unregulated, fixed and variable voltage regulators — particularly for electronics workshops. Also included are cassette power supply, Ni-Cad charger, voltage step-up circuit, and simple inverter plus info on designing your own supply. All designs are low voltage types for semiconductor circuits.

BP76 \$6.40

RADIO CONTROL FOR BEGINNERS

How complete systems work with constructional details of solid state transmitters and receivers. Also included — antennas, field strength meter, crystal controlled superhet, electro-mechanical controls. Ideal for beginners. Section dealing with licencing etc not applicable to Australia.

BP79 \$6.40

POPULAR ELECTRONIC CIRCUITS — BOOK I.

Yet more circuits from Mr. Penfold! Includes audio, radio, test gear, music projects, household projects and many more. An extremely useful book for all hobbyists offering remarkable value for the designs it contains.

BP80 \$7.15

ELEMENTS OF ELECTRONICS

This series provides an inexpensive intro to modern electronics. Although written for readers with no more than basic arithmetic skills, maths is not avoided — all the maths is taught as the reader progresses.

The course concentrates on the understanding of concepts central to electronics, rather than continually digressing over the whole field. Once the fundamentals are learned the workings of most other things are soon revealed. The author anticipates where difficulties lie and guides the reader through them.

BOOK 1 (BP62): All fundamental theory necessary to full understanding of simple electronic circuits and components.

BOOK 2 (BP63): Alternating current theory.

BOOK 3 (BP64): Semiconductor technology leading to transistors and ICs.

BOOK 4 (BP77): Microprocessing systems and circuits.

BOOK 5 (BP89): Communications.

This series constitutes a complete inexpensive electronics course of inestimable value in hobby or career.

Books 1/2/3 \$8.25 (each)

Books 4/5 \$10.80 (each)

ORDER FORM

Please forward

Book	Qty	BP1	...	BP50	...	BP69	...
205	...	BP2	...	BP51	...	BP70	...
207	...	BP14	...	BP52	...	BP72	...
211	...	BP23	...	BP53	...	BP73	...
213	...	BP24	...	BP55	...	BP75	...
218	...	BP27	...	BP56	...	BP76	...
220	...	BP33	...	BP57	...	BP77	...
221	...	BP36	...	BP58	...	BP78	...
222	...	BP37	...	BP60	...	BP79	...
223	...	BP38	...	BP61	...	BP80	...
224	...	BP40	...	BP62	...	BP82	...
225	...	BP41	...	BP63	...	BP86	...
226	...	BP43	...	BP64	...	BP87	...
227	...	BP44	...	BP66	...	BP88	...
228	...	BP45	...	BP67	...	BP89	...

PLEASE NOTE: Following titles being reprinted.

Delivery expected within six weeks . . . 160, 202, BP39.

Trade enquiries welcomed

Send to ETI Book Sales, 4th Floor,
15 Boundary St, Rushcutters Bay NSW 2011.

Please allow 4 - 5 weeks for delivery.

Post & handling:

1 - 4 books: \$1.35 11 - 20 books: \$3.50
5 - 10 books: \$2.70 over 20 books: \$5.00

I enclose \$ (inc. p & h.)

Name

Address

..... postcode

Building a bench DMM

The variety of 'bench' digital multimeters available is quite wide and making a choice depends on many factors, price being a prime consideration. Can you get what you want in a do-it-yourself kit and save money?

THE SABTRONICS RANGE of bench instruments is available in both kit and built-up form in Australia, distributed by the Sydney-based company, Christie Rand. We took the opportunity recently of building one of their kits — the Model 2010A bench digital multimeter. This features a 3½-digit LED display and dc accuracy is quoted as 0.1%. It has five dc and ac voltage ranges from 260 mV to 1000 volts, six dc and ac current ranges from 200 μ A to 10 A, resistance from 200 ohms to 20 M and a diode test function at 1 mA, 10 μ A and 0.1 μ A. Accuracy on ac ranges is given as 0.5%. The kit is priced at \$138 (inc. tax). It is intended for battery operation.

The kit comes well-packed and includes individually packed resistors, capacitors, semiconductors and calibration components (and sheet), plus all necessary hardware. Assembly and operator's manuals are included. We found nothing missing, and most parts appeared to be of high quality.

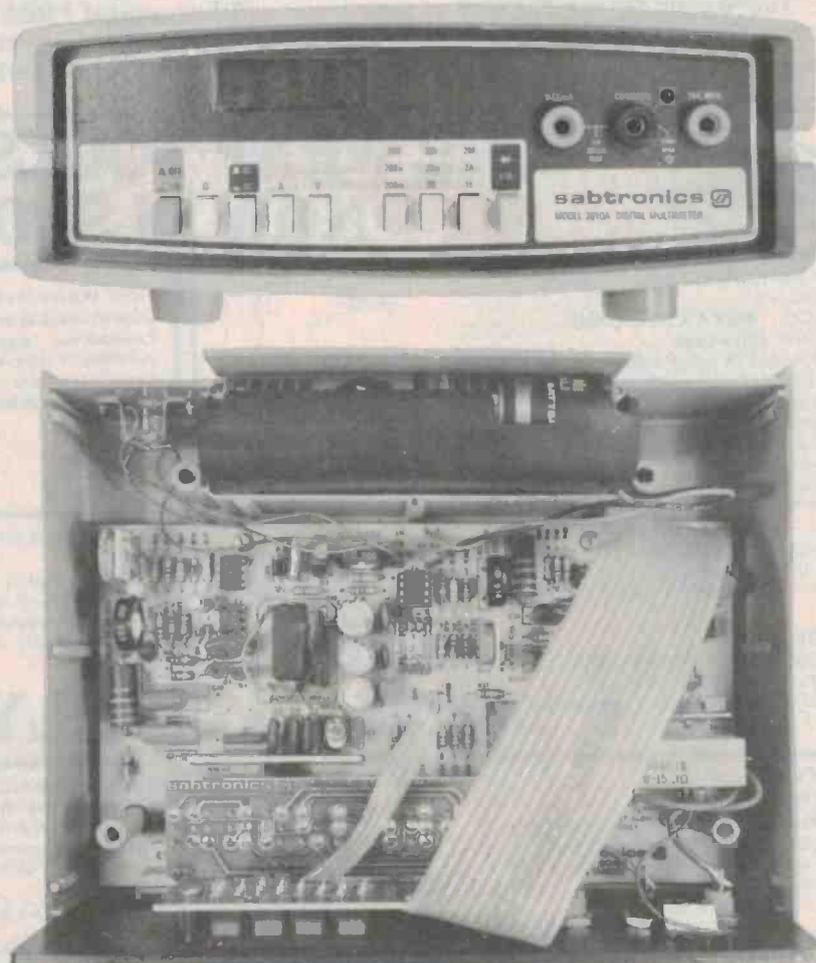
The kit was quite easy to assemble, the instructions being clear and easy to follow. It took about four to five hours. One capacitor turned out to be the wrong value.

A soldering iron with a small tip is essential. Flux stripping of the pc boards was necessary, but needs to be done with care to prevent the solvent affecting plastic parts.

When it came to calibration, we ran into difficulties. Two procedures are given; we found procedure #1 easy and accurate, and it's enough to get the unit up and going, *except* the method for ac where the parts were not supplied. The peak detect method we think is *dangerous* as it requires measurement on the mains. The book gives a warning, however. The high frequency compensation procedure is a guess.

Procedure #2 requires access to test equipment but is more detailed and results in greater accuracy. We checked it against our Fluke 8600A bench DMM and the 2010A came within specification.

When completed the unit looks attractive, is functional and easy to use. The case has a wire tilt stand which can be used at the front or the rear. Although battery powered, it could be supplied from a plug pack. Nicads may be used as the voltage regulator on



board is adjustable. The ranges provided are useful, particularly the ac current and the diode test. The x10 switch is also useful! The decimal point sensibly shifts with range change.

So much for the 'fors'. Now the 'against's'. The test leads do not have finger guards, in common with every other instrument we've handled in recent years. The LED display presents a high current drain so the four 'C' cells powering the unit do not last too long. The battery compartment and clip fitted badly on our unit. During construction we found that some identification numbers on the pc board did not agree with the parts list or assembly instructions, but it was obvious where things went. The holes for the power resistor leads were not drilled large enough. The ribbon cable supplied to provide inter-connection between boards had single-

strand wire and care is necessary to prevent fracture. One capacitor was the wrong value (C7 in ours) and caused problems in the ac calibration procedure.

We would recommend this kit only for the constructor with some experience. If you're prepared to go to the minor trouble of constructing it yourself, you can obtain quite a useful instrument that will serve your measurement needs for many years, and at a very attractive price. We felt several aspects could be improved upon, but overall the Sabtronics 2010A is well worth close consideration if you're after a bench DMM.

Further details can be obtained from Christie Rand Pty Ltd, P.O. Box 48, Epping NSW 2121. (02)477-5494.

Simon Campbell
Roger Harrison

RESISTORS - FOR FREE!!

You have seen many advertisements lately for resistors at crazy prices — but not this crazy! That's right — you get your resistors **FREE** from Jaycar. This is what you must do to get your 1/4 watt 5% carbon film resistors for nothing:-

You must order at least \$15.00 worth of general components i.e. Semiconductors, plugs, capacitors, P.C.B's etc. The 1/4 watt 5% resistor part of your order will be supplied **FREE** up to 30 pcs. (Mailorder customers do not send money for your resistors). You are limited to one order per week and both Mailorder customers and personal shoppers can participate. This is a wonderful opportunity to save money — call in **NOW!**



WIRE WRAP TOOLS AND WIRE NOW IN STOCK!!

We also stock wire wrap IC sockets!

The NEW BW 630 HOBBY WRAP TOOL is a

PRICE BREAKTHROUGH!

- Pistol grip design
- Moulded in tough ABS
- Complete with built-in bit
- Produces preferred "Modified" style wrap
- Built-in device to prevent overwrapping
- Uses 2 x 'C' cells



ONLY \$39.50

Wire stripping, wrapping and unwrapping hand tool. High quality universal tool. WSU-30M **ONLY \$9.50**

ONLY \$9.50

WIRE ROLLS
4 colours, Blue, Yellow, White, Red. 50 feet of AWG-30 (0.25mm) silver plated easy-strip solid conductor wire.

ONLY \$2.98 per roll

INSERTION AND EXTRACTION KIT

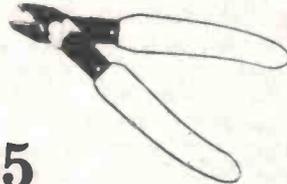
Contains MOS-safe 14-16 pin Insertor, 24-28 pin inserter, EX-1 tool with terminal for attaching a ground strap.
WK-7 **ONLY \$29.50**



ONLY \$29.50

"MINI SHEAR" Diagonal cutting pliers.

- Made in USA quality
- Quality hardened steel jaws
- Fantastic soft-feel cushion handles!
- Will cut up to 16g wire



ONLY \$4.95

JUST WRAP WIRE WRAP TOOL with in-built dispenser roll.

Economical way to get the benefits of wire-wrap technology. Dispensing tool has replaceable roll of wire attached. Nothing else to buy.

Only \$24.50

JW-1-W White
JW-1-B Blue
JW-1-Red



DIP IC INSERTION TOOL INS1416

Industrial quality. Narrow profile enables work in densely packed areas. Tool includes a remarkable pin straightener built into the handle.

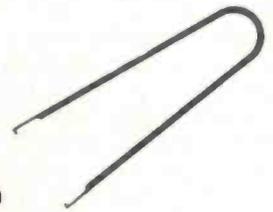
ONLY \$5.95



DIP IC EXTRACTION TOOL

Ideal for the hobbyist or laboratory engineer. One piece spring steel construction. Will extract from 8-24 pin devices safely.

EX-1 **ONLY \$2.95**



ONLY \$2.95

"XURO GRIP" Miniature Fine Nose Pliers.

- Jaws only 2mm wide
- Parallel sided
- Made in USA
- Spring loaded

Why buy South Asian junk when you can have the best for no

ONLY \$4.25

Fantastic New Pro-Quality Tools at Hobby Prices!

CMOS	74LS	95	0.75	LINEARS	1496	198
4000B 0.40	4053B 1.75 00	0.35	109	TL-071	EXAR 2206	5.95
4001B 0.35	4056B 0.80 01	0.40	109	TL-072	CA 3046	1.45
4002B 0.48	4059B 0.48 02	0.40	122	TL-075	CA 3080E	1.30
4007B 0.38	4069B 0.70 03	0.60	123	TL-076	CA 3130E	1.80
4009B 0.50	4070B 0.48 04	0.40	126	AT-1-0212	CA 3160	1.45
4011B 0.35	4071B 0.48 05	0.60	138	TC4-220	LM-3900	0.95
4012B 0.35	4073B 0.85 06	0.40	139	1.45	LM-301	0.60
4013B 0.90	4075B 0.60 09	0.50	147	2.95	LM-307	0.90
4015B 1.35	4076B 1.25 10	0.40	148	3.95	LM-308	1.25
4016B 0.50	4077B 0.50 11	0.40	157	1.50	LM-311	0.95
4017B 1.20	4078B 0.85 12	0.80	166	2.95	LM-319	3.50
4020B 1.45	4071B 0.48 05	0.60	138	0.92	LM-324	1.20
4023B 0.28	4081B 0.60 13	0.65	175	1.65	LM-339	0.95
4024B 1.18	4093B 0.80 14	0.85	221	2.25	LM-348	2.25
4025B 0.35	4511B 1.50 20	0.40	240	3.50	OM-350	2.25
4027B 0.90	4512B 1.25 27	0.80	241	3.50	LM-380	9.50
4028B 1.18	4518B 1.50 30	0.50	244	3.55	LM-382	1.68
4029B 1.25	4520B 1.50 33	0.50	245	2.95	LM-382	2.60
4030B 0.80	4528B 1.25 42	0.95	259	2.50	ZN-414	2.50
4031B 2.20	4533B 1.95 47	1.45	268	1.25	NE555	0.35
4040B 1.65	4539B 0.50 73	0.95	273	2.95	NE570	5.75
4042B 0.70	4542B 1.75 74	0.75	373	2.95	SAR0600	9.95
4046B 1.55	4544B 1.65	0.85	395	3.50	LM-723	1.25
4049B 0.75		0.50			LM-741	0.40
4050B 0.90		0.75			LM-747	1.95
4051B 0.95		0.85			TEA 1002	17.50
					TDA 1022	9.50
					1488L	5.35
					1495	7.90

Jaycar

380 Sussex Street Sydney 2000

Phone 264 6688

Telex 72293

Shop Hours

Monday — Sunday
9am — 5.30pm



VELOSTAT FOAM
A must for storing or handling MOS devices. 8"x9" sheet of 1/8" high density foam. Original 3M. **ONLY \$3.50**

WE ALSO STOCK THE ENTIRE RANGE OF FUN-TO-BUILD KITS FROM "HOBBY ELECTRONICS" MAGAZINE



Australia's Opto House

Announces a new deal from an Opto World Leader



HEWLETT PACKARD

Commercial L.E.D.S.

Features

- Low Cost: Broad Application
- Long Life: Solid State Reliability
- Low Power Requirements: 20mA @ 1.6v
- High Light Output
- 0.8mcd Typical for 5082-4850
- Wide Viewing Angle
- Red Diffused Lens

5082-4850	Commercial Red	
1-99	100-999	1000 +
.15_{ea}	.13_{ea}	.11_{ea}



**VSI
ELECTRONICS
(AUSTRALIA)
PTY LTD**

High Efficiency L.E.D.S.

Features

- Light Output Categories
- Wide Viewing Angle and Narrow Viewing Angle Types
- General Purpose Leads
- IC Compatible/Low Current Requirements
- Reliable and Rugged
- High Intensity
- Choice of 3 Bright Colours
- High Efficiency Red
- Yellow
- Green

Popular T-13 / 4 Diameter Package

5082-4555	High Efficiency Red	
4655	High Efficiency Yellow	
4955	High Efficiency Green	
1-99	100-999	1000 +
.27_{ea}	.23_{ea}	.21_{ea}

* Prices (Plus Sales Tax If Applicable)

The Distributor Offering Something Unique - Service

Adelaide 51 6483 Brisbane 52 4261 Melbourne 877 5311 Perth 328 8091 Sydney 439 8622

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.

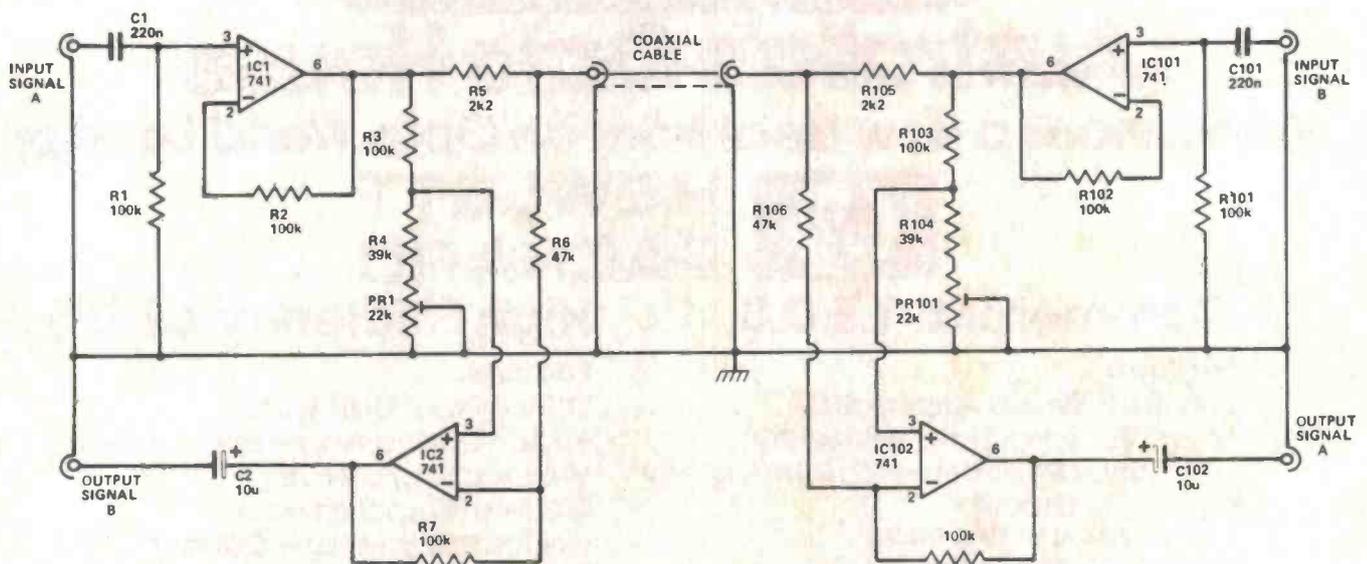
Bidirectional audio link

This simple circuit arrangement from T. Hopkins of Stockport, UK, enables audio signals to be sent along a single piece of coaxial cable in both directions simultaneously. The input signals are buffered by IC1, IC101 and fed to the cable by resistors R5, R105. IC2, IC102 subtract the signals on the cable from

the output of the buffer amplifier; the difference is the signal put onto the cable at the other end. The net result is that signals inserted at one end appear only at the other end.

The audio signals should be between 100 mV and 3 V (RMS). Potentiometers PR1, PR101 set the rejection of the unwanted signal; these should be of good quality and preferably multitrurn presets. A rejection of 50-55 dB can be obtained.

The prototypes were used in an audio system where the control unit was remote from the signal source and the power amplifiers and speakers. Other possible uses include intercom and talkback systems. If this technique is tried at higher frequencies, resistors R5, R105 should be adjusted to match the characteristic impedance of the coaxial cable used. A similar system has been successfully used for digital signals.



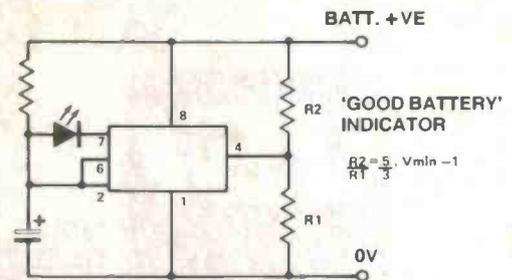
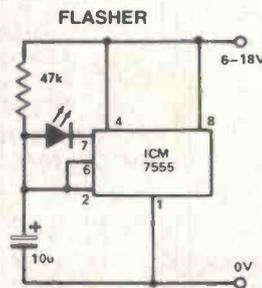
Micropower LED flasher

This circuit will brightly flash an LED, yet draws a supply current of only 150 μ A. In a normal 555 astable, the timing capacitor is discharged straight to ground. Here, the charge is made use of by discharging it through the LED. A suggested use is for an on-off indicator in a battery-powered circuit.

With a slight modification the circuit can be used as a good battery indicator. A potential divider is connected to pin 4 (reset) from the supply rail of the circuit

whose battery is being monitored, so that when the supply drops below a predetermined voltage, then the voltage on pin 4 drops below 0.7 V. Thus the LED

will only flash if the supply is higher than the predetermined voltage. Keep the value of the resistors high to reduce current consumption (e.g. 1M for R1).



Here's a unique offer....

BONUS BUYS

YES BANKCARD WELCOME!

NEW!

microphones

\$29
UNI DIRECTIONAL DUAL IMPEDANCE 500/30K OHMS 50-17KHZ Lc-7758/HH/5808

SAVE \$10
AS ABOVE COMPLETE with **\$49** Usually \$59

floor stand
BONUS: PACK OF 5 CABLE CLIPS FREE!

P.A. EQUIPMENT

SPEAKER DUAL CONE \$6
8" x 8" x 10W

COMPLETE WITH LINE TRANSFORMER \$8

SPEAKER GRILLES WHITE FLUSH MOUNT 8" \$2

LINE OUTPUT TRANSFORMER 70v. 100v LINE \$3 EA

BONUS: 10 METRES SPEAKER CABLE WITH EACH SPKR/GRILLE

resistors

All Wanted Values 1 ohm-10 Meg/ohm.

1/4 Watt... \$1.00
Packs of 100 PACK ONE VALUE

PACKS OF 500 ASST. VALUES \$2

CAPACITORS CERAMICS PACKS OF 100 ONE VALUE \$4

PACKS OF 100 ASST. VALUES \$2

BONUS: 11 PACKS FOR PRICE OF 10

SWITCHES

ROCKER SWITCHES

30c
WERE 80c, SAVE 50c

QUALITY SWITCH BARGAINS
SPST SPDT DPDT

55c 60c \$1
were 90c were \$110 were \$150

BONUS: 2 FREE SLIDE SW. WITH SW. ORDERS \$5.00 +

Speakers

8" WOOFER & 25W RATING
55-5KHZ **7.50**

5" MID-RANGE
500-12KHZ **5.95**

3" TWEETER
5KHZ-18KHZ **4.50**

CROSSOVER NETWORK 800HZ, 5KHZ **6.90**

GREAT VALUE!

BONUS: BUY ALL THREE, YOU GET X'OVER FREE!

Dynamic stereo headphones

20-20KHZ
320HM
ONLY 40GMS
6.5MM STEREO PLUG

\$12
SUPER-LIGHT ULTRA-THIN!

WERE \$18.00 SAVE \$6.00

BONUS: DUAL-PURPOSE 3.5 TO 6.5mm ADAPTOR FREE!

NO.1 IN CAR STEREO'S!

STEREO CASSETTE
HIGH POWER!
2x20W 4Ω
Under-Dash Mtg., LED bar-graph display, AUTO-STOP, auto size

\$75
\$49.50

3 WAY SPEAKER SYSTEM
CHOICE OF 2, BEST VALUE EVER!
The RM one is 70W 4Ω Ferris quality, was \$59 PA. Save \$10
The LH one is 30W 4Ω imported HIGH QUALITY River-Tone speakers. \$49.50

AM/FM RADIO/AUTO EJECT CASSETTE
SAVE \$20 **\$229**
WITH DOLBY PUSH-BUTTON AND TUNING

ALSO LOCKING FAST FORWARD AND REWIND, SEPARATE BASS AND TREBLE CONTROLS PLUS 7 WATTS OUTPUT PER CHAN. 10 4 OHMS - UNIVERSAL IN-DASH INSTALLATION

CAR SPEAKERS

25Wx2 BOOSTER/GRAPHIC EQUALIZER
SAVE \$30 **\$49**
WAS \$79

BONUS: 2 HIGH QUALITY CASSETTE TAPES WITH CAR HI-FI PURCHASE!

STEREO BOOSTERS

WITH GRAPHIC EQUALIZERS
\$69
24W+24W AND ILLUMINATED FRONT PANEL PROTECTED SPEAKER OUTPUTS!
LED BAR-GRAPH DISPLAYS PLUS FADER CONTROL - HI QUALITY

\$55
25Wx2 LED BAR-GRAPH POPULAR MODEL

Graphic Equalizer-Amplifier
60 Watt **\$79**
7-Band **\$79**
SAVE \$10 DE-LUXE MODEL WITH "OFFEAT" SWITCH AND LED OUTPUT POWER INDICATORS

GRAPHIC GIVES 12dB + and - AT 60HZ, 250HZ, 500HZ, 1KHZ, 2KHZ, 4KHZ, 8KHZ, 15KHZ, FREQ.

AUDIO MIXERS

for Home, Group & Semi-pro use.

\$82
NEW IMPROVED MODEL!
2 Mic channels, 2 Phono channels, 1 channel for Tape or Tuner Magnetic or Carcass inputs & tape outputs, 2 VU meters to monitor output or cut for each channel, Stereo or Mono display, operation with ext. DC input socket

• 9V battery operation with ext. DC input socket
• Size 285x195x70mm • Headphone socket

4 CHANNEL PLUS MASTER GAIN MIKE MIXER
See as above except has 4 side inputs, all high or low, and no cue controls **\$64**

5 BAND STEREO GRAPHIC EQUALIZER 240VAC MIXER
\$199
THE PRO MODEL

• Facilities for 4 stereo program input and 2 mic. inputs
• Built in low noise preamplifier for magnetic phono and low or high impedance microphones
• Professional stereo slide controls
• Headphone circuits to monitor each input and output
• Talk switch to attenuate music volume 10dB to mic can be used without reducing music levels
• 5 channel stereo graphic equalizer section using separate slider controls
• Balances monitor the output of left and right channels independently

BONUS: WITH ANY MIXER PURCHASE THIS MONTH WE WILL SUPPLY FREE HEADPHONES

POWER TRANSFORMERS

DOUBLE BONUS OFFER!
2 for 1
FOR PERSONAL SHOPPERS ONLY
FOR 2

12v-0-12v 500mA \$1

MAINS 120v PRIMARY
PRIMARY CAN BE IN SERIES (240v)
SECONDARIES CAN BE SERIES/PARALLEL

Outputs of 12V, 24V, 36V, or 48V at 500mA, 12V or 24V at 1A are possible!

LEDs

3mm Round
RED... 10c
GREEN... 15c
YELLOW... 15c

5mm Round
RED... 10c
GREEN... 15c
YELLOW... 15c

5x2mm RECC
RED... 20c
GREEN... 25c

THE MODERN PHONE DIALER

• EASY INSTAL IN MINS
• ONLY 3 WIRES
• IVORY COLOUR
• FULLY G'VEED
• LED INDICATOR
• LAST NUMBER MEMORY REDIAL
if called number is engaged

Direct replacement for rotary dial.
Not approved by Telecom currently

\$29.99

BONUS: BUY 9, GET 1 FREE!

ALL ONE LOW PRICE \$1 WITH A BONUS!

BONUS: THIS MONTH ONLY, BUY 12 PACKS, RECEIVE 13 (BAKER'S DOZ)

20 Tripoints 1K or 2K or 5K or 10K or 75K.....	\$1
2 18 way edge connectors 0.25" spacing.....	\$1
5 DPDT mini slide switches PCB atg.....	\$1
4 36V 1W 1R52S36B zener diodes.....	\$1
1 7824 24V 1A pos. voltage regulator 10-270.....	\$1
10 metres speaker cable, colour-coded.....	\$1
12 metres assorted colours hook-up wire.....	\$1
10 NE-2 neon, 90V working.....	\$1
8 6.3V RES diode lamps.....	\$1
3 28" x 3/8" diameter ferrite aerial rods.....	\$1
1 2 1/2" (57mm) diameter speaker 8 ohms.....	\$1
12 pot-nuts and washers.....	\$1
3 magnetic earphones for radio.....	\$1
5 metres single shielded cable.....	\$1
3 metres 3 core shield cable grey.....	\$1
1 Mono turnover phono cartridge, Rcl.....	\$1
10 12V 120mA globes, wire leads.....	\$1
2 LED red bezels 2.2V.....	\$1
1 mini n.o. reed switch - 12V coil.....	\$1
4 In-line std 3AG plastic fuseholders.....	\$1
2 1A 200 PIV silicon bridge rectifiers.....	\$1
3 2N6027 PUI transistors.....	\$1
2 2N5458 (4PF105) FET transistor.....	\$1
4 4mm insulated terminals, 2 red, 2 black.....	\$1
10 mini cradled clips, 5 red, 5 black.....	\$1
1 4W mini PCB atg, high speed relay.....	\$1
2 fibred heatinks for TO-3 transistor.....	\$1
5 3.5mm telephone plugs and sockets.....	\$1
6 transistor radio PVC tuning gangs.....	\$1
4 5K transistor radio volume controls.....	\$1
10 assorted 1/2" shaft volume control knobs.....	\$1
1 edge connector 0.155" pitch, to 80 way.....	\$1
1 2N-1000 OR GR-911 0-9 mini tube.....	\$1
10 0274 22V zener diodes 360mW.....	\$1

EX-COMPUTER GUARANTEED FANS

115v 3" **\$15** 115v 5" **\$15** 240v 5" **\$18**

82x82x40mm | 82x82x40mm | 130x130x30mm | 130x130x40mm

250v 6" **\$17** 220v 7" **\$19** 220v 7" **\$21**

166mm diam. | 185mm diam. | 185mm diam.

POWERFUL HIGH VELOCITY BLOWERS
SINGLE OR TWIN LARGE HEAVY-SQUIRREL-CAGE \$24 DUTY 240V FANS
240V BLOWERS \$24 200x200x100mm

BONUS: BUY ANY 9, GET 1x5" FREE!

LOW VOLTAGE MINIATURE LAMPS

5V 20mA
6V 60mA
12V 40mA
14V 80mA
24V 50mA
28V 40mA

50c EA

TAKE YOUR PICK! ACTUAL SIZE
BUY 10+ 42c, 100+ 35c
12V 120mA 20c ea

PRE-PAK electronics p/l

1a WEST ST, LEWISHAM, NSW

P.O. BOX 43 CROYDON 2132

569-9797 PACK/POST: ADD 10" ORDER VALUE

Phone or mail order BANKCARD accepted

David Reid Electronics

We're overstocked with Amplifiers! Our loss your gain.

LINEAR



LA230



LA250



LA270

SPECIFICATIONS

LA230
Power Output: (typical both channels driven into 8 ohms) 30 watts RMS/channel
LA250
Power Output: (at 8 ohms) 50 watts RMS/channel
LA270
Power Output: (at 8 ohms) 70 watts RMS/channel

LA230 ~~\$205.00~~ \$165.00
LA250 ~~\$255.00~~ \$195.00
LA270 ~~\$349.00~~ \$285.00

Whilst Stocks Last

Now that you can see we've got a great Amplifier here're the Speakers

LINEAR



L33-75

SPECIFICATIONS

L22-30
Response: 60Hz - 18KHz ± 5db
Power: 30 watts RMS
L33-50
Response: 50Hz - 18KHz ± 4db
Power: 50 watts RMS
L33-75
Response: 40Hz - 22KHz ± 4db
Power: 75 watts RMS

L22-33 ~~\$199.00 pr~~ \$170.00 pr
Limited stock on this
L33-50 ~~\$399.00 pr~~ \$299.00 pr
L33-75 ~~\$499.00 pr~~ \$379.00 pr
SAVE \$100.00
SAVE \$120.00

Again only whilst stock lasts

Looking to buy an instrument

Kaise Digital Multimeters



Models 6200 \$ 69.50 + Tax (77.31 Tax paid)
6220 \$ 79.50 + Tax (88.44 Tax paid)
6100 \$108.00 + Tax (120.15 Tax paid)
6110 \$118.00 + Tax (131.27 Tax paid)

Auto-ranging for these plus

We're now stocking



8022A \$149.00 + Tax
8020A \$199.00 + Tax
8024A \$249.00 + Tax
8050A \$415.00 + Tax



YES! We've also a full range of standard Analog multimeters.

Model Spiod 4KR/V \$18.45
all Analog prices include tax
ST350 2KR/V 10AMP \$18.95
YN360 TR 20KR/V + trans metering \$24.95
ST303 TR + transistor metering \$34.95

How's this for VALUE!!



GOOD WILL



GOS955 6.5 meg scope \$235.00 incl tax

GAG808 Audio Generator \$189.00

GVT706 Millivolt Meter \$169.00



GPS1820 Variable Power Supply 0-18 volt at 21 AMP \$115.00

GPS3020 Variable power supply 0-30 at 20 AMP \$130.00

GPD3020 Dual Variable 0-30-0-30 at 2AMP \$303.00

SPECIAL PRE-RELEASE OFFER

INCREDIBLE!!
sinclair ZX80
PERSONAL COMPUTER



Down to the amazing new LOW PRICE ... WAS \$295.00

NOW \$199.00
INCLUDING SALES TAX, POSTAGE AND PACKING

Be first to get one at this amazing new low price.

8K ROM \$75
16K RAM \$150
AVAILABLE NOW !!

Aug Holidays! Keep the Kids busy ...

We've a good range of electronic kits.

- 1 One Trans Radio \$ 5.95
- 2 Two Trans Radio \$14.50
- 3 10-1 Elect Proj \$24.50
- 5 Intercom Kit \$ 9.95
- 6 Stereo Preamp \$34.50
- 8 16 W Stereo Amp \$31.50
- 9A Stereo Amp Cab \$52.00
- 10 3 W Audio Amp \$ 7.50
- 15 Mag Preamp \$ 7.95
- 17 4.5 W Stereo Amp \$14.75
- 25 Continuity Test \$ 5.50
- 28 Elect Train Horn \$ 7.50
- 33 Snooze Alarm \$20.00
- 41 Calculator \$10.50
- 43 Burglar Alarm \$13.50
- 47 Power Sup for Kits \$11.95
- 48, 49, 51-52
- 48 30 W Power Mod \$27.95
- 49 50 W Power Mod \$38.95
- 50 Stereo Amp \$38.25
- 51 10 W Power Mod \$16.50
- 52 20 W Power Mod \$23.45
- 60 Cassette Deck \$36.95
- 66 LCD Credit Card \$14.25
- 68 Gents 5 Function \$16.50
- 69 Ladies 5 Function \$16.50
- 81 Elect Decision \$ 8.25
- 82 Elect Siren \$ 6.25
- 83 Elect Organ \$ 9.50
- 85 Elect Police Car \$ 7.50
- 89 Elect Light Flasher \$ 7.50
- 90 Elect Dampness \$ 6.95
- 92 Solar Power Kit \$16.95
- 105 Crystal Set \$ 5.95
- 106 Temp Alarm \$ 8.95
- 114 Led Dice \$11.50
- 124 Speed Control \$19.50
- 129 2Way Xover 8ohm 12db/oct \$18.25
- 130 3Way Xover 8ohm 12db/oct \$21.65



DAVID REID ELECTRONICS PTY. LTD.

SYDNEY:
127 York Street
Sydney 2000 N.S.W.
G.P.O. Box Q103
Sydney 2001 N.S.W.
Phone: (02) 29 6601

Part No.	Description	Quantity	Price	Total
Please print clearly. Date _____ Minimum Postage Packing charge				1.00
Tel _____ Plus Postage Packing surcharge				
Name _____			Subtotal	
Address _____				
Postcode _____			TOTAL	

Enclose your personal cheque. Money Order or Bankcard Numbers as specified below: Check and fill in

Cheque or Money Order Enclosed
 Charge to my Bankcard No. CARD HOLDER'S NUMBER

496 _____
Signature _____
Card Expiry Date _____

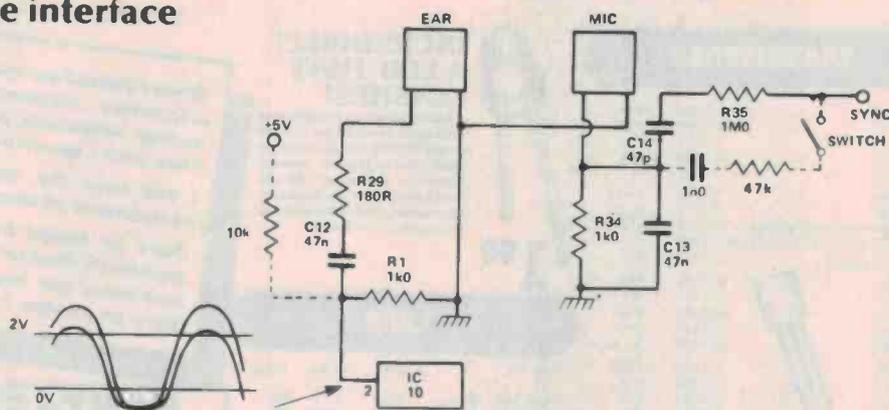
Ideas for Experimenters

Improving the ZX80 cassette interface

J.C. Corall

THE SIGNAL OUTPUT from the computer to the cassette recorder is usually about 1 or 2 V RMS while **SAVEing**, which is about the right level for the microphone input of many cassette recorders. Unfortunately, the small size of this signal means there is always a danger from ambient noise. With the additions to the circuit shown, closing the switch raises the output signal to about 30 mV, which makes it compatible with the "Auxiliary" socket on cassette recorders. A ZX80 modified in this way has also been found to give satisfactory recordings when connected to the DIN socket of a music centre. Playback is made through the headphone socket to the computer.

When loading a program, the signal from the cassette recorder is fed to an



LS TTL buffer, which requires at least 2 V on its input to register a logic 1. A cassette recorder that runs from 6 V, for example, can be hard pushed to supply this sort of signal without severe distortion.

However, a 10k resistor added as shown forms a potential divider with R1, and adds 0.5 V dc shift to the signal. This has been found to allow reliable program loading over a range of cassette volume control settings.

Simple photographic timer

ALTHOUGH this timing device may seem to be rather unsophisticated, it is a handy little gadget for timing darkroom exposures, or time exposures, or time exposures made on a camera with the shutter set to the 'B' position. The unit simply flashes a LED indicator briefly at one-second intervals. If, for example, one wishes to make a ten-second time exposure, then the shutter is opened during any convenient flash produced by the unit, and then closed after a further ten flashes have been produced. Adequate accuracy for normal requirements can be obtained in this way.

The circuit is based on the CMOS version of the well known 555 timer device. The CMOS version has the advantage of having a current consumption which is only about one hundredth of that taken by the conventional version, and this is obviously beneficial in a battery-powered piece of equipment such as this one. The average current consumption of the unit is actually less than 1 mA, giving an extremely long battery life.

The CMOS version of the 555 operates in the same basic manner as the ordinary version, with timing capacitor C2 first charging up to $\frac{2}{3} V+$ by way of the timing resistors — R1, R2, R3. The device is then triggered into the

discharge mode, resulting in C2 being discharged through R4 to a potential of $\frac{1}{3} V+$, whereupon the circuit reverts to its original state with C2 charging up once again. Continuous oscillation thus results. The frequency of operation is adjusted to 1 Hz by adjusting R1, and in practice this is adjusted by trial and error to obtain (say) 60 flashes in a one-minute period. Longer calibration periods can be used if better accuracy is required.

The output of IC1 assumes the high state while C2 is charging, and the low state while it is discharging. As C2 charges via R1, R2 and R3, but only

discharges through R4, the discharge time is therefore much shorter than the charge time. By connecting LED indicator D1 and its current limiting resistor R4 between the output of the IC1 and the positive supply, the required brief flashes are thus obtained. ●

ERRATA

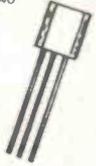
A rather obvious, but potentially dangerous error occurred in the circuit on the top left of page 60 ('Power Monitor') in the March issue. It shows the mains active input connected to the earth at the output. The mains active input should instead go to the fuse. Correct your copy now. Correction slips were inserted in the majority of copies distributed.

'Don't be misled by a few 'bargain' components offered by other suppliers: ALL my components are discounted!'



TRANSISTORS

AC126	Z-1064	95c
AC127	Z-1062	95c
AC128	Z-1064	95c
AC187	Z-1080	80c
AC188	Z-1082	95c
AD161	Z-1110	\$1.75
AD162	Z-1112	\$1.75
BC109C (BC549C, BC209C)	Z-1329	34c
BC159 (BC179, BC214, BC559)	Z-1359	17c
BC639 BC640	Z-1388	45c
BC640	Z-1389	45c
BCY71	Z-1241	95c
BD139	Z-1443	55c
BD140	Z-1444	55c
BD682	Z-1460	\$1.45
BD681	Z-1462	\$1.26
BF115	Z-1560	75c
BF173	Z-1590	89c
BF180	Z-1602	73c
BF184	Z-1604	\$1.00
CL33 NPN disp driver	Z-1750	\$1.00
CL34 PNP disp driver	Z-1752	90c
D13T1 (2N6027) PUT	Z-1780	59c
DS2646 UJT	Z-1786	95c
FPT100 (photo trans)	Z-1950	\$1.38
MEL12 (photo darlington)	Z-1952	95c
MJ2955	Z-1800	\$1.50
MPF102	Z-1832	59c
MPF105 (2N5459)	Z-1838	58c
MPF106 (2N5484)	Z-1840	58c
MPF131 (MPF121)	Z-1848	\$1.20
OC26 (AD149)	Z-1930	\$2.75
OC44	Z-1932	95c
OC71	Z-1941	75c
TIP31B	Z-2020	79c
TIP32B	Z-2024	79c
TIP2955 (MJE2955)	Z-2005	\$1.25
TIP3055 (MJE3055)	Z-2008	\$1.25
TT800 (2N4030)	Z-2064	89c
TT801 (2N3019)	Z-2068	89c
2N2053	Z-2130	53c
2N3055	Z-2145	83c
2N3055 (Motorola)	Z-1804	\$1.50
PN3563	Z-2180	30c
BC337	Z-2190	23c
BC328	Z-2242	17c
2N4360	Z-2246	22c
PN3642	Z-2250	45c
BC338	Z-2252	30c
PN3645	Z-2256	25c
PN4250	Z-2320	48c
PN4258	Z-2326	38c
2N4342	Z-1833	\$1.18
2N5484	Z-2340	58c
2N5590	Z-2390	\$6.50
2N5591	Z-2391	\$12.95
2N6048	Z-2394	\$16.20
BUX80	Z-2150	\$7.50
MJ15003	Z-1808	\$5.00
MJ15004	Z-1810	\$5.00



INCREDIBLE! A LED THAT FLASHES!

Amazing advances in solid state technology have now put a micro-circuit INSIDE a LED, making it flash! Ideal for projects, warning indicators, alarms, etc. All you do is apply power - no more circuitry needed. (Data sheet available on request). Cat Z-4000

\$1.80

LEDS

Type No	Size	Cat No	Price
Small Red	3mm	Z-4010	20c
Small Green	3mm	Z-4020	28c
Large Red	5mm	Z-4030	16c
Large Orange	5mm	Z-4036	55c
Large Yellow	5mm	Z-4034	34c
Large Green	5mm	Z-4032	28c
Large clear Red	5mm	Z-4038	55c
Rectangular Red		Z-4040	40c
Rectangular Green		Z-4042	40c
Rectangular Yellow		Z-4044	40c
Infra Red		Z-3235	\$1.50



RECTIFIERS

Type No	PIV	A	Cat No	Price
1N4002 (EM401)	100	1	Z-3202	6c
1N4004	400	1	Z-3204	8c
1N4007 (EM410)	1000	1	Z-3207	14c
1N5408 (MR510)	1000	3	Z-3228	43c
1N5404 (1N5624)	400	3	Z-3222	43c
MR110 (50-10 stud)	100	10	Z-3240	\$1.45
MR410 (50-10 stud)	400	10	Z-3244	\$1.95
BYX21L/200	200	25	Z-3260	\$1.95
BYX21L/200R	200	25	Z-3262	\$1.90
WO-2 bridge	200	1.5	Z-3300	\$1.90
WO-4 bridge	400	1.5	Z-3304	70c
PA80 bridge	600	8	Z-3326	\$5.50
PB40 bridge	400	25	Z-3334	\$5.50

SIGNAL DIODES

Type No	Type	Cat No	Price
DSOA91	Germ G/P	Z-3042	12c
OA47	Gold Bonded	Z-3232	38c
OA90	Germ G/P	Z-3030	18c
OA91	Germ G/P	Z-3040	18c
OA95	Germ G/P	Z-3050	18c
BB119	Silicon G/P	Z-3060	34c
BA102	Sil Varicap	Z-3070	43c
OA202	Sil small signal	Z-3100	34c
1N4148	Hi Sp switch	Z-3120	5c
5082-2800	Hot carrier	Z-3230	\$2.88

When I started my electronics business over 12 years ago, I sold discounted components direct to the public: at less than the normal 'wholesale' prices of the day! They said I would never survive. I still have the same policy today: prime spec, guaranteed components at discount prices - even for one-off purchasers. Don't be fooled by other supplier's spot specials - or their apparently cheaper prices (until you read the fine print telling you how many you have to buy!) Save on all your components at Dick Smith Electronics.

FANTASTIC NEW SEMIS!

(Introduced since our last catalogue).

Type	Description	Cat No	Price
BF469	Transistor	Z-1635	\$1.20
BF460	Transistor	Z-1636	\$1.20
BPW50	PhotoDiode	Z-1958	\$3.50
2N5245	N Channel JFET	Z-2335	90c
	4 digit L/C display	Z-4175	\$8.95
MC3021	Opto Triac Driver	Z-4516	\$2.75
	60 deg. solar cell	Z-4835	\$2.95
74LS05	Hex inverter	Z-4905	40c
74LS32	Quad 2 Input NOR	Z-4932	35c
74LS86	Quad 2input OR	Z-4986	45c
74109	Dual J/K flip flop	Z-5252	50c
74157	Multiplexer	Z-5267	85c
74LS139	Multiplexer	Z-5285	90c
74LS165	Par load 8 bit s/r	Z-5288	\$1.85
74LS174	bit D flip-flop	Z-5290	\$1.00
74LS367	Hex driver/3 st o/p	Z-5292	75c
74LS373	Dual D flip flop	Z-5295	\$1.95
81LS95 (97)	tri-st. oct div.	Z-5300	\$1.80
4040	Bcd/dec decoder	Z-5640	\$1.70
4046	phase-locked-loop	Z-5646	\$1.95
4069	Inverter Circ.	Z-5669	45c
40938	Quad 2 In Schmitt	Z-5693	65c
40194	4 bit bi direct s/r	Z-5694	\$3.50
72168	freq/period counter	Z-5747	\$29.95
MM5369 (EYRN)	80 Hz div	Z-5782	\$3.50
CA3080	Op amp	Z-6024	\$2.45
TL071cp	Fet inp op amp	Z-6030	95c
TL074cp	Quad fet op amp	Z-6034	\$2.75
LM334N	Quad comparator	Z-6039	70c
LM311	Voltage compar.	Z-6048	70c
LM394C	Dual notch pre.	Z-6083	\$4.50
NE5534	Low noise preamp	Z-6090	\$4.25
ICL7106	3.5 digit driver	Z-8300	\$9.50
LM3177/KC	Adj pos v/reg	Z-6541	\$1.95
LM334	Temp Sensor	Z-6810	\$1.95
MM5865	Timer	Z-6816	\$9.75
XR2206	Synthesiser IC	Z-6820	\$6.95
79101	Melody IC	Z-6822	\$6.25
SN76488N	Synthesiser	Z-6823	\$4.95
Z-80PIO	PIO chip for Z-80	Z-9101	\$14.95
2516	Prog monit. eeprom	Z-9207	\$11.95

1W ZENERS: For about the same as you're paying for 400mW types now!

4V7 (1N432)	Z-3523	5V1 (1N4733)	Z-3525
5V6 (1N4734)	Z-3527	6V2 (1N4735)	Z-3529
6V8 (1N4736)	Z-3531	7V5 (1N4737)	Z-3533
8V2 (1N4738)	Z-3535	9V1 (1N4739)	Z-3537
10V (1N4740)	Z-3539	11V (1N4741)	Z-3541
12V (1N4742)	Z-3543	13V (1N4743)	Z-3545
15V (1N4744)	Z-3547	16V (1N4745)	Z-3549
18V (1N4746)	Z-3551	20V (1N4747)	Z-3553
22V (1N4748)	Z-3555	24V (1N4749)	Z-3557
27V (1N4750)	Z-3559	30V (1N4751)	Z-3561
33V (1N4752)	Z-3563		

ALL VALUES: 29c!

IC'S

Don't forget, we stock a full range of
 ● TTL IC's (74 series)
 ● CMOS IC's (4000 series)
 ● Low Power Schottky TTL (74LS)
 ● Linear IC's (all types)
 ● Special function digital IC's
 - all at discount prices. Space is too limited to list them all here: please refer to page 75 or our 1981 Dick Smith Catalogue for a full listing (also see the new listing at left).

BIG SAVINGS - USE OUR BULK PACKS!

Big savings on individual prices are made using our bulk packs. We have various types of resistors and capacitors in hobbyist packs at big discounts. Try these for example:
 Resistor Pack: 300 computer selected 1/4 watt values (worth \$12.00). Cat R-7010 \$5.90
 Metal film pack: 300 1% 1/4 watt metal film types (value \$18.00) Cat R-7015 \$12.90!
 Green cap pack: 60 greencaps, various values, at least \$13 value. (Cat R-7040) \$6.50!
 Electrolytic pack: 55 electros, worth at least \$16.00. (RB Type) Cat R-7030 \$6.50
 Ceramic Pack: over 60 ceramics, worth around \$8-\$9. Cat R-7050 \$4.50!

THIS IS ONLY A SMALL PORTION OF OUR RANGE: IF WHAT YOU WANT ISN'T LISTED, ASK FOR IT: WE PROBABLY STOCK IT!

Yes! On these most popular transistors we offer a unique **FIVE YEAR GUARANTEE** (as long as they are used within specs) - and the specs are equal or better than the 'usual' 'BC'... series transistors!

D8847 (Z-1500) D8848 (Z-1508) D8849 (Z-1519): ALL 14c each!
D8887 (Z-1540) D8888 (Z-1548) ALL 17 cents each!!!



MANUFACTURERS...

Dick Smith components are prime spec, top quality and guaranteed! We import direct to save you money! Phone our wholesale division, Dick Smith Distributors, on Sydney (02) 888 3200 for quantity prices on all our components.

DICK SMITH Electronics

- AURURN 648 0558
- BLAKEHURST 546 7744
- BROADWAY 211 3777
- BROOKVALE 93 0441
- CHULLORA 842 9822

- GORE HILL 439 5311
- PARRAMATTA 683 1133
- SYDNEY 290 3377
- NEWCASTLE 61 1898
- WOLLONGONG 28 3800

- CANBERRA 80 4944
- BURANDA 391 6233
- CHERMSIDE 59 8255
- ADELAIDE 212 1892
- MELBOURNE 67 9834

- RICHMOND 428 1614
- SPRINGVALE 547 0522
- PERTH 328 8944
- CANNINGTON 451 8666



STOCK UP NOW!

MAIL ORDER CENTRE: P.O. Box 321 North Ryde, NSW. 2113. Ph. (02) 888 3200

ELLISTRONICS • ELLISTRONICS • ELLISTRONICS • ELLISTRONICS • ELLISTRONICS

289 LATROBE ST., MELBOURNE 3000
PHONE (03) 602 3282 - 602 3836 TELEX AA 37758 LSTRON



Ellistronics are direct distributors for Weller, Hitachi and Trio. For quantity discounts etc. ask for Trade Division.

SPECIAL FOR THIS MONTH AT ONLY
WELLER WTCPN SERIES
LOW VOLTAGE, TEMPERATURE CONTROLLED
SOLDERING STATION

\$56.85

TAX
EXEMPT

Subminiature LEDS

New!



Highly-reflective chrome holders Tax
Red LED, 276-068 65¢ ea. B
Green LED, 276-069 .. 65¢ ea. B

VERO TYPE BOARDS



Ex Tax Inc Tax

H5614 90x80mm \$117 \$125
H5602 150x90mm \$230 \$264
H5116 310x100mm \$344 \$396

Plated Strips-Alpha Numeric Grid, the most versatile board of the lot. Etched copper strips are pre-drilled and plated for soldering ease. These boards have an Alpha Numeric Grid to facilitate positive Pin Identification.

JUST WRAP™

- 30 AWG wire
- Daisy chain or point-to-point
- No stripping or slitting required—just wrap
- .025" square posts
- Built-in cut off
- Includes 50 ft. wire

Part No	Wire Color	Price
JW-1-B	Blue	\$19.50
JW-1-W	White	Tax
JW-1-Y	Yellow	Exempt
JW-1-R	Red	

JUST WRAP™ Replacement Wire

Part No	Color	Price
R-JW-B	Blue	50 ft. roll ... \$2.73+15% tax
R-JW-W	White	50 ft. roll ... \$2.73+15% tax
R-JW-Y	Yellow	50 ft. roll ... \$2.73+15% tax
R-JW-R	Red	50 ft. roll ... \$2.75+15% tax

Proto Clips

14-PIN CLIP PC-14	\$ 6.67+15% tax
16-PIN CLIP PC-16	\$ 7.04+15% tax
24-PIN CLIP PC-24	\$12.58+15% tax
40-PIN CLIP PC-40	\$21.29+15% tax

Intersil LCD 3 1/2 DIGIT PANEL METER KITS

BUILD A WORKING DPM IN 1/2 HOUR WITH THESE COMPLETE EVALUATION KITS

Test these new parts for yourself with Intersil's low cost prototyping kits, complete with A/D converter and LCD display (for the 7106) or LED display (for the 7107). Kits provide all materials, including PC board, for a functioning panel meter.

ICL7106EV (LCD) \$29.50 +\$4.43 TAX



Intersil 8 Digit — 10 MegaHertz Universal Counter Kit

- Kit Includes:
- ICM7226AIDC IC
 - 10 MHz Quartz Crystal
 - (8) 7 Segment 3" LED Displays
 - PC Board
 - Resistors
 - Capacitors
 - Diodes
 - Switches
 - IC Socket

Order Part Number ICM7226AEV \$77.22 + \$11.58 TAX



POLY PACK SPECIALS

- PP.1 100 Mixed Disc Ceramic capacitors **\$1.50**
- PP.2 100 Mixed Polyester capacitors Includes values .001uf up to 1uf **\$3.00**
- PP.3 50 Mixed Electrolytic capacitors. RB. and RT. from 1uf to 4700uf. **\$2.50**
- PP.4 25 Assorted Potentiometers Includes slide and rotary types. **\$2.50**
- PP.5 20 Assorted Switches Includes Toggle, Rocker and Slide types **\$2.00**

60C post and pack, per item
RUSH THESE!!



120mm (4 1/2") DIA. **COMPUTER COOLING FANS**

\$16.80 EX **\$19.32** INC. TAX



HITACHI V-152B



5mV/div—5V/div ±5%, DC — 15MHz, —3dB
1mV/div—1V/1V/div —6%, DC—5MHz Typ, —3dB (Using x5 amplifier)
24ns
More than 4div at 15MHz.

Direct 1M ohm, approx. 30pF
600Vp-p or 300V (DC+AC peak)
CH1, CH2, DUAL, ADD, DIFF
DC—500kHz, 5mV/div—5V/div.
Phase difference DC—10kHz 3"

AUTO, NORM, TV (+), TV (—)
TV sync-separator circuit
Over 1 div (V sync-signal)
Over 1 Vp-p (V sync-signal)

Frequency	Internal	External
20Hz—2MHz	0.5div	200mV
2—15MHz	1.5div	800mV

±
0.2us/div—0.2s/div ±5%, 19 calibrated steps
10 times (±%)
100ns/div
\$570 (Exempt) **\$634** (Inc. Tax)



Prices plus
15 percent sales tax.

TOP QUALITY LOW COST TRANSFORMERS

R-2150-2851,
Primary: 240V AC.
Secondary Voltage: 12.6 volts CT.
Secondary Current: 150mA.
Termination: Flying leads. **\$250**
10 up \$210

R-2155
Primary: 240V AC.
Tapped Secondary Voltages:
6.3, 7.5, 8.5, 9.5, 12.6, 15.
Secondary Current: 1 amp. **\$390**
10 up \$351

R-6672
Primary: 240V AC
Tapped Secondary Voltages:
15, 17.5, 20, 24, 27.5, 30.
Secondary Current: 1 amp.
Termination: Solder lugs. **\$619**
10 up \$4

\$2000 8" (200mm) wide range general purpose
Includes transformer, mounting holes for P.A. and
background use. Very smooth over-all response 45 Hz-12
KHz. Fitted to a 1.9 cubic ft vented enclosure they sound
unbelievable.
8 Ohm 8 Watt RMS 5.6 oz. magnet.
\$6.00 TRADE, \$6.95 Inc. tax.



**HEAVY BASE
SOLDERING
IRON STANDS**
INC. SPONGE
\$5.77 ea.

New! JIFFY BOXES

PCB's SNAP IN horizontally
Guides for larger boards
(Less 10% for 10)



UB1 \$1.69 + 25¢ tax
UB2 \$2.56 + 38¢ tax
UB3 \$1.35 + 21¢ tax
UB5 .81¢ + 8¢ tax



**HERE
IT IS!**



Top Projects Vol. 7

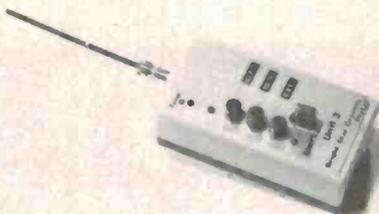
Over 20 of our top-popularity projects from recent years' ETIs plus several projects from a few years back that have enjoyed renewed interest. All assembled in one big volume — there's something to suit every electronics enthusiast's interest, from the ETI-250 Simple House Alarm to the ETI-1500 Discriminating Metal Detector, from the ETI-325 Auto-probe to the ETI-562 Geiger Counter, from the ETI-724 Micro-wave Oven Leak Detector to the ETI-565 Laser. TWENTY projects, in all — PLUS: 'An Introduction to Lasers', 'pH — the Acid Test' and 'Experimenting With Ultrasonics'. Top Projects Vol. 7 also contains a Shop-around guide on where to obtain pc boards, front panels, kits and components for the projects between its covers.

ON SALE NOW AT NEWSAGENTS AND SELECTED ELECTRONICS SUPPLIERS. Or you can obtain a copy direct from ETI for \$3.95 plus 65 cents post and handling. Send your cheque or money order to ETI Magazine, 15 Boundary St, Rushcutters Bay NSW 2011. Ask for: 'Top Projects Vol. 7.'

**35
years
young**

**and
still on
top**

**NEW
CRYSTAL MARKER
OSCILLATOR**



Marker frequency from 2MHz to 20MH

Manufacturers of

PIEZO ELECTRIC CRYSTALS
Contractors to Federal and State
Government Departments.

REPRESENTATIVES:

NSW: J. E. Waters,
11 Salisbury St, Botany. 2019.
Ph 666-8144.

SA: R.W. Electronics,
51 Wood Ave, Riddleyton. 5008.
Ph 46-4571.

QLD: Fred Hoe & Sons P/L,
246 Evans Rd, Salisbury North,
Brisbane. Ph 277-4311.

WA: Westest Electronics,
71 Jean St, Hamilton Hill. 6161.
(Mail only) Ph (09) 337-6393.

TAS: Dilmond Instruments,
PO Box 219, Bellerive. Hobart.
Ph 479-47-9077.

Send SAE for new catalogue or quote for
your requirements.

**Bright Star
Crystals** Pty. Ltd.

PO Box 42, Springvale.
Ph (03) 546-5076 Telex AA36004

**RADIO
DESPATCH
SERVICE**

869 George Street,
Sydney, NSW. 2000.
(Near Harris Street)
Phone 211-0816, 211-0191.

**AUGUST
SPECIALS**

- TV/FM Line Wall Tap-off
WT01 or WT02\$4.00 ea
- 8-Track Cartridge Head
Cleaner "M/Sound" 50¢ ea
- Top Cowl Car Aerial
CA-30 42" Ext.....\$4.00 ea
- 6 Voltage Plug Pack 300
MA Supply PS-499\$8.05 ea
- Speaker Transformer
E5K-15 Ferguson\$2.00 ea
- Finch Nite Light70¢ ea
- Transistors BC237 or
BC238 10 for 75¢
- Transformer: PL12/20VA/2,
12V/20W only.....\$4.50 ea
- Adcola RS-30 Soldering
Iron\$15.80
- PAR-38 100 watt E.S.
Floodlamp\$6.00 ea
- Kambrook KD30 Light
and Cord Reel Unit.....\$20.00 ea
- Texas Calculators** excl. ST incl. ST
- TI 59.....\$233.09 \$260.00
- TI 58c\$141.11 \$156.00
- PC100c Printer \$216.28 \$239.00
- TI 55.....\$54.27 \$60.00
- TI 30 Student Pack \$20.13 \$22.50
- TI 35 Student
Kit.....\$24.57 \$27.00
- TI 25.....\$21.70 \$23.95
- TI 1750\$16.72 \$18.50
- Paper PC100c.....\$12.50
- BP1A Battery Pack\$8.00
- BP6 Battery Pack\$5.90
- BP7 Battery Pack\$8.90
- 58C/59 Libraries... \$33.40 \$37.00

See us for all types of valves.

WE SPECIALISE IN

- PC Boards for ETI and EA projects.
- Scotchcal labels made under order for ETI and EA projects 1979 and onwards.

MAIL ORDER CUSTOMERS

- Packing.....\$1.00
- Minimum postage\$1.00
- Minimum interstate postage.....\$1.50

OPEN: Mon-Fri 8 am to 5.30 pm.
Thursday night late shopping until
8.30 pm. Saturday 8 am to
11.45 am.

Shoparound

THIS PAGE is to assist readers in the continual search for components, kits and printed circuit boards for ETI projects. If you are looking for a particular component or project — check with our advertisers if it is not mentioned here.

ETI-332 stethoscope

So far as components and component availability are concerned, this project is straightforward. The K&W C642 case is quite inexpensive and stocked by many retailers. We used collet knobs for the pot shafts and both C&K and Associated Controls distribute a range, which you'll also find widely stocked.

For the probes, crystal earpieces or mic inserts make excellent microphones. Crystal earpieces are convenient and cheap, and we attached a length of aluminium tube to the ear-plug part of a crystal earpiece for a probe. Again, crystal earpieces and mic inserts are widely stocked. The same goes for headphones. Only an inexpensive pair of 'phones need be bought.

ETI-1503 battery charger

The only 'stock' power transformer we could locate to suit this project was the Dick Smith model M-2000. This has a secondary rated to provide 18 V at 6 A load but can deliver well over twice that current for short periods, with some

drop in output voltage — but that has been taken into account in this design. The relay used was a DEC type MC2U with contacts rated at 10 A. This too is stocked by Dick Smith, catalogue No. S-7200. The Fujitsu type FRL264/D012/02CK is also suitable. This is distributed by IRH Components and available through a number of suppliers. It is the same relay we used in the ETI-567 core-balance relay back in the April issue.

The Arcol HS25 0R22 resistor (R1 in the circuit) we obtained from Everest Electronics, 61 Compass Drive, Seaford S.A. 5169. If you intend using the light globe substitute circuit you will need another Arcol resistor, an R047 HS25, obtainable from the same source.

For the meter, we used a TD-66 centre-zero type, 1 mA fsd. These are supplied by University Graham Instruments, who can supply suitable scales for this project as well.

The whole project was housed in a K&W case, type C1066. These are manufactured and distributed by Ballarat Electronic Supplies, 5 Ripon St, Ballarat Vic. 3350. (See June issue Shoparound, p.79). Many retailers are stocking cases from the K&W range and readers should experience little difficulty in obtaining a case.

ETI-607 sound effects

As Murphy's law would have it, the SN76488 IC which this series of projects

hinges upon provided some difficulties for us. However, we must acknowledge the efforts of staff at VSI Electronics and Texas Instruments Australia in arranging a source of supply so that the chips would be available when this issue went on sale. Thanks, chaps.

The SN76488 comes in two packages — the A package (standard size, 28 pins) and the NF package (small size, 28 pins). The pinout for each is the same but we had to design a pc board to suit each package without varying the location of the other components. Make sure you buy a pc board to suit the package of the device you purchase. The board should be marked 'A pack' or 'nf pack' accordingly.

VSI Electronics will be stocking the SN76488 but we understand many suppliers will be carrying kits, so contact your favourite/nearest kit supplier.

We also note that Tandy stores stock the A pack SN76488 in a bubble pack with data sheet, catalogue number 276-1766, for \$9.95.

Suitable speakers for these projects are a common item.

Specials

Every enthusiast loves a bargain! Jaycar in Sydney are making an extraordinary offer for the months of August and September. In constructing a project, you will always need resistors, usually ¼ W, 5% types. If you are buying \$15 worth of goods from them, then the resistors (¼ W, 5%) will be free, with a limit of 30 per order. That's roughly a 10% discount. It's available to all personal and mail order customers and, if popular (if? . . . Ed.), will become a permanent service, says proprietor Gary Johnston.

- Convert your oscilloscope to digital storage
- Make a hard copy of a transient waveform
- Transfer the waveform to computer in digital form

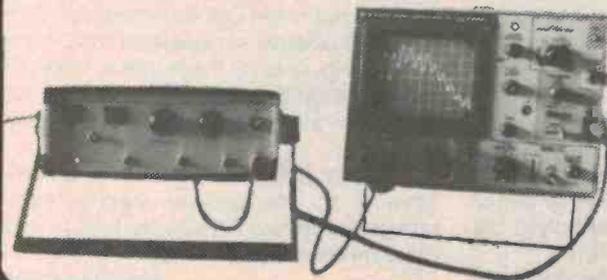
\$485

EPIC WAVESAVER

APPLIED MEASUREMENT
AUSTRALIA PTY. LTD.

47A KARNAK RD., ASHBURTON
(03) 25 8844

Perth: Cairns Instrument Service 325 3144
Adelaide: Ken Tuffee & Co. 258 4538



LETTERS

Dear Sir,

I note your "new direction" editorial — an excellent objective.

As a subscriber to this journal since its inception, and also to many other technical journals for many years, I wish to make some suggestions, hopefully helpful.

1. Indexing. There is a wealth of technical information in there but with over ten years filed on my shelves how do I refer back to it? I suggest:

(a) Page 3 index clearly set out like your new Quick Index but more complete so that one can more surely and quickly identify what the project or article is about.

(b) "Ideas for Experimenters" (valuable) should be listed in the index, ditto "Shoparound".

(c) An annual index in December issue is a must. This should be under sub-headings, and on a recognised position preferably the last pages.

(d) From time to time a comprehensive index going back over say five years should be published.

(e) I do not appreciate your messy index on pages 4 & 5.

(f) The "Kits for Projects" index is valuable and would be even better if after each was added the page number e.g. Electronic Mouse Trap (Aug 82 p.27).

As I subscribe to at least ten Australian and overseas electronic monthly magazines I can assure you that your magazine has a host of valuable articles, but is one of the poorest for referencing for the reasons I have indicated.

I would also be interested if you arranged to supply annual binders — they would have to be thicker than the usual because of your thicker magazines.

I trust my comments are of use, and hopefully achieve some action.

Bruce R. Mann
VK3BM
Swan Hill, Vic.

Many thanks for your recent letter concerning our new directions and your comments on indexing and referencing.

You will be pleased to note in our April issue a ten year project index. Also in the April issue, as we do each year now, you will find last year's index which includes a complete index of "Ideas for Experimenters". The December '74 issue contains indexes for Volumes 1, 2, 3 and 4 (1971 to 1974 inclusive), December '75

contains the Volume 5 index, January '77 the Vol. 6 index, April '79 Vol's. 7 and 8 indexes. The indexes appear in April now to give us time to compile and correct the previous year's index and collection of errata (e.g. errata for the November and December issues would appear in the following year's January to March issues and must be included in the index — hence the index does not appear in the December issue.).

Regarding our monthly indexes (or 'contents'), I am sorry you do not like our two page index on pages four and five. However, readers seem to be divided on this issue — as are staff, I might add. We are currently researching a different way to present the contents.

For space reasons we are no longer regularly publishing the "Kits for Projects" page. When we first published it many readers quite clearly found it valuable and used it but that seems to be no longer the case.

Whilst we have done a ten year project index, appearing in the April issue as I said before, we are looking at compiling a ten-year index of articles in other categories. As you would appreciate this is an enormous undertaking.

With regard to binders, these can be supplied at \$7.50 each and are advertised on our 'credits and services' page each month, generally located immediately before the Dregs page.

Many thanks for your comments and suggestions once again. We appreciate letters like yours.

Roger Harrison,
Editor.

Dear Sir,

I feel I must comment on the letter submitted by Mr. G. Tucker re Permostat in the ETI June '81 issue.

I am afraid I disagree with all that he says. I first saw an ad for Permostat in an English publication, Hi-Fi for Pleasure. I kept a sharp lookout and as soon as the first batch arrived in Australia I bought a kit.

Before this my antistatic defences were conducting felt mats plus a Decca carbon fibre earthed conductor on an arm which tracked the record. In spite of this the record gathered dust, and often the carbon fibres were loaded with it.

I admit my first few attempts with Permostat were a mixed blessing (my

fault). I put too much on and didn't buff dry enough. Result: record sticks in plastic cover and when viewed in the light shows a slight patina on the surface. Nevertheless results were outstanding.

I have a collection of over 500 records, about 250 classical and the rest very easy listening and jazz. Although not really expensive per record, it is expensive to Permostat them all when you have hundreds of records, so over the last 18 months or so I have nearly done all the classical. If I live long enough I'll do the lot.

The proper way to use the stuff is to spray the record very very lightly from at least one foot away. Then get the buffing pad into action very quickly, within seconds, buffing the whole side four or five times. Then you're in business.

I have dispensed with my Decca fibre brushes now because they don't pick up any dust as there is none on the records. The stylus doesn't have to be shampoo'd after each side and life is a whole lot easier.

In case you think I am a wide-eyed wonder, at age 73 I can recall the then manager of Kriesler Radio in about 1959 listening to one of the few stereo home-made outfits in Australia. Kriesler brought out their first stereogram three months later. My present set-up is nice, though only a quarter of the cost of Mr. Tucker's; but it's built to suit my tastes. Speakers I designed myself, Rega 3 turntable, Entre M/C cartridge, Lenlec head amp, Sony VFET 35 watt A class amp, Omnisonic 801 imager and full-range graphic equaliser to tune the speakers to the room.

Anyway, I consider the Permostat process one of the really great advances of the decade.

Ron Lockerbie
Merimbula NSW

Dear Sir,

Congratulations on your items on the Turin Shroud — they were the most comprehensive and interesting articles on the Shroud I have so far read, especially the one covering the scientific analysis of the Shroud.

As a Christian, my faith doesn't depend on the authenticity or otherwise of the Shroud, but one must admit that the sum total of evidence is consistent and fairly convincing, and yet incomplete; I refer to the mystifying lack of knowledge or evidence as to **how** the image was formed.

I am a science teacher, and look forward to the general science/electronics 'interface' articles as well as the electronics! Keep up the good work.

Malcolm Beck
Toowoomba Qld.

Dear Sir,

As a keen hobbyist I look forward each month to the next issue of the world's finest hobbyist electronics publication — ETI.

However, as I am a keen hobbyist I also read many other relevant periodicals, some from overseas.

Thanks to the very comprehensive nature of your project articles I have never experienced any difficulty in obtaining components or hardware for your projects, but this is not always the case with either my own special-application projects or in constructing from circuit diagrams originating overseas.

Sometimes, fortunately infrequently, I have a need for a component for which I can find no listing in any semiconductor equivalents reference book.

A case in point is that I am presently looking for a 1N2939 Tunnel Diode for an FM transmitter project. Not one supplier listed in the Brisbane phone book can find a reference to it. Further, with the exception of one or two suppliers, no-one contacted stocked tunnel diodes of any description.

My questions are:

1. What in your opinion is the best and most comprehensive semiconductor equivalents reference work on the market, for world-wide application and including semiconductors of all types (diodes, transistors, ICs, etc.)?
2. Who would be the top two or three major components stockists in Australia? That is, those who would be most likely to carry the widest range of semiconductors. I have had a long and happy relationship with the likes of Dick Smith Electronics and Tandy, but when getting into the out-of-the-ordinary one must start shopping around.
3. Any suggestions on a 1N2939 Tunnel Diode?

Bill Hely
Welipa Qld.

Thank you for your kind remarks about the magazine. I sympathise with your problems concerning uncommon components — tunnel diodes are just about the rarest devices around! Characteristics and circuits for the 1N2939 are listed in the 'G.E. Transistor Manual' published in 1964. However, regarding your first question, the most comprehensive book(s) we have come across listing semiconductor information is a series put out by a US company that specialises in this. The company is D.A.T.A. Inc., of San Diego, California. They are represented in Australia by J.H. Book Services of 75 Archer St, Chatswood NSW 2067, (02)419-7779. D.A.T.A. Inc. publish three groups of comprehensive data books: Discrete Device Services, Integrated Device Services and Special Applications Services. The books are actually

periodicals, published twice a year, being updated each time. In the Discrete Device Services, they have Transistors and Discontinued Transistors, Diodes and Discontinued Diodes. The 'Discontinued' books are put out annually. Specifically you would be interested in one of the books on diodes. The books are enormous and very comprehensive and the information is arranged in such a way that you can compare and contrast devices with similar characteristics by looking at one page. However, for the average hobbyist the books are expensive bought individually (around \$50), less so as a subscription but I feel many hobbyists would not be able to justify the expense. You could suggest to your local librarian though that the library take the subscription service.

Those stockists carrying a wide range of semiconductors available on a retail basis change seasonally. VSI's Silicon Valley stores stock a very comprehensive range. Individual retailers such as Ellistronics, Stewart Electronics, Rod Irving Electronics, All Electronic Components, Radio Parts, George Brown's, Radio Despatch Service, Jaycar, etc, each stock a comprehensive range — the range of one overlapping the other. As to who would be the top two or three, I wouldn't hazard a guess.

As for the 1N2939 tunnel diode, I suggest you abandon the FM transmitter project and take a look at the Radio Microphone project in the July issue of ETI's off-shoot, Hobby Electronics (Project HE 106)!

Roger Harrison
Editor, ETI.

Dear Sir,

The UHF to VHF TV converter in May's ETI is certainly a neat and timely design; however, there are a couple of points I would like to bring up.

Firstly, nowhere in the article does it mention that one of the main functions of the RF amplifier stage is to suppress local oscillator radiation. A user in a high signal strength area could well be tempted to omit the OM350 and just put a link between pins 1 and 5. In this case, local oscillator signal could well feed back up the antenna line and be transmitted.

The second point is in the 'How It Works' discussion. In column 2, second last paragraph, it reads: "Reception of a UHF station can also be obtained with this converter design by tuning the local oscillator above the channel frequency."

It is perhaps possible that reception might be obtained this way, but I expect the results would be terrible. The reason for this is twofold: TV in Australia uses a single sideband vestigial carrier system, and putting the local oscillator on the high side of a received signal **inverts** the

sidebands.

If a receiver and IF strip has been designed with these facts in mind, OK, but to completely fold back the sideband and thus to lose all the effects of the specialised IF alignment would, I think, be too much.

Also, why didn't you design this unit so it could power the masthead amp previously described?

Doug Richard
Leichhardt NSW

You are quite right about one of the functions of the RF stage of the ETI-735 UHF TV converter being to suppress local oscillator radiation and we regret not making mention of it. In addition, we didn't make it clear that the local oscillator should be set to either the high side of the signal or the low side of the signal, depending on the relationship between the front end local oscillator and the IF in your TV receiver. The majority of TV receivers available in Australia have a low side oscillator, we understand. Setting the oscillator for best reception will soon let you know the proper setting of the local oscillator trimmer in the converter.

The UHF masthead amp, ETI-729, in the April issue, was designed principally for those readers who had a TV receiver incorporating a UHF tuner, and the sensitivity of the ETI-735 UHF converter was set such that a masthead amp would not be necessary, except perhaps under extreme 'fringe' conditions. You could power the masthead amp from the UHF converter's power supply, however, with the addition of one component — an RF choke having a value anywhere between 500 nH and 10 uH. Connect it between the output pin of the regulator (IC2) and the antenna input socket. This will provide +12 V to the inner core of the coax, decoupled for RF, as required by the masthead amp.

Dear Mr. Harrison,

Thank you for the enlightening article on the Shroud of Turin. An example of responsible 'social science' at its best.

All too often the voices of religion and science ignore (or sometimes berate) each other, to the detriment of both.

It is difficult for many to reconcile science and religion without the media presenting extremes and displaying ignorant, simplistic conceptions in an 'I win, you lose' format, e.g. creationism/big bang evolution. So keep up the good work.

Intriguing thought — combine a good portrait artist with the talents of, say, a plastic surgeon to come up with a 'live' depiction of the face on the Shroud?

R. Stirling
Bardon Qld.

HUGE

SCOOP PURCHASE OF THE FEATURE PACKED YAESU FT207R VHF TRANSCEIVER



AUTOSCAN

Up or down scanning of full band, with 3-way setting — clear, busy or manual.

Specifications:

- 144-148MHz band coverage in 800 channels.
- High and low power (400mW-2.5W)
- .32uV sensitivity — 7.5kHz selectivity
- NiCad battery pack and charger included in price
- External antenna, ear, microphone socket.
- Compact size — 180 x 65 x 55mm
- Rubber Duck antenna included.

Normally ~~\$358~~

August only at **\$295**
Cat. D-2888 P&P \$5.50

DIGITAL DISPLAY

Large easy to read LED readout. Auto turn-off for power saving too!

19 key easy to use keypad. For frequency input, memory recall, scanning etc.

800 CHANNELS (4 memory channels)

Instant recall of your 4 favourite repeaters or simplex frequencies. (Easy to read program)

High power Mobile

That's The **FT7B** Simple to operate for mobile use!



Cat. D-2868 P&P \$5.50

This particular unit ideally suited for novice! All current HF bands available with continuous variable power output up to 50 watts. You have the option of AM, CW or SSB with a choice of VFO or crystal locked channel. Base or mobile — whatever you application, the FT7B will give excellent results! Call into one of our stores and see the specs. for yourself.

was \$599
\$549
save \$50!!

Add to hand held above for real mobile power. Also suitable for SSB, CW AM etc. Operates from 13.6V DC up to 15W input for maximum power. Includes 12dB receiver, pre-amp. with automatic transmit receive control. (above hand held may not drive to full power)

Linear amp

Cat. D-2547

\$235
P&P \$5.50



EXCLUSIVE: Receiver pre-amp built-in

DRIVE TO MAX LEGAL POWER All-Band linear amp



FL2100Z
Want REAL power the FL2100Z is rated at a whopping 1.2kW — so at our maximum legal power it's just coasting. Tubes last much longer — everything is way under ratings. Built-in SWR/Power meters, suitable for all HF bands.

was \$580!
\$559
Cat. D-2548 P&P \$5.50

REMEMBER: We will match or beat any advertised offer!

DICK SMITH Electronics

- AUBURN 648 0558
- BLAKEHURST 546 7744
- BROADWAY 211 3777
- BROOKVALE 93 0441
- CHULLORA 642 9822

- GORE HILL 439 5311
- PARRAMATTA 683 1133
- SYDNEY 290 3377
- NEWCASTLE 81 1896
- WOLLONGONG 28 3800

- CANBERRA 80 4944
- BURANDA 391 6233
- CHERMSIDE 59 6255
- ADELAIDE 212 1962
- MELBOURNE 67 9834

- RICHMOND 428 1614
- SPRINGVALE 547 0522
- PERTH 328 6944
- CANNINGTON 451 8666



MAIL ORDER CENTRE: P.O. Box 321 North Ryde, NSW, 2113. Ph. (02) 888 3200



SX-200 scanner a winner!

The J.I.L. SX-200 programmable VHF/UHF scanning receiver, which was reviewed in this column in June '80, has reached a sale of 750 units since its release.

Unit 750 was purchased by Peter Walsh, a blind amateur who lives in Glenroy, Victoria. Peter is an avid listener on the HF bands and plans to extend his listening into the VHF/UHF spectrum with his acquisition of the SX-200 receiver.

The popularity of the SX-200 has been attributed to its unique design features and good performance, according to the importer/distributor, G.F.S. Electronic Imports.

Covering a frequency range of 26 to 88, 108 to 180 and 380 to 514 MHz, it uses a keyboard entry programming technique providing a selection of over 33 000 channels available to the user. Up to 16 fre-

quencies may be placed in a non-volatile memory. Scanning can be carried out over a specific frequency range by programming upper and lower frequency limits.

Unique squelch circuitry is employed, having three modes, allowing the receiver to (a) stop scanning with open audio on carrier only, (b) to stop on carrier with closed audio until modulation is applied to the carrier, or (c) not stop at all until carrier and modulation are detected.

A front panel-mounted fine-tuning control ensures that all Australian-allocated two-way radio frequencies are covered. AM or FM reception is possible on all bands. Direct operation from 240 Vac or 12 Vdc is provided for.

We at ETI had the opportunity to review the latest model of the SX-200, which J.I.L. have improved since the receiver was first released, apparently. We found the unit to be remarkably sensitive — exceeding its specifications by quite a margin — and the front panel is not only highly functional but a delight to use. The three-mode squelch circuitry is very handy, particularly in mode (c). The three slider controls



all perform smoothly and we noted the squelch control seemed smoother than on the last unit we used.

Reception using the whip supplied, which screws into a socket at the top rear of the cabinet, is remarkably good. On an external groundplane it pulls in a host of signals! A discone antenna would

undoubtedly produce outstanding results. Overall, a fine piece of equipment and good value for money.

The SX-200 sells for \$499 including sales tax. For more information contact the Australian distributors, G.E.S. Electronic Imports, 15 McKeon Road, Mitcham Vic. 3132. (03)873-3939.



Money back if not satisfied ...

Telex Communications Inc. have made unprecedented claims for their Hy-Gain two-metre V-2 antenna — and backed them up with a guarantee to refund money if the purchaser is not satisfied!

Their claim is that the new two-metre extended double zepp vertical antenna will "equal or surpass the electrical performance of any competitive two-stacked 3/8-wave antenna, regardless of gain claims".

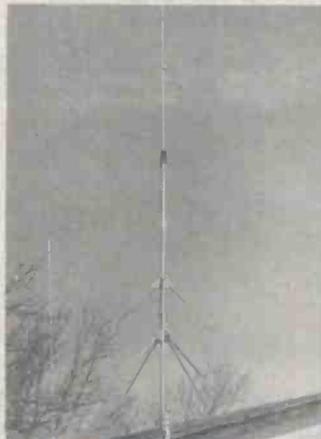
The decoupling system of the antenna allows no RF on the coax feedline, and the V-2 is said to be easy to assemble and mountable on any mast up to 50.8 mm (2") in diameter.

Two sets of 1/4-wave radials and a centred feedpoint produce a radiation pattern that is very close to the horizon with a minimum of power loss into the sky.

The V-2 is designed to operate from 138 MHz to 174 MHz, and obtains a VSWR of less than 1.5:1 at resonance, having a 2:1 VSWR bandwidth of at least 7 MHz. The antenna's isolation from the supporting mast is 20 dB

minimum.

For further details contact Audio Telex Communications, 1 Little St, Parramatta NSW 2150. (02)633-4344.



High-powered British CB

The British Government has allocated 40 channels and a transmitter power output of 4 W to CB radio, which will become legal in the UK later this year. (See ETI, April 1981.)

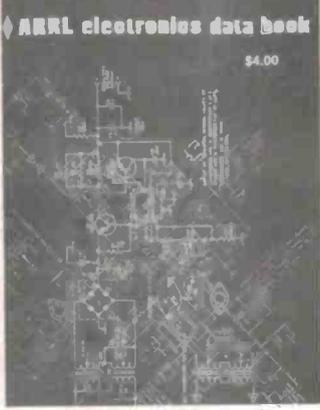
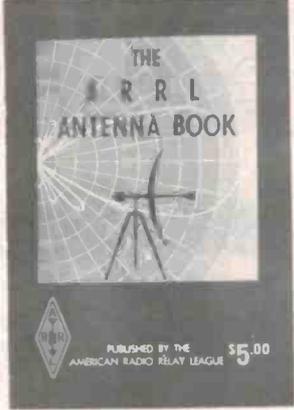
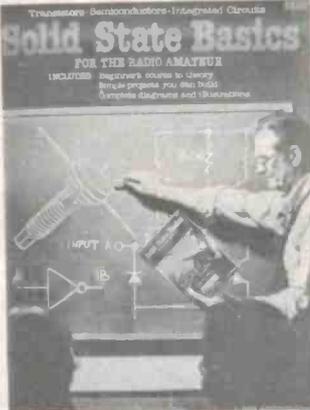
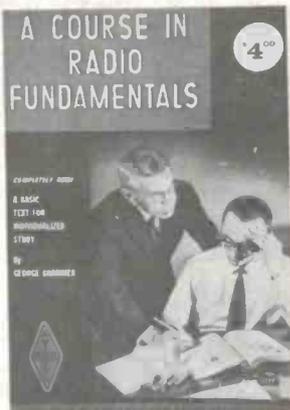
This is both more channels and a higher transmitter power than recommended by the European Conference of Postal and Telecommunications Administration (CEPT), but the British Home Office has rejected the idea that those recommendations have in fact produced a European standard. The Home Office also feels that any attempt to restrict British CB users to the recommended 22 channels and 0.5 W transmitter power would fail to produce a convincing alternative to the present illegal AM equipment that is creating so much interference.

Britain, like France, Germany and Holland will permit only FM; the present high-powered American AM equipment will remain illegal.

Because of the high transmitter power, however, the new equipment will not be readily transferrable to other European countries; this is common with all European-manufactured CB equipment, and British CBers have indicated a preference for losing this facility rather than the higher power.

Should there be any general European move towards standardisation of CB frequencies, power rates, etc, Britain would be very keen to play an active part, but until this should happen the Home Office has selected a sub-band that should cause "a minimum of inconvenience to other users of radio in the UK"

Brian Dance



ARRL PUBLICATIONS — DIRECT FROM ETI

Now you can order a selection of popular and useful publications put out by The American Radio Relay League, direct from ETI by mail order.

A COURSE IN RADIO FUNDAMENTALS

Written by the world-renowned author, George Grammer, this book is recommended reading for anyone studying for their amateur licence, be it Novice, Limited or Full. In fact, it's a very good reference text for any enthusiastic hobbyist. The book contains 26 chapters, covering a considerable amount of basic theory from electric and magnetic fields to ac and dc circuits, resistance, reactance, transformers, RF circuits, filters, etc, to vacuum tubes and transistors, amplification, feedback and amplifier circuits. A chapter on practical experiments is included and each chapter has associated problems to work out (answers given).

180 pages **\$7.00**

SOLID STATE BASICS

An essential book for everyone who wants to understand solid state circuits and how to design them. This book takes you from simple solid state theory to transistor circuit design. Then follows an introduction to linear and digital ICs and how to work with them. It's crammed with practical circuits designed using the techniques discussed.

160 pages **\$6.75**

ARRL ANTENNA ANTHOLOGY

This book is a compilation of the best of recent HF antenna articles and theory presentations published in QST magazine. Its five chapters cover Vertical Antennas, Yagi Antennas, Quad Antennas, Miscellaneous Antenna Types and Antenna Theory and Test Methods. Construction of more than 30 antennas is described along with a range of matching networks and systems.

152 pages **\$7.00**

ARRL ANTENNA BOOK

A basic reference text that should be in every enthusiast's and amateur's library. In 18 chapters, this book covers such topics as Wave Propagation, Transmission Lines, Long-Wire Antennas, Multiband Antennas, VHF/UHF Antennas, Rotatable Antennas, Specialised Antennas and Antenna Measurements. It is a comprehensive text chock-full of tables, charts and construction information.

336 pages **\$8.75**

ARRL ELECTRONICS DATA BOOK

A must for every electronics enthusiast's or radio amateur's bookshelf. Its 10 chapters cover Math Aids and Tables, Time and Frequency, RF Circuit Data, LCR Networks, Transformers, Filter Design, Antennas and Feed Systems, Catalogue of Solid State Circuits, Constructions and Testing Data, Data Potpourri. How could you do without it?

128 pages **\$6.75**

BASIC BOOK OF HAM RADIO

A basic guide of what the hobby's all about. Though written for the American scene, the theme is universal. Ten chapters tell it all, from what hams do to a guide to the equipment, how to get on the air to how to speak the jargon.

128 pages **\$7.75**

ARRL WORLD MAP

This is a modified equidistant azimuthal projection map showing all areas of the world with political boundaries, call areas, IARU continental subdivisions, ITU regional boundaries, world time zones and cities. A valuable addition to any shack.

1020 x 780 mm **\$6.75**

Please send me (tick as applicable):

A Course in Radio Fundamentals

Solid State Basics

ARRL Antenna Anthology

ARRL Antenna Book

ARRL Electronics Data Book

Basic Book of Ham Radio

ARRL World Map

I enclose \$ plus 90¢ per book postage and packing (Australia only).

TOTAL \$

NAME

ADDRESS

.....

..... Postcode

Signature

Please allow up to four weeks for delivery.

Send coupon to: ETI Book Sales, 15 Boundary St, Rushcutters Bay NSW 2011.

UPDATED
VERSION

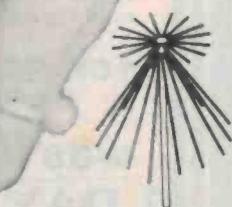
NEW J.I.L. SX-200



NOW MONITOR AIRCRAFT, POLICE,
AMBULANCE, 10, 6, 2 & 0.7m AMATEUR BANDS.
HF & UHF CB, PLUS HUNDREDS MORE.
INCLUDING SERVICES IN THE
AUSTRALIAN LOW BAND

FEATURING:

- Airband
- Australian low-band



Ask about our
range of BASE
ANTENNAS.



J.I.L.

PROGRAMMABLE SCANNER DOES IT ALL. 26 - 180MHz, 380 - 514MHz.

SPECIFICATIONS

- **Type:** FM & AM
- **Frequency Range:** a) 26-57.995 MHz Space...5 kHz
b) 58-88 MHz Space...12.5 kHz
c) 108-180 MHz Space...5 kHz
d) 380-514 MHz Space...12.5 kHz
- **Sensitivity:** FM.. a) 26-180 MHz 0.4uV S/N 12 dB
b) 380-514 MHz 1.0uV S/N 12 dB
AM.. a) 26-180 MHz 1.0uV S/N 12 dB
b) 380-514 MHz 2.0uV S/N 12 dB
- **Selectivity:** FM.....More than 60 dB at -25 kHz
AM.....More than 60 dB at -10 kHz
- **Dimensions:** 210 (W) x 75 (H) x 235 (D) mm
8-1/4 (W) x 3-1/4 (H) x 9-1/8 (D) in.
- **Weight:** 2.8 Kgs.
- **Clock Error:** Within 10 sec./month
- **Memory Channel:** 16 Channels
- **Scan Rate:** Fast8 Channels/sec.
Slow4 Channels/sec.
- **Seek Rate:** Fast10 Channels/sec.
Slow5 Channels/sec.
- **Scan Delay Time:** 0 or 4 sec.
- **Audio Output:** 2 Watts
- **Ant Impedance:** 50-75 ohms
Whip or External Antenna with
LO/DX Control (20 dB ATT.)
- **Freq. Stability:** 26-180 MHz ... Within 300 Hz
380-514 MHz ... Within 1 KHz

The new SX-200 represents the latest STATE-OF-THE-ART technology in the development of Scanning Monitor Receivers. It has many features that previous have not been available on receivers of its type.

For example the tremendous frequency coverage, which encompasses all of the following bands:— HF & UHF CB, 27 & 155MHz MARINE, Australian LOW BAND, AIRCRAFT band, VHF SATELLITE band, 10Mx, 6Mx, 2Mx and 70CMx AMATEUR, VHF HIGH BAND and UHF TWO-WAY band. Other features include Automatic detection of AM or FM on all bands, Squelch Circuitry that can be used to LOCK OUT carrier only and spurious signals, Fine Tuning control for off channel stations, 240 VAC plus 12VDC operation, Squelch Operated Output that may be used to trigger a tape recorder or channel occupancy counter and accurate Quartz Clock.

Now cover the VLF BANDS with your SX-200.

5 KHz to 1500 KHz

With the addition of a DATONG VLF CONVERTER

- Excellent sensitivity
- Connects simply in series with antenna lead of SX-200

PRICE \$99 plus \$4 Post



\$499
+ \$8 P&P

TRADE ENQUIRIES
WELCOME

AUTHORISED DISTRIBUTORS:
W.A.: Letco Trading Co. (09) 387 4966
N.S.W.: Emtronics (02) 211 0531
Plus many other regional outlets.
CONTACT GFS FOR YOUR NEAREST STOCKIST.

Australian Agent:

G.F.S. Electronic Imports, 15 McKeon Road, Mitcham, Vic. 3132 (03) 873 3939

PRICE SLASHED!

on the brilliant
SYSTEM 80
PERSONAL COMPUTER

Our huge bulk buying power has slashed the price of Australia's fastest selling home computer: the superb System 80.

Complete with in-built cassette deck (and provision for a second) plus internal VHF modulator (you can use the System 80 with any TV set!), this low, low price now includes the full 16K of memory which was optional!

Join the 6000 happy owners of Dick Smith System 80 computers: enter the exciting world of computers in your own home!

16K RAM & LEVEL 2 BASIC - ALL FOR

was ~~\$750~~ now

\$695

Cat. X-4005



DIRECT PRICES COMPUTER

NEW LOWER PRICE

on **SYSTEM 80 BUSINESS SYSTEM**

Cat. X-4100

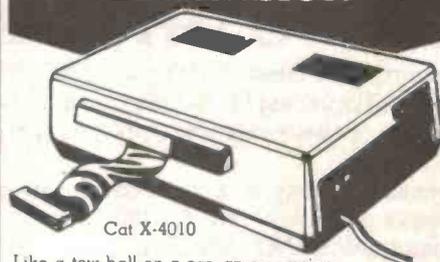
And we've slashed the price of our Business System 80 too: a massive 33% off! It's the ideal computer for all small businesses - and we have specially written programs suiting Australian conditions.

Ask for a free brochure. **now was ~~\$1495~~ \$995**

7 DAY MONEY BACK GUARANTEE!

Try our exclusive offer: buy a system 80 from any of our stores and examine it, play with it, use it in your own home for seven days. If you're not completely happy, return it to the point of purchase, in original condition and packing and with all original documentation, and we'll give you your money back! What could be fairer than that?

UNLEASH THE FULL POTENTIAL OF YOUR COMPUTER WITH S-100 EXPANSION



Cat X-4010

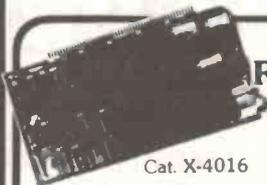
Like a tow-ball on a car, an expansion unit allows your computer its full potential. All sorts of peripherals can be added: and because it's the S-100 bus system, you're not tied to any one supplier for your add-ons. Your System 80 can be expanded to a full 48K memory with this unit and the RAM card below.

Why limit your computing power: add the S-100 expansion unit and the computing world is yours!

Look at what 'BYTE' magazine thinks of the S-100.

Those who wish to have a machine capable of getting the maximum benefit of microprocessors, must go the S-100 route.

October 1979



Cat. X-4016

S-100 RAM CARD

\$199

Made to the S-100 standard, specifically intended for the above Expansion Unit. This RAM card is suitable for other computers using the S-100 system. Supplied with 16K dynamic RAM fitted, with sockets provided for an extra 16K.

LOOK AT THIS INCREDIBLY PRICED PRINTER!

Amazing value! You've seen the price of all the other printers - now look at this one. Unique single hammer system gives unbelievable print quality; takes up to 204mm paper. Ideal for business or hobby computing.

\$495

Cat. X-3252



RIBBONS
Replacement ribbons to suit this printer.

\$695

Cat. X-3253

FAN-FORM PAPER

2000 sheets, continuous fan-form paper. 204mm wide with sprocket holes.

\$2750

Cat. X-3254

SYSTEM 80, TRS-80, SORCERER & OTHER COMPUTER OWNERS -

TWICE THE STORAGE OF A TANDY DRIVE...



& it costs less!

TANDY TOTAL PRICE: \$1378

DICK'S TOTAL PRICE: \$649

The Tandy disk drive with 35 tracks gives 87.5K of storage and costs \$699. If you want approx. the same storage as the Dick Smith Micropolis™, you will need to spend \$1378. The Dick Smith Micropolis™ has 77 tracks with 2.5K per track giving a total of 192.5K of storage on one disk drive!

THAT'S TWICE THE STORAGE CAPACITY FOR A LOWER PRICE!

Dick Smith MICROPOLIS™ Disk Drive

\$649

Cat. X-3208

VERIFIED C10 CASSETTES

New from Microsette, a trusted name in data cassettes. Fully verified C10 data cassettes. At this price, why risk dropouts, using an unknown brand!

\$195



Cat. X-3502

DAISY WHEEL PRINTER LESS THAN \$2000!



Cat. X-3265

\$1995

The quality of the Dick Smith Daisy Wheel printer shows in its ultra sharp, clean copy - so important for those special applications such as word processing. This printer accepts standard or continuous stationery up to 400mm wide. A large range of fonts is available, making it versatile as well as being a high speed printer. Centronics-type parallel interface, suitable for most available microcomputers.

IMPORT ON HARDWARE

DISK PRICES TUMBLE!

133mm (5¼in) minifloppy diskettes. Superb quality.



\$4.95 each

Hard Sector (Cat. X-3505) Soft Sector (Cat. X-3510)

LOOK AT DICK'S PRICE FOR A GREEN PHOSPHOR MONITOR!

Cat. X-1198

\$199



For the professional user — or even the hobbyist who uses his System for long periods, a Green Screen Monitor is a must. Superb definition, with ultra-sharp print that can be looked at for hours longer with less fatigue.

NOW WITH IN BUILT AMPLIFIER FOR PROGRAMS WITH SOUND EFFECTS.



Cat. X-3648

\$725

GIVE YOUR SYSTEM 80 A VOICE!

The 'Sound Off' package provides all you need to enter the exciting world of computer sound effects and music synthesis. Includes a cassette with sound effects demo program (for great sound effects!) plus a program to let you add sound effects to your existing programs. Complete with detailed instruction manual. Requires a 16K machine.

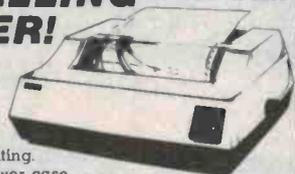
TREMENDOUS VALUE MAKES THIS OUR

TOP SELLING PRINTER!

Cat. X-3255

The Itoh 8300P offers so many advantages over its competitors.

High speed, bi-directional printing. Full upper and lower case character set. Accepts standard fan-form paper, from 115 to 240mm.



\$895

DISK LIBRARY \$5.95

This disk library holds and protects up to 10 diskettes, in their jackets in an upright position for easy use. Can be closed for storage. A cheap investment!

Cat. X-3515



RUN A PRINTER WITHOUT AN EXPANSION UNIT

IT'S POSSIBLE WITH THIS PARALLEL PRINTER!

The low-cost way to obtain a Centronics-type printer port from your system 80 computer without need for an S-100 Expansion Unit.

\$49.50

Cat. X-4013

DISK DRIVE HEAD CLEANING KIT

For longest life and absolute reliability, your disk drive should be cleaned at least once per week. This 'Scotch' brand kit has everything you need: cleaning solution, two cleaning disks and full instructions.

Cat. X-3516

\$34.95

LATEST & GREATEST SOFTWARE

LEARN TO TYPE WITH TYPING TUTOR



An interactive program that teaches you to touch type. Claimed to teach typing skills faster than other methods; widely acclaimed by business colleges. Requires 16K memory.

Cat. X-3682

\$19.95

COMPUTERISE YOUR TAX RETURN for only \$29.95 AUSTAX '81 Cat. X-3762

YES! You can now use your personal computer to accurately complete your personal income tax return! Working step by step, nothing is overlooked. Calculations are done automatically, adjustments can be made at any time during the program. Both Form 'A' and Form 'S' are available on disk. As far as we know, the ONLY program of this type written for a personal computer!

3D TIC-TAC-TOE

The familiar "naughts and crosses" game, expanded and made more challenging. Four grids, one behind the other. It's you versus the computer! Cassette, needs 16K.

Cat. X-3671

SUPER MAZE

The maze game to end all maze games! Generates mazes up to 100 x 100 elements. It could take you hours to find your way out! Cassette, needs 16K.

Cat. X-3672

NOW! PRO QUALITY WORD PROCESSING FOR SYSTEM 80!

WORP-9

The WORP-9 provides a host of features including unlimited text insertion, ability to print mailing labels and merge name and address file with a standard form letter. Complete with easy-to-read User Manual. Requires 32K and at least one disk drive.

Cat. X-3761

Large and ever expanding range of games, business and educational programs

NEW! DOUBLE DENSITY DISK ADAPTER FOR SYSTEM 80 AND TRS-80 MODEL I COMPUTERS

\$225

Cat. X-3540

Owners of the System 80 and TRS-80 (Mod. 1) computers can now virtually double the storage capacity of their floppy disks, thanks to this new low cost adapter. Called the 'Doubler', the adapter unit allows existing single density disk systems to read, write and format using double density recording (modified FM).

With conventional 35-track drives, double density recording gives a formatted capacity of 175K bytes, compared with the 87.5K available with single density recording. Similarly with 40-track drives the capacity rises from 100K bytes to 200K. If 77-track drives are used, the capacity rises to an incredible 385K bytes.

One of the big advantages of the Doubler is that it retains the system's ability to operate in single density mode. This means that full compatibility is maintained with a user's existing software and data on single density disks. Recording mode is software selectable, giving great flexibility.

YOUR COMPUTER CAN SPEAK TO OVERSEAS DATA BANKS

This Australian designed and made Modem features:

Answer/Originate switching making it suitable for communicating with both data base services and other computers.

Standard RS-232C interface - suits all normal data terminals and computers like System 80, Sorcerer, TRS-80, etc.

Powered from either 9V DC plug pack or terminal/computer.

Meets CCITT spec. V24, conforms to Australian Telecom Standard. Fully approved.

(Note: handset not supplied with Modem.)



Cat. X-3270

\$399

DICK SMITH Electronics



NSW AUBURN 145 Parramatta Rd 648 0558
BLAKEHURST 613 Princes Hwy 546 7744
BROADWAY 818 George St 211 3777
BROOKVALE 531 Pittwater Rd 93 0441
CHULLORA 147 Hume Hwy 642 9822
GORE HILL 162 Pacific Hwy 439 5311
NORTH RYDE 396 Lane Cove Rd 888 3200
PARRAMATTA 30 Grose St 683 1133
SYDNEY 125 York St 290 3377
TIGHE HILL 173 Maitland Rd 61 1896
WOLLONGONG 263 Keira St 28 3800

ACT Fyshwick 96 Gladstone St 80 4944
QLD BURANDA 166 Logan Rd 391 6233
CHERMSIDE 842 Gympie Rd 59 6255
SA ADELAIDE 60 Wright St 212 1962
VIC MELBOURNE 399 Lonsdale St 67 9834
RICHMOND 656 Bridge Rd 428 1614
SPRINGVALE Dandenong & S'vale Rds 547 0522
WA CANNINGTON Wharf St & Albany Hwy 451 8666
PERTH 414 William St 328 6944
Mail Order Centre: PO Box 321, North Ryde 2113.
Phone: (02) 888 3200

GRAFIX PLUS!



Standard features include:—

- Dot addressable GRAPHICS
- Full Communications Control including DEC Protocol
- 100% Duty Cycle
- National Service Support
- 3 inbuilt interfaces and 1.75-15.5 inch Form width
- New Low noise operation
- Attractive OEM/Dealer Pricing
- Multiple pitches and complete forms control. 132 to 220 columns



MADE BY
ANADEX INC.
USA



SOLD BY
BELL & HOWELL AUSTRALIA PTY. LTD.
and selected Dealers Australia/S.E. Asia

HIGH RESOLUTION PRINTERS

COMPUTING TODAY

Direct Instruction microcomputing

To date the main teaching method using microcomputers in schools has been Computer Aided/Assisted Instruction (CAI). The more recent Direct Instruction Technology offers a number of enhancements to learning microcomputing and places strong emphasis on student participation and comprehension.

CAI is a concept of teaching by machine that was introduced by B.F. Skinner at Harvard University in the USA during the late 1950s. CAI is based on the premise that the computer presents material, the student learns it, the computer tests, and students respond. There is very little emphasis placed on the student's ability to understand the mechanisms of the computer, development of individual students' programming skills or extension of students' logic.

Direct Instruction methodology ensures that all students understand the logical processes, or steps, according to individual student levels, and that students are able to master the various components essential in microcomputing. Direct Instruction is a much more interactive teaching methodology than CAI. A number of academics support the theory that microcomputing is only within the reach of the top 10% of students; CAI programs enforce this theory. Direct Instruction methodology, on the other hand, integrates teachers, students and the microcomputer to place meaningful microcomputing within the reach of all students.

Direct Instruction

Direct Instruction microcomputing comes out of Direct Instruction, a new methodology of effective teaching programs that, supported where necessary by behavioural management, literally and most effectively teach every child. Direct Instruction programs are incredibly flexible; the most 'retarded' to the most 'gifted' of children can be extended by them.

Programs teach the essential or required skills across a range of over thirty programs including reading, spelling, maths, languages, creative writing, cursive writing, microcomputing, etc.

Direct Instruction recognises individual differences by ensuring that the child is taught at an appropriate level in each of his skill areas, and that different motivational strategies are used when necessary. The instructional strategies, where reasoning replaces rote learning, ensure that a small amount of learning is specifically made to generate disproportionately large areas of self-generated learning.

Over the past decade classroom research has looked at 'good' teachers and 'good' students to try and tease out contributing factors. International and Australian work in schools has elicited about ten factors that are known to contribute to effective teaching and effective learning. These factors are:

- an emphasis on mastery learning
- ensuring that students are heavily engaged in academic content areas
- use of structured teaching procedures
- a focus on teacher-centred classrooms
- directly teaching children in small or large groups
- using the demonstration-practice-feedback teaching procedures
- an emphasis on high achievement and scholastic excellence
- establishing success patterns in learning where errors are minimal
- an emphasis on teaching the general case or rule — i.e. identifying the minimum set of 'building blocks' which can be used to help

students perform the maximum number of tasks.

Independent educational researchers, drawing together the pattern of classroom evidence incorporating these factors, termed the most effective teaching model produced 'Direct Instruction'.

Direct Instruction microcomputing is based on the notion that all learners can perform and achieve to high competency levels, provided they are taught effectively. Whether or not the learners do achieve depends on our instructional strategies and how well we are trained in Direct Instruction microcomputing.

A workshop on Direct Instruction microcomputing will be held at Macquarie University on September 10 and 11 this year. The workshop

has been designed to encourage 'hands on' experience in the use of microcomputers for parents, teachers and beginners. Instructors have been specially selected from universities, schools and the computer industry. Practical workshops will be conducted on both days.

Computer Reference Guide at Chatswood (publishers of the Australian Microcomputer Handbook) will publish papers from the workshop; these papers will be produced in book form and will provide an invaluable reference for all parents, teachers and students.

Additional information about the workshop and publication can be obtained from Mrs. Joan Booth, Secretary, AADI Teacher Training Institute, 20 Ronald Avenue, Ryde NSW 2112. (02) 38-3424.

New Commodore VIC from Edible Electronics

Edible Electronics have released more details on the new Commodore computer due for release around September this year.

Called the VIC, which stands for Video Interface Computer, it is designed to plug into any standard colour television and will probably sell for under \$500.

The unit has a full-size keyboard with four user-definable keys which perform eight functions. The display is 22 characters wide by 23 lines, utilising 64 ASCII characters and full PET graphics.

The VIC produces eight background colours, sixteen foreground colours and eight character colours.

It has four 'voice' sounds including a sound effects generator. The VIC comes standard with PET BASIC and 5K of RAM, which can be upgraded to 32K.

The VIC is designed to take advantage of a wide range of accessories to be available later, including a single disk drive, printer, joysticks, paddles, lightpens, high resolution graphics, etc.

For further details contact Joel Gotlib at Edible Electronics, 50 Park Street, Abbotsford, Melbourne, Vic. (03) 41-5708.

RIT ROD IRVING ELECTRONICS

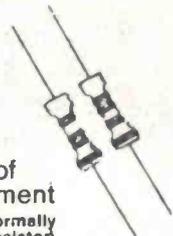
425 High St, Northcote. Vic.

Phone (03) 489-8131. Telex 38897

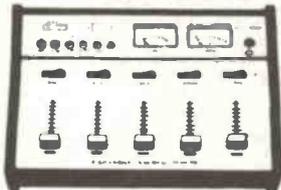
COMPONENT SPECIALS

	1-9	10+
2708	\$6.50	\$5.90
2716	\$7.90	\$6.90
4116	\$2.90	\$2.30
2732	\$17.90	\$16.90
2114	\$2.75	\$2.40
2114 LP3	\$2.80	\$2.50
Z80 P10	\$5.90	\$5.25

FREE!!
250 pack of resistors on purchase of over \$10 on presentation of this advertisement
Save \$10 (Normally 4¢ per resistor)



AUDIO MIXERS



- 2 Hi-Low microphone inputs
- 2 Magnetic/Ceramic phono inputs
- Also tape and tuner inputs
- 2 VU meters
- Stereo or mono
- Independent CUE on each chan
- Compact size. 26 x 20 x 6.5cm
- 9V battery operation, ext. DC input socket

\$89

PRO Model



- Facilities for 4 stereo program input and 2 mic. inputs
- Built-in low noise preamplifier for magnetic phonos and low or high impedance microphones
- Professional stereo slide controls
- Headphone circuits to monitor each input and output
- Talk switch to attenuate music volume 14db so mic's can be used without readjusting music levels
- 5 channel stereo graphic equalizer section using separate slider controls
- Meters monitor the output of left and right channels independently

\$169



"Selectalott"

With this great little kit you don't have to bother about thinking up numbers anymore. It features 40 LEDs and tells you what numbers to choose. Great for picking a winner.



\$22.50

CYLON VOICE

Are you sick and tired of that boring voice? Build this delightful little kit and impress your friends with the Cylon Voice.

\$18.50

'LE GONG' door bell kit

Are you sick of ding-dongs? You don't have to spend a fortune to hear a pleasant sounding doorbell. This great little kit does the job simply and cheaply. (pushbutton not included)

\$15.00

REGULATORS

	1-9	10+
7805	90c	80c
7812	90c	80c
7815	90c	80c
7818	90c	80c
7824	\$1.00	90c
7905	\$1.20	\$1.10
7912	\$1.20	\$1.10
7915	\$1.20	\$1.10
7924	\$1.20	\$1.10

2851 240V/12.6C.T. 150MA \$2.50
2155 240V/16.3-15V 1A multitap \$3.85

S.E.C. APPROVED AS WELL

DON'T TAKE ANY RISKS!

NOW

ANOTHER

K.O.! 2156

only **\$6.25**

2 AMP VERSION OF THE 2155

INCREDIBLE

6672

TRANSFORMER

240V/15-30V
1A multitap
HURRY!!!

\$4.90

REED SWITCH AND COIL **30¢**
NOW THRASHED TO RIBBONS **60¢**

RACK MOUNTING BOX



from **\$35**

Beautiful fashionable sturdy durable matt black finish

1-4 \$39.95

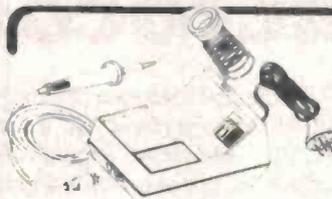
5 up \$35.00

Standard 19" (48.3cm) stacking

RELAY

- 8-12 V DC operation
- 225 Ohm coil resistance
- Silver change over (S.P.D.T.) contacts handle up to massive 2 amps at 24 V DC or 100 V AC
- Mounts directly on to PCB
- Ideal for many applications

SAVE 1's **\$1.50** 10's **\$1.20** 25 up **\$1.00**



WELLER SOLDERING STATION

A transformer powered soldering station, complete with a low voltage, temperature controlled soldering pencil. The Special Weller features a 'closed loop' which controls maximum tip temperature, thereby protecting temperature sensitive components while the grounded tip protects voltage and current sensitive components. Features: • quick connect/disconnect plug for the soldering iron • extra large wiping sponge • tip tray to store extra tips • 2m flexible 3-wire power cord.

ONLY \$56.90

LCD PANEL METER KIT



This economical evaluation kit features on-board clock and reference, accuracy guaranteed to ± 1 count over entire ± 2000 counts, single reference voltage for ratio metric operation plus many more important features. Kit includes PC Board & hardware, A/D converter, LCD display, resistors, capacitors, wiring diagram, application notes and data sheet (power supply not included).

\$34.50

ROD'S REAL VALUE SPECIALS



TRIO CRO'S NOW IN STOCK

(write for full product range and price list)

130 mm DUAL-TRACE
15 MHz, TRIGGERED SWEEP
OSCILLOSCOPE

TRIO \$555
plus tax

* Simplified circuitry improved performance and dependability have been successfully realised with the use of IC's throughout.

* A vertical amplifier provides as wide a bandwidth as DC to 15 MHz, as high a sensitivity as 10 mV/div, and a low input capacitance.

* A sweep rate extends from 0.5 sec/div to 0.5 sec div in 19 ranges. Further, TV vertical and horizontal syncs are available for measuring video signals, and with its X5 magnified sweep, its range of application is extremely wide.

* Very easy X Y operation of high input sensitivity for Lissajous measurements

* Dimensions 260(W) X 190(H) X 385(D) mm. Weight 8.4kg.

QUALITY SPEAKERS ETI-4001 4-WAY

150W kits; Pair \$529
Cabinets \$190



bankcard
welcome here

Bankcard Mail Orders Welcome

Please debit my Bankcard

Bankcard No

Expiry Date

Name

Signature

ETI3/81

TO ORDER: Heavy items sent Comet Freight on.Mall Order phone 481-1436. Wholesale Customers phone: RITRONICS WHOLESALE 489-7099 or 489-1923. Mall Orders to P.O. 235 Northcote 3070. Minimum mall order \$2. Add extra for heavy items and registration, certified mail. Prices, spec. subject to change without notice.

S100 MICROCOMPUTING

MICROTRIX

Microtrix is an Australian manufacturer and supplier of a comprehensive range of S100 products, from single boards to complete computer systems. We only market products that meet our exacting standards of quality, reliability, and efficiency of design. Our own state-of-the-art projects as well as those of S.O. Systems, a Dallas-based manufacturer of high quality components, are supplied. All our cards are internally compatible, being integrated into a powerful micro-computer system by specially written software. Considerable expansion capability is built into our systems from conception, meaning that any system can be inexpensively upgraded at any time.

MICROCOMPUTER



This is our professional 12 slot S100 mainframe. It features a serial port, a parallel port, a shielded motherboard, 64K of RAM, 2K monitor, up to 16K PROM, counter/timer, heavy duty power supply, mains filter, and cooling fan.

MCS 200 — 64. \$1640.

SBC 200 SINGLE BOARD COMPUTER

The original single board computer with 1K RAM, 2K monitor included, up to 16K PROM, counter/timer, serial port, parallel port, 4 MHz, software programmable baud rate generator. High quality imported PCB with solder resist mask and component overlay. Beware of low quality local copies.

With monitor. Kit \$400. A/T \$470.

MPC-4 MULTI-USER INTELLIGENT I/O

A brilliant new board from S.O. Systems. Features on-board Z-80 CPU, 1K RAM, PROM, 4 serial I/O ports, and a counter/timer circuit. Ideal for multi-user and communications work. All inputs and outputs are buffered. Interrupt driven. Software programmable baud rate generation for each port.

Kit \$635. A/T \$715.

VDB 8024 VIDEO CARD

Contains on-board Z-80. I/O mapped. 80 x 24 display. CRT 5037 video controller chip. On-board software and character generator in PROM, easily changed if required. Full 96 character upper and lower case ASCII set. Special characters also available. 2K RAM.

Kit \$460. A/T \$530.

VERSAFLOPPY 2



Industry standard controller. Single/double density, single/double sided. IBM format compatible. 8" and 5 1/4" discs. PLL data recovery for reliable operation. Vectored interrupts optional. Control and diagnostic software available. Operates with either SDOOS or our CP/M 2.2.

Kit \$375. A/T \$435.

EXPANDORAM 2



State-of-the-art dynamic RAM card. Operates at 4 MHz. Expandable from 16K to 256K on board. Bank select, ideal for multi-user systems.

While stocks last.
16K Kit \$330 A/T \$400
64K Kit \$435 A/T \$505

VERSAFLOPPY 2, DOBIOS, SDOOS



A new package from S.O. Systems and Microtrix. Everything you need to add floppy disc capability to your S100 system. Comprising the Versafloppy 2, DOBIOS PROM, and SDOOS, a powerful CP/M compatible operating system. Includes new documentation.
Kit \$480 A/T \$540.

VISUAL 200 VDU

A brilliant Z-80 based intelligent terminal. Emulates ADM3A, Hazeltine 1500, ADDS 520, and VT52. Many switch selectable features. RS232 and 20mA current loop. Printer port. Self diagnostics. Full cursor control. 31 character graphics set. Function keys. Slow scroll. Detachable keyboard with capacitive keys.
Kit \$1295.

FLOPPY DISC SUBSYSTEM



Now supplied with double-sided, double-density YE Data drives, our companion floppy disc unit features cooling fan with washable filter, mains filter, and electronically protected power supply. A very professional unit.

FDS 400 \$1750.

PROM 100 PROM PROGRAMMER

Turn our computer into a development system. Programs 2708/2758/2716/2732 EPROMS. Dip switch selection. Zero insertion force socket standard. Software available for SDOOS, in PROM, or our own menu-driven CP/M 2.2 compatible utility.

Kit \$250 A/T \$295.

MULTI-USER SYSTEMS

Our philosophy of expansion is evident in our multi-user systems. A standard single-user system can be easily upgraded to multi-user capability, and a two user system can be expanded to cater for up to five terminals. The two-user system is particularly attractive, being a simple and inexpensive upgrade. For more than two users, the MPC-4 intelligent input/output board is required. In both cases, the operating system is the powerful COSMOS multi-user software.

2-user system	\$5365
Including Visual 200's	\$7955
5-user system	\$6995
Including terminals	\$13450

SOFTWARE

SDOOS 1.8 Single user, CP/M compatible operating system developed by S.O. Systems (USA) for our range of boards. Various utilities, including a Z-80 assembler, Linker, Loader, Editor, and others are included. Single or double density. \$210

CP/M 2.2 Industry standard operating system with our own BIOS that dynamically checks and changes between single and double density depending upon the diskette used. Our unique Sysgen program allows the user to easily tailor the software to suit his requirements. Standard \$165. Microtrix \$210

Note: All our software is genuine, sold with licensing agreement.

YE DATA 8" DRIVES

8" double sided, double density floppy disc drives. Excellent value. \$650.

COMPLETE SINGLE USER SYSTEM WITH OPERATING SYSTEM

\$4185	\$5480
Including Visual 200	



MICROTRIX PO Box 158, Hurstbridge, Victoria 3099
Phone (03) 718-2581

Please note: all our boards are of the highest quality, and most are imported. Beware of low quality local copies.

We will be undertaking some exciting new development over the next few months. Watch our ads for details, or send for our catalogue and be put on our mailing list.

Please add 15 per cent. sales tax if applicable. Postage on any board is \$3. Prices and specifications subject to change without notice.





THE S-100 BUS MULTI USER EXPERT

NORMANBY CHAMBERS, 430 LITTLE COLLINS STREET, MELBOURNE, 3000

Telephone: (03) 602 3946 ah 580 4798

*We are skilled specialists in customized software and hardware computer systems.
We provide a generous guarantee, full maintenance and a satisfying back up service for all our customers.*

Workshop Seminars: \$80

A 2 hour session on how to assemble our hardware kits with additional testing aids after completion for beginners. Enquire for bookings and further details.

Z80 Starter Board Programming Seminar: \$80

A 2 hour session on how to program with our Z80 Starter Board for beginners. Enquire for bookings and further details.

FREE: Programming Seminar with first five Z80 Starter Kit packages sold.

FREE: Workshop Seminar with first five S100-Bus Board Kits sold.

HARDWARE:

Z80 Starter Kit \$420 — Kit. \$480 — A&T.

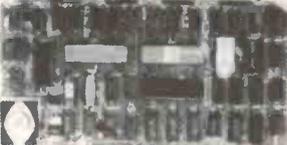
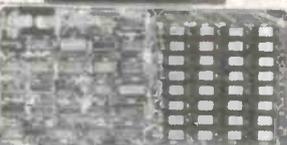
Z80 CPU with 158 Instructions, On-Board Keyboard and 7 segment Display, On-board PROM Programmer for single voltage PROMs (2716, 2758, TI2516), Kansas City standard cassette interface with simple controlled load and dump, expansion provision for two S-100 connectors (sockets not included), wire wrap area for custom circuitry, single step through RAM and PROM, memory examine and change, port examine and change, Z80 CPU resistor and change, 2K byte ZBUG monitor in ROM, 1K bytes of RAM (expandable to 2K bytes), counter timer (Z80-CTC), parallel I/O ports (Z80-P10), up to 5 programmable breakpoints, switch selectable PROM or monitor restart, vectored interrupts provided by Z80-CTC and Z80-P10.

Computation Monitor PROM (2716): \$120. FREE: with every SBC-200 sold.
Features commands to develop machine language programs including the manipulation of memory locations and I/O port data, breakpointing and single stepping. In combination with the computailor BIOS PROM it provides a comprehensive range of disk management primitives.

Computailor BIOS PROM (2716): \$120. FREE: with every VERSAFLOPPY II sold.

Features routines to execute disk operation for single density, double density, single sided, double sided, 5 1/4" and/or 8" drives. Obeys CP/M BIOS calling conventions and is hence suitable for SDOS, CP/M, COSMOS and MP/M operating systems. Contains comprehensive cold boot routine for most disk operating systems.

S-100 BUS SINGLE/MULTI USER MICROCOMPUTER SINGLE BOARD GUIDE:

Number of boards per system.	Board	Features	UNIT COST	
			Kit \$	A & T \$
	 <p>Any S100 Standard Board Prom Programmers, A/D - D/A Converters, Expandoproms, Hard-Disk Controllers, General I/O Boards.</p>	 <p>RING FOR DETAILS</p>		
4 Boards for 16 User System.	 <p>MPC-4 Multi-Port Communicator</p>	Z80-CPU, Real Time Clock, Progr. Baud Rate Gen, 1K RAM (Static), 2 x Z80-Darts, 2K PROM (2716), Fifo Buffer, Z80-CTC.	\$600	680
1 Board for single or 16 User System.	 <p>VERSAFLOPPY II Floppy Disk Controller.</p>	2K Bios PROM (2716), IBM 3740 Standard Single Density or Double Density, Single or Double Sided Drives, 5 1/4" and/or 8" Drives, up to 4 Drives. Free: Computailor Bios PROM (2716).	\$425	\$485
1 Board for Single User, 8 Boards for 16 User System.	 <p>EXPANDORAM II Dynamic Ram Card</p>	Expandable Dynamic Memory 16K-256K, Selectable Boundaries, Up to 4MHz Operation, Phantom Output Disable, Page Mode Operation. Uses 16K (4116) or 64K (4164) Memory Devices.	\$360 16K \$440 32K \$520 48K \$600 64K	\$420 \$500 \$580 \$660
1 Board for Single or Multi-User System.	 <p>VDB-8024 Video Display Board</p>	80 characters x 24 lines, 7 x 10 Matrix, Composite or TTL Video Output, Keyboard Power & Interface, Forward & Reverse Scrolling, Blinking, Underlining, Field Reverse, Field Protect and Combinations, Full Cursor Control, 96 Upper and Lower Case Characters, 32 Special Character Set, 128 Additional User Programmable Characters (Optional), On-Board Z80-CPU, 2K BYTES Independent On-Board Ram Memory, Glitch-free Display.	\$450	\$520
1 Board for Single or Multi-User System.	 <p>SBC-200 Single Board Computer</p>	Computailor Monitor 2K PROM (2716), Z80-CPU, 1K RAM, 16K EPROM, Serial I/O, Parallel I/O, Z80-CTC, 4MHz Operation. Optional Vectored Interrupts, Power-on jump to 4K boundaries. On-board memory can be switched out under programme control. Free: Computailor Monitor PROM (2716).	\$395	\$465

FULL SYSTEMS:

Any configuration from a simple dedicated system or a single user system to the most complex multi user system. Arranged with a selection of floppy disk drives, hard disk drives, printers and VDUs.

PERIPHERALS:

VDUs, printers, disk drives, etc.

SOFTWARE:

Single user SDOS 1.6 operating system \$200
Single user CP/M 2.2 operating system \$160
Multi user COSMOS operating system \$380
Multi user MP/M 1.1 operating system \$310

Enquire for customized operating systems. Pascal, BASIC, FORTRAN, Word processor (Wordstar) and Utility programs are also available on request.

Ask for our short form catalogue.
All prices are tax free; add 15% sales tax if applicable.
Mail orders are welcome, add \$3 — postage.

Prices and specs. subject to change without notice.



Versatile RAM kit from SD Systems

The Melbourne-based company Microtrix recently introduced a range of S100 microcomputer boards from SD Systems of the US here, and we had the opportunity to review their ExpandoRAM II kit back in June.

The ExpandoRAM II kit is available in two versions: 16K and 64K. The memory array consists of up to 32 dynamic RAM chips organised into four banks of eight RAMs each. (Where's the shepherd?). The eight RAMs each contribute one bit to an addressable location. The total capacity is either 65 536 or 262 144 bytes, depending on the chips employed. Included on board, apart from the memory array, is circuitry for memory decode and control, address multiplexer and data buffer.

The memory decode and control section is responsible for generating the timing signals for the memory array, address multiplexer and data buffer. Timing within the memory decode and control section is generated by a TTL-compatible delay line. An 82S130 PROM is used to select the proper banks according to the address lines, board select (DIP) switches and the board select latch.

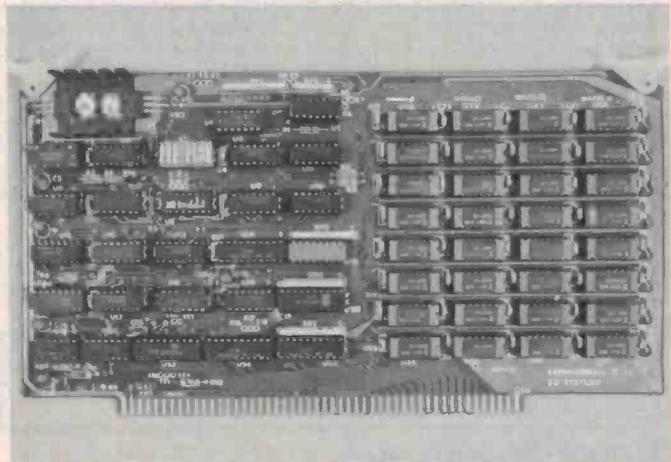
The address multiplexer is re-

sponsible for taking the address bits from the address buss buffers and multiplexing the proper row and column address into the memory array under control of the memory decode and control section.

The data buffers (controlled by the memory decode/control section) isolate the memory array from the data buss. Also included is a Port FF Board Select which decodes the port FF and latches the output port data on the board.

Our ExpandoRAM II for review arrived already assembled. The board is standard S100 size and is relatively uncluttered despite the large number of ICs employed. Sockets were used for all the chips and the board is silk-screened on the component side to assist the constructor to locate the parts. Conveniently, all ICs face the same way. The board is double-sided with plated-through hole construction, solder masked with gold-plated pins on the edge connector.

The instruction manual supplied is clearly written and circuitry and



timing diagrams are supplied, along with a complete parts list. Reproduction of the board overlay is not terribly good, but parts location should be easy owing to the silk-screening on the board. A checkout procedure is given in the book, along with a memory diagnostic software listing.

We tried the board in a system using the SD Systems SBC200 CPU card (just coincidence, really) running at 4 MHz with no WAIT states. A DTC1403D disk controller

was installed in the system, driving a Shugart 10M hard disk. The ExpandoRAM II performed faultlessly. For around \$400 tax paid this kit offers good value for money.

As a parting note, you can plug in 64K chips to make a 256K board — if your bank manager has sufficient discretionary allowance to advance you the loan!

Further enquiries should be addressed to Microtrix, P.O. Box 158, Hurstbridge Vic 3099. (03) 718-2581.

'Computailor' — customised computers

Computailor Pty Ltd was formed by two enthusiastic men with a combined background embracing both variety and experience.

Lutz Bilko, Computailor's administrator and electronics technician, began his career in 1959 as an apprentice with the Brown-Boveri Werke AG in Austria. After comprehensive training and both practical and theoretical experience he went to work for the Westinghouse Brake and Signal Company as a technician, and following this he was employed as a research technician in the Department of Electrical Engineering at the University of Melbourne. He specialised in designing and implementing digital electronics circuitry as well as maintaining various computers and peripherals.

Chris Price, Computailor's design and sales engineer, obtained his First Class Honours degree as a bachelor of electrical engineering in 1978 and completed his Master's degree in 1981 at the University of Melbourne. As a student he covered electrical theories as well as computer science. Today he is an authority on several high and low level computer languages, notably Pascal, Cosmos and MP/M.

With the combined knowledge and varied experience of Lutz and Chris, they are confident that Computailor can successfully design and tailor computer software and hardware to provide a pro-



Chris Price

fessionally customised computer system for both the community and industry.

A distributor contract from the USA provides Computailor with a ready range of highly proven S-100 computer boards, along with low



Lutz Bilko

and high level language software for single user and/or multi-user. Word processors and computer peripherals are also available.

Computailor can be contacted at 23 Bennett St, Bacchus Marsh Vic. 3340.

Commodore 8032 alternative to 'dumb' terminal

B.S. Microcomp have announced the release of the **MICROCOMMS** package, which enables the Commodore 8032 microcomputer to be used as a terminal for other computer systems.

The package consists of an 8032 with a serial interface and communications software. Optional extras are an 80-column printer which uses continuous fan-fold paper and a floppy disk for data storage.

Originally designed to be used with Telecom DATEL lines at 300 baud, the MICROCOMMS package has been used successfully up to 4800 baud.

The specially developed communications software turns the 8032 into a VDU with 24K of scrollable screen memory. This means that the user can connect to

a remote computer to interrogate a database and have the entire dialogue stored in the 8032's memory. The connection can then be terminated and the dialogue printed out in whole or part and/or stored on disk or tape.

When this capability is added to the large range of existing software for the 8032, it is claimed that it becomes a viable alternative to the mainframe-dependent 'dumb' terminal.

For more information contact B.S. Microcomp, 4th Floor, 561 Bourke St, Melbourne Vic. 3000. (03)614-1433.

The review of Spellguard software published in the July 1981 issue of ETI was substantially based on material by Bill Burns, published in the March 30th 1981 issue of InfoWorld, and should have been acknowledged accordingly. Our apologies to the parties concerned.

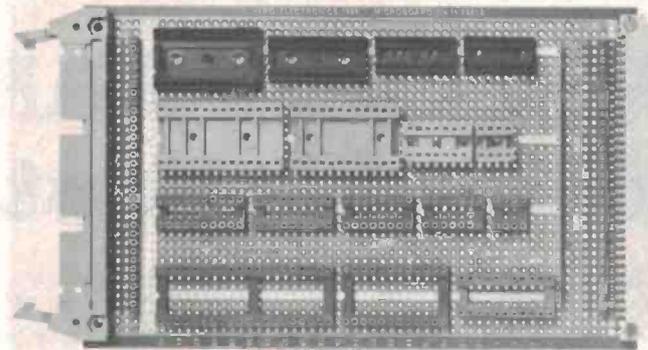
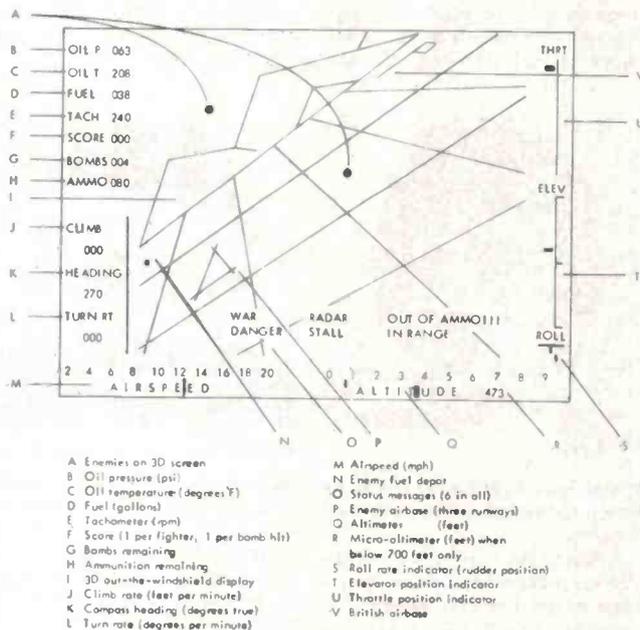
Come fly with me

Dick Smith Electronics have released a computer program for their home personal computer that teaches you to fly a plane without even leaving your lounge room!

The X3684 Flight Simulator and do aerobatics. Program is claimed to teach you the laws and theory of flight in three dimensions. You can become a 'British ace' and fly aerial battles armed with machine guns and bombs, can participate in dog fights

Full instrumentation is provided, plus the 'out-of-the-window' 3D dynamic flight display and radar, all for only \$34.90.

Full details are available from all Dick Smith stores.



Micro-board Eurocards for microprocessor applications

Micro-board Eurocards — the first of their kind to be specifically designed for microprocessor applications, where compatibility, flexibility, high density and screening are of prime importance — are now available from Warburton Franki.

The boards, which are compatible with all sub-rack systems conforming to IEC 297 and DIN 41494 specifications, have power rails running beneath dual-in-line packages, allowing high packaging density and easy decoupling. They may be hard-wired or wire-wrapped.

DIN 41612 connectors can be positioned for front and rear mounting, with the added facility for interfacing the front of the board

using ribbon cable headers in up to 60 ways.

Other features include colander ground plane, which is provided for maximum screening between component and wiring sides, full alphanumeric grid references on the wiring side, solder resist coating and screen printing on the component side of the board.

For further information contact Warburton Franki Ltd, 372 Eastern Valley Way, Chatswood NSW 2067.

Conversation with a computer?

The UK National Physics Laboratory claims to have produced a system of speech recognition that can handle any person's speech.

The system, the result of ten years' work, is said to be able to handle speech from a person who has not communicated with it previously, unlike most systems, which require training with each individual speaker who is to use the equipment. The vocabulary is also said to be much wider than in other systems.

The equipment breaks up the speech into 16 constituent sounds, similar to phonemes but not linked to any particular language like normal phonemes. Analysis of the sound leads to the identification of words, whereas most other speech recognition systems work by identifying the waveforms associated with each word.

The system is also said to show great improvements in the identification of strings of words spoken

together, as in normal speech — one of the most difficult problems of speech recognition systems. It can detect key words in the middle of a flow of words, which is said to be beyond the ability of systems currently on the commercial market.

The probable areas of application for the NPL system range from office and business systems to avionics/defence and industrial process control. The Laboratory has formed a technology transfer club which companies can join for between STG£8000 and STG£10 000 per year; these subscribers receive all the details of the system so far developed, and will help to formulate the research and development programme into speech recognition.

Brian Dance

New edition of Optoelectronics/Fibre Optics Applications Manual

Because of the growing complexity of today's optoelectronic product applications and the problems associated with them, Hewlett-Packard's optoelectronics division has written a second edition of the Optoelectronics/Fibre Optics Applications Manual, HPBK-2000.

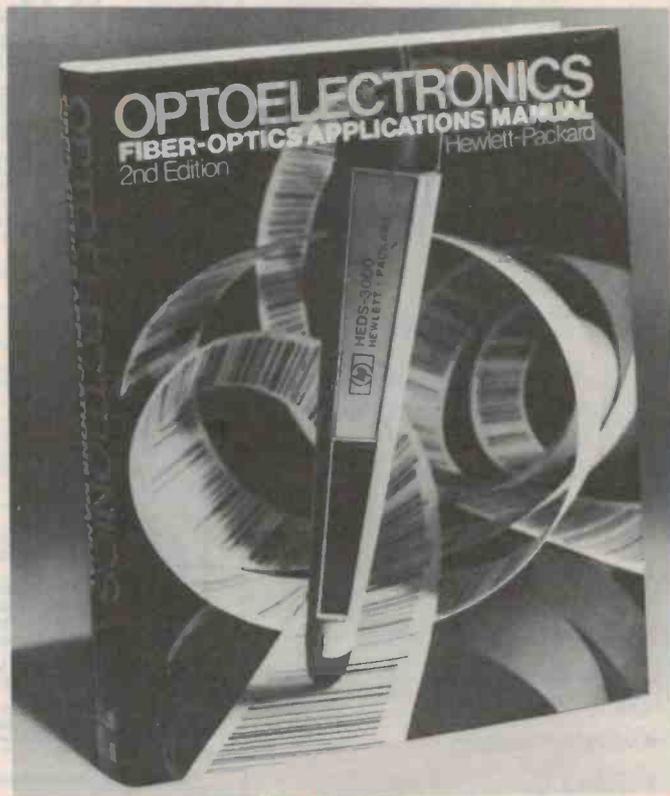
This hard-cover, over 400-page book discusses possible solutions to the most common problems that arise in the application of fibre optic systems, optocouplers, emitter/detector and digital bar code systems, and optoelectronic displays and lamps.

In addition, such subjects as photometry/reliability of optoelectronic components and the mechanical handling of optoelectronic components are covered. Circuitry and software examples are given which can be used directly in circuit designs.

Each of the major sections covers

the theory of a particular area of technology, the theory behind products designed to service needs in that area of technology, and practical solutions to technical problems encountered in the area. Enough theory and technical analysis are provided for each application so that the solution can be easily extended to other applications.

The Optoelectronics/Fibre Optics Applications Manual can be ordered and purchased from Hewlett-Packard's authorised distributor, VSI Electronics, at \$25 Aust. and \$30 N.Z.



British Telecom to launch Teletext service

Peter Benton, Managing Director of British Telecom, has announced that early next year Telecom will provide a high speed desk-to-desk message service to open up the era of the electronic office.

This new service will offer Teletext users the ability to prepare and edit correspondence, together with the means of accurately and rapidly conveying the information to a distant terminal. In a typical case, a full page of text will be transmitted in a few seconds.

The users of this service will be able to type letters, internal memoranda and other messages on their terminals as if they were using ordinary typewriters, and their correspondence will then be sent over the telephone network. The setting up of the calls, their transmission and reception will be fully automatic without anyone having to be present at either end.

Telecom's primary role in the new service will be to provide the network; it is expected that British industry will supply the terminals. Various manufacturers have already stated that they intend to proceed with the development of suitable terminals. In its simplest form a terminal can be an electric typewriter with a communication facility, but a more complex unit can include a multi-function visual display unit with word-processing and other software packages to perform a

variety of specialised business functions.

Initially the Teletext service will use the public telephone network and the packet-switched data service, but shortly afterwards connections will be provided with the telex network, thus enabling Teletext customers to communicate directly with 90 000 telex terminals in Britain and with about one million telex users overseas.

Mr. Benton stated that Telecom are at present discussing arrangements for an international Teletext service with Sweden, Belgium and West Germany, but in due course the service will be available to many countries.

Teletext messages will be transmitted at rate of up to 3500 words per minute compared with the 80 words per minute of telex. The resulting short calls should sharply reduce delays owing to the called terminal being engaged, but if the remote terminal is busy, the sending terminal can automatically try again later. A terminal can be programmed to automatically transmit a series of messages in turn, calling up each of the numbers required in sequence until all the messages have been transmitted.

Brian Dance

New single-board computer from Intel

The iSBC 86/05 Single-Board Computer was introduced recently by Intel Corporation as the second low-cost member of the iSBC family of multibuss-compatible architecture 16-bit microcomputers.

The board features an Intel iAPX 86/10 microprocessor with an 8 or 5 MHz clock, and is compatible with the iSBC 337 Multimodule Numeric Data Processor, which employs Intel's 8087 arithmetic chip.

Two iSBX interfaces are present for simplified on-board expansion with the iSBX Multimodule board series.

The board has 8K bytes of RAM and capacity for 32K bytes of EPROM. Both capacities can be doubled directly on the board using the new iSBC 302 RAM Multimodule and iSBC 341 EPROM Multimodule boards. These provide 8K of RAM and capacity for 32K of EPROM respectively, resulting in a total on-board memory capacity of 80K bytes.

System memory can be expanded beyond the on-board capacity up to one megabyte by using any of the multibuss-

compatible boards available, including both semiconductor and magnetic bubble memories in the iSBC product family. Mass storage can be further enlarged by adding single or double density diskettes or Winchester and SMD hard disk controllers.

Two programmable interval timers, 24 parallel I/O lines, a serial I/O port with programmable baud rates, and nine levels of vectored interrupt control are standard board features.

Intel also introduced the iRMX 88 Real-Time Multitasking Executive, optimised for small size and high-performance applications.

Complete software development support is available with the Intel family of development systems, languages and debugging facilities.

For further information contact AJF Systems and Components, 310 Queen St, Melbourne Vic. 3000. (03)67-9306.

**AADI
MICROCOMPUTING
WORKSHOP**

Sept 10-11
Macquarie Uni.

**"HANDS ON"
EXPERIENCE**

FEATURING the

- Fairlight
Computer Instrument!

**TOPICS TO BE COVERED
INCLUDE:**

- What Can Microcomputers Do?
- How Will They Affect Employment Problems Now and In the Future.
- An Introduction to Microcomputer Languages.
- Programming Skills in BASIC.
- The Maintenance and Use of Microcomputers in Schools.
- Music Synthesizers.
- Systems Security in Schools.

An Exhibition of Microcomputer materials has been arranged to familiarise participants with this technology.

ENROLMENT:

The number of enrolments is limited and early enrolment is advised to secure a place. An enrolment fee of \$40.00 covers the two days (School students under 18 - \$20.00). A cocktail party may be attended for \$5.00 a head (Thurs. 10-4.30-6.30 pm). Please fill out the attached coupon and send enclosed with a money order or cheque to:

Mrs Joan Booth,
20 Ronald Avenue, RYDE, 2112.

Cheques payable to: AADI Teacher Training Institute. Receipts and acknowledgements will follow as soon as possible.

ENROLMENT FORM:

Name:

Occupation:

School Attending: Year:

Enclose a cheque/money order for:

Two Day Workshop \$40.00

School Student Discount \$20.00

Cocktail Party \$5.00 a head

**SEMINAR PAPERS
AVAILABLE - \$9.95**

**L O Y
VIDEO**

Shop: 418 Bridge Road, Richmond, Vic.
Mail: PO Box 347, Richmond, 3121, Vic.

**OHIO - OSI - 6502
(SII, C1P unless specified)**

HARDWARE

- Superboard II; C1P, series 2 version. Better supply - Better Prices, with free Cursor and swap tapes.
- Mother board system - mother board, 8K RAM board, VIA/PIA, floppy controller, cables, kits, assembled and tested, if required.
- EPROM - DA BUG III - cursor control/single key basic - Pascal and level II.
- Superboard smoky cover, or metal box, or fibreglass case (holds case).
- R.F. modulators, power supplies, monitor TV's, 2114 chips.

OHIO SOFTWARE

G43 Galaxia.....	\$9.95
G44 Minos (3D Mazo).....	\$9.95
G45 Interceptor.....	\$9.95
U13 Word processor.....	\$39.00
U19 Cursor control C1P or C2/4/8 (specified).....	\$11.95
U24 Full assembler.....	\$19.95
I21 Morse code: receiving - converter and tape.....	\$16.95
I23 Light pen instruction.....	\$6.00
I25 R.T.Y. for C1P: send/receive with tape.....	\$16.95
I26 Cheap modem (data sheets) - C1P.....	\$4.95
B5 Mailing list.....	\$8.95
T1 The First Book of OSI (Aardvark).....	\$16.95
T2 Aardvark Journal (\$2.50 each) 6 issue subscription.....	\$14.00
T5 OSI Basic in ROM (rewritten & expanded).....	\$9.95
K2 Catalogue of over 100 pieces of software.....	\$1.95

Allow postage on software: 1-2 items \$1.00, 3-5 \$1.50, 6-9 \$2.00, 10 or more items \$2.50.

All prices INCLUDE sales tax.
Prices subject to change without notice.

**AFFORDABLE INSTRUMENTATION
MICROCOMPUTER POWER
SUPPLY**



PS1
5V at 4A adjustable ±12V at 0.4A
A&T \$74.50

PS2
5V at 8A ±12V at 0.8A
A&T \$95

Available with bench case, AIM 65 enclosure and SCR crowbar. DRAM PLUS for OS1 and PET available.

SPECIAL
TEAC FD50A 5 1/4 DRIVE
125kb. unformatted \$280
EPSOM MX80 printer \$730.



P.O. Box 6502
GOONDA 4306
PHONE(07)
288 2757
PRICES PLUS TAX
IF APPLICABLE.

**TRY THIS EXCITING
HOBBY!**

Build your own Organ, at
half the cost of a
ready-built Organ.

**WITH WERSI ORGAN
KITS**

Wide range of models:
COMBO to large CHURCH ORGANS



Also
available
ready-built.

- STRING ORCHESTRA
 - BASS SYNTHESIZER
 - ELECTRIC PIANO
- Also
- and the famous
WERSIVOICE
ROTATION SOUND

For a Colour Catalogue send 80c.
Klaus Wunderlich Demonstration Record, music only with jacket
notes - \$7.00 (incl. postage.)

CLEFTRONICS PTY. LTD.
9 Florence St., Burwood, Vic. 3125
Phone: (03) 288-7899

LASER INSTRUMENTS

**LASER DISPLAY AUGUST 26-27
OPEN HOUSE 10 AM-12 NOON**

Helium Neon laser kit \$280
Helium Neon laser for
schools..... \$275

Plus lasers for research
and medicine.

memory electronics

M80; 80 Peripheral pro-
cessor board. 2K RAM.
Runs Tiny Basic from \$135
M800; 80 Superboard 4
MHz Clock, up to 64K
RAM, up to 32K ROM.
Addresses 2.5 M Byte
packed into 115x80 mm
board. Basic, monitor, STD
compatible, serial ports
etc from..... \$800

Telephone Christopher or
Andrew (03) 557 5394.
70 Patterson Rd,
Moorabbin
Vic 3189

For Sorcerer Apprentices

The backlog of Sorcerer mail both here and waiting for me at the ETI offices has reached such mountainous proportions that I think Australia Post must believe by now that 'Sorcerer' is a code name for mail order pornography. However, many apologies to all those who are still waiting for an answer or for an evaluation of a program they have sent in; my excuses are many and varied but all true.

Firstly, I have to earn a living as well as answer Sorcerer mail; secondly, some of the questions asked are so complex that it takes me some time to sort out the answers; thirdly, even if I do prepare an answer and get it to Roger, it will then be six to eight weeks before you read it in ETI because of the publishing deadlines. And on top of all that, much as I would like to appropriate the majority of ETI's pages for Sorcerer information, space is limited, and I can only answer a few letters a month. So please have patience and bear with me till the backlog is cleared.

Here goes with a few queries and program suggestions:

Dear Sir,

I am writing to ask for your help in several questions I have about programming the Exidy Sorcerer in machine language.

Firstly, is it possible to turn off the cursor completely during cursor movements? Secondly, is it possible to generate random numbers in machine language? Thirdly, could you tell me how to do trig. functions in machine language?

Yours, Rex di Bona

Dear Editor,

I have been reading your column for Sorcerer computer users since it started, and now, like many others, I have needed to try three-dimensional graphics — and that is where the problem starts.

I became curious about using specific subroutines within the ROM PAC in my own programs, but to do this I need to know the location of the routines and the way data flows in the routine.

The questions I have are: What are the locations of the mathematical function and operator routines in the ROM PAC, the position where the data and results are placed, and the format of the code used in these routines?

If this is not possible, could you please give examples of how to calculate sin, cos, etc, in a machine language routine?

Yours, Arthur Ralskio

Thanks to Arthur and Rex for their interesting questions. I assume that Rex wants to turn off the cursor completely in order to avoid the little white lines jumping to a position where printing begins. You cannot, however, turn off the cursor by software unless you write your own video driver. I suggest you use an instant cursor positioning program. There are several such programs around, but my preferred one is the one by John Woolner, which uses the OUT function. (If the OUT statement is used as intended, the initial values are poked back in, prior to use (PEEK 231 for right value.) Here it is:

```

1000 RESTORE 2000
1001 FORW=32TO61:READA:POKEW,A:NEXT:POKE262,231
1010 REM lines 2000 — 2002 are data for cursor positioner
1020 REM lines 1000 & 1001 initialise cursor positioner
1020 PRINT "Cursor is currently here"
1030 OUT 25,25 : PRINT "and now here
1030 OUT 5,15 : PRINT "here
1040 OUT 15,5 : PRINT "and now here
1050 OUT 25,25 : PRINT "see how it works ?
1060 REM please note that the program does NOT verify if
1070 REM the parameters passed through the OUT statements
1080 REM are within the limits of 30 lines and 64 positions
1090 REM We trust you'll make sure of this yourself.
1100 PRINT CHR$(12) : OUT 15,20 : PRINT "HAPPY COMPUTING
2000 DATA229, 71, 205, 232, 233, 175, 253, 119, 107, 203, 24
    
```

2001 DATA31,203,24,31,253,119,104,253,112,105,58,63

2002 DATA1,253,119,106,225,209,201

Random numbers in machine language can be generated in several ways. But no random numbers are really random unless you "seed" them. This is normally done by asking for a name or the date. A very simple machine language random number generator is listed below:

```

KEY EQU 0E009H ;Exidy RECEIVE
START: PUSH HL ;save it
; our random
;number is there !
CALL KEY ;call the keyboard

JR NZ,GOT IT ;someone pressed it.
POP HL ;restore random number
INC HL ;we count up
;if higher than FFFF,
;who cares ?
JR START ;wait till key pressed

GOT IT: POP HL ;that's it
RET ;we have a 16 bit
;random number in HL
;or two 8 bit in H + L
    
```

The fully relocatable object code of this is:

E5 CD 09 E0 20 04 E1 23 18 F6 E1 C9

Should you question the number's randomness, try getting the same number twice! Naturally, the assumption here is that at one stage or another you'll have to call a keyboard entry routine, but then I have never seen a program which does not do just that. I assume you require the function for a game or similar type of program, for which the above is quite satisfactory. Should you require a random number generator for statistical programs, where it is vital that you can prove the number is a random number, write to me again and I'll publish a more complex generator. Let me remind the novice that this program will NOT operate as a subroutine to your BASIC program, since it is written in Z80 Assembler language. Use the RND (random) function in your BASIC program if you need random numbers.

The question of trigonometry and its calculation is a different kettle of fish. The whole complexity of such calculations is very neatly and easily solved by using the routines provided in the BASIC PAC. This means that the program using the functions is dependent on the PAC being resident during execution. I spent several hours in the middle of BASIC and can report the following: it is difficult. BASIC uses the following addresses for the corresponding functions:

LOG 0D4ABH; SIN 0DA14H; COS 0DA0EH; TAN 0DA75H.
ARCTAN 0DA8AH

Arguments are passed through the floating point accumulator, residing from 01BFH to 01C3H (447 to 450 decimal). At this stage, I cannot tell you exactly how to set up the registers. I suggest you try out different combinations and check the results which are passed back into the floating point accumulator. If anyone is successful she/he might send in the solution. I am sure it will be much appreciated by other readers.

Those of you who remember the second-last column may recall my asking for some programs for evaluation. The response was not overwhelming, but nevertheless interesting.

This month I'll report on three programs supplied by Customized Technology: CASSETTE FILES, BASEBALL and GRAPHICS. Let's examine Cassette Files first.

The program's main function is to read and record your variables from your Exidy BASIC programs. Documentation is good, with a sample program provided (in print only). Cassette Files relocates the BASIC stack and then relocates itself above that area. Of course, this means that you lose some of your memory to the program. The program uses the USR function; strings and arrays are passed to it and it will then allow you to place or retrieve them to and from tape. Writing to tape is done automatically once the buffer is full, while you can read one array after the next. Gone are the days of troublesome and frustrating CSAVEing and CLOADing. The recording quality of ▶

Print-out

Cassette Files is good; I bought software that took several days and several machines to load, and I had no CRC-errors and it loaded first off. Cassette Files is reasonably priced at below \$20. Next month I'll review String Saver, another program of the same type.

As its name implies, BASEBALL is a computerised baseball game. If you have kids, you may keep them amused for a couple of hours with this program, but to my mind, while the graphics are quite good, it's just another one of those 'press the button and let the computer do it' games. This one struck out for me.

GRAPHICS is truly extraordinary. Here we have a program written in such an exquisite way, so beautifully documented, that it is a great pity the author himself does not supervise its marketing. The cassette contains two programs, a machine language and a BASIC program. First on tape is the machine language program with a BASIC Goaddress. The disastrous result, if you simply read the cassette which says :LOG, is a crash, so if you are away making a cuppa while loading you have a surprise waiting! For a program selling for over \$20 one would hope that at least the fundamentals were correct. I know there are programs which sell for several hundreds of dollars and are still full of bugs, but I have never accepted that very happily either. Whatever happened to quality control in this industry?

Well, that feels better now. Nothing like a good whinge from time to time. Once having loaded the program, it was pure joy looking at the demonstration, which is all the program does. The demo lasts for a few minutes and consists of graphics on the whole screen. The program divides the screen into 11 520 dots and any one can be on or off. The most valuable part of the program, though, is all the REM statements, explaining exactly what is going on. It is very complex in internal operation but dead simple to follow. Again, parameters are passed via the USR function. Since plotting is done in machine language, it is very fast. This program is definitely recommended, since it uses the Sorcerer's graphics to its fullest potential. For those of you who have already purchased it, and presumably have the wrong Goaddress on tape, here is how to fix it:

Load the machine language part into the Sorcerer. Set the Goaddress to 0E78A and resave it. You will then be able to LOG it and the second one will automatically load as well. This goes for any other programs too. Simply key in LOG, though; don't use a name in case the second program has a different name.

Bye for now
A.P.F. Fry

Versatile EPROM programmer

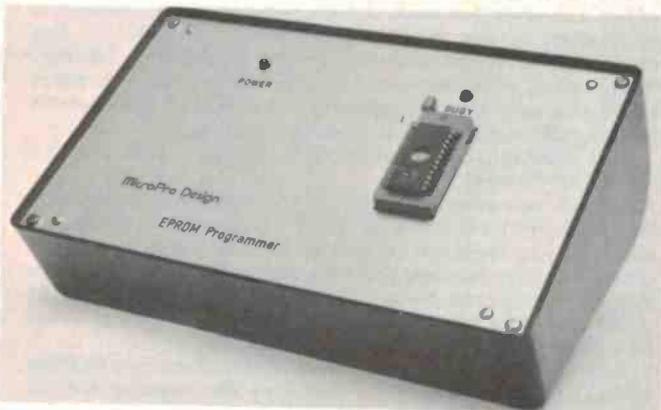
MicroPro Design have announced the availability of a versatile EPROM programmer for use with the Commodore micro-computer.

The unit can program all the Commodore microcomputer, currently available 1024, 2048 and 4096-byte EPROM integrated circuits, and menu-driven commands on the Commodore's screen give the ability to program, copy, read, display and modify an EPROM's contents.

Since all functional capabilities for the programmer are under control of a program executing in

the programmer module itself is simple and requires no controls. The programmer module simply connects to the parallel user port of the full range of Commodore computers.

For more information contact Andrew Mowat, MicroPro Design Pty Ltd, Suite 205, 6 Clarke St, Crows Nest NSW 2060. (02)438-1220.



Series 4500 to test micro-based systems

To provide organisations with a cost-effective test system for test program development, production go/no-go testing, repair and depot troubleshooting or fault isolation on microprocessor-based boards and systems, Millennium has introduced the new Series 4500 test station.

The Series 4500 is a universal based systems. Currently, testers which uses emulators to provide the flexibility to test functionally a broad range of microprocessor-

emulators are available for the 6800, 6802, 8080A, 8085A, Z80A, 6801, 6803, 8021, 8041, 8048

8035, 8039 and 8748.

The 4500 test station incorporates three basic approaches to micro-system testing and troubleshooting: time-domain analysis, in-circuit emulation and signature analysis. The test station provides results that can be read directly without requiring interpretation for rapid fault location, and may therefore be used by technicians with a minimum of training.

Utilising in-circuit emulation, the 4500 and plug-in emulator replace the system-under-test's own microprocessor to provide bit streams to stimulate the system. Signature analysis is used to sense and condense data streams throughout the system at every node. The condensed nodal data stream produces a bit pattern signature which is unique to every node being probed. In this way, the operator is able to trace correct and incorrect signatures to the failed component.

The Series 4500 operates in real-time using the clock speed of the system's microprocessor.

With the Series 4500 test station, Millennium offers a five-day seminar/workshop to assist test engineers in developing functional testing and diagnostic software for their microprocessor-based products. During the courses attendees will learn techniques for logically partitioning systems, writing diagnostic software and methods of generating software stimulus to use signature and time-domain analysis for nodal level fault detection.

A wholly owned subsidiary of American Microsystems Inc. (AMI), Millennium offers a complete line of universal microprocessor support equipment for lab, test and field service applications.

For more information contact Warburton Franki Ltd, 372 Eastern Valley Way, Chatswood NSW 2067.



FREE! FREE!

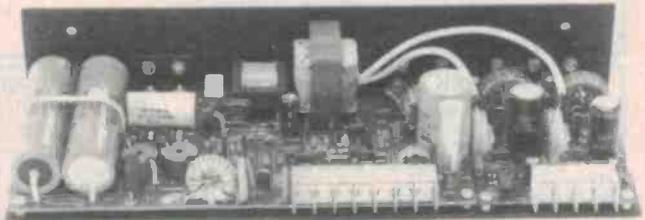
Send for free list of low cost New Zealand designed kits, innovations, novelties and circuit books, including details of our remarkable new "HUG" microprocessor kit. Complete with 7K on board memory, full colour and expansion facilities. 1K Tiny Basic and all sorts of back-up software available.

Please PRINT your name and mailing address in the centre of a blank piece of paper and send to:

KIT PARTS (AUSTRALIA) PTY. LTD.,
Private Bag, Noosa Heads, QLD. 4567.

SWITCHING POWER SUPPLIES

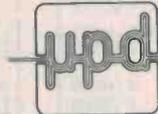
The California DC range of switching regulated power supplies is now available in Australia. The LR Series of open frame supplies provide size and weight savings over linear, series regulated supplies. Conservatively rated for long life, the LR Series was designed for use in computers, computer peripherals and industrial controls. They provide power for floppies, tape drives, memories and microprocessors. The range includes versions with up to four independent output voltages.



Standard features include:

- Plus/Minus 20 percent line tolerance
- Inrush limiting on turn-on
- Individual output regulation of 1 percent
- Individual output current limiting with foldback
- Thermal protection
- 50 millivolt P-P output ripple and noise
- 0-40 degrees C convection cooling without derating
- 70 percent minimum efficiency at full load

The power supplies range in price from \$170 to \$330.



MicroPro Design Pty. Ltd.

PO Box 153, North Sydney, NSW 2060. Phone (02) 438-1220.

BIRTHDAY NEWS! BIRTHDAY NEWS! BIRTHDAY NEWS! BIRTHDAY NEWS! BIRTHDAY NEWS!
SOFTWARE SOURCE ONE YEAR OLD. SOFTWARE SOURCE ONE YEAR OLD!

DISCOUNTS

CP/M 2.2 ACCX
AIR TRAFFIC CONTROLLER
BASIC-80 MASTER
SUPERCALC EPSON MX-80
SAVE \$\$\$ AUDIOTREK
GRAFIX UTIL 3

Software Source

is
1

We have the COMPLETE range of DISK & TAPE-based software & PERIPHERALS for the SORCERER.

SAVE EVEN MORE:

5% discount off ALL TAPE SOFTWARE in our current catalogue if you quote A.A.1.

Offer closes 1st September 1981.

Write for FREE CATALOGUE

PO Box 364, Edgecliff NSW 2027. Phone (02) 33 4536.

NEW!!! — DIGI-PLOT — Intelligent x-y plotter ONLY \$1,390.00

CAN YOU AFFORD NOT TO SUBSCRIBE TO MICRO-80?

MICRO-80 is a monthly magazine dedicated to users of SYSTEM 80 and TRS-80 microcomputers. Owned and produced entirely in Australia, each issue of MICRO-80 contains at least six programs, articles, useful hints and answers to readers' problems; all designed to help YOU get the most out of your SYSTEM 80 or TRS-80. Since MICRO-80's first issue in December 1979, we have published over 80 major pieces of software and 10 hardware projects. Most of the programs and articles are written by our readers to whom we pay publication fees thus enabling them to make their hobby pay. MICRO-80 readers can save money by buying Tandy products at 10% discount from an authorised dealer - for details see any issue of MICRO-80. Our sister business, MICRO-80 PRODUCTS, sells Australian designed and produced software and high quality, imported goods at low, sensible prices. We repeat, if you own a SYSTEM 80 or TRS-80,

CAN YOU AFFORD NOT TO SUBSCRIBE TO MICRO-80? 12 month subscription delivered to your door, only \$25.00

CASSETTE EDITION only \$60.00 for 12 months

If you do not have enough time at the keyboard to type in the program listings which are published in MICRO-80 each month, then you need a cassette subscription. As well as MICRO-80 magazine, you receive a cassette each month containing all the programs listed in the magazine.

SPECIAL OFFER TO ALL NEW SUBSCRIBERS TO MICRO-80

A FREE cassette containing 6 programs (3 Level I + 3 Level II), together with complete documentation, will be sent to every new subscriber to MICRO-80.

Suspicious of mail order? Then send \$2.50 for a single copy of MICRO-80 and see for yourself that this is the magazine for you!

Daisy Wheel Typewriter/Printer

MICRO-80 has converted the new OLIVETTI ET-121 DAISY WHEEL typewriter to work with the TRS-80 and SYSTEM 80 or any other microcomputer with a Centronics parallel port (RS 232 serial interface available shortly). The ET-121 typewriter is renowned for its high quality, fast speed (17 c.p.s.), quietness and reliability. MICRO-80 is renowned for its knowledge of the TRS-80/SYSTEM 80 and its sensible pricing policy. Together, we have produced a dual-purpose machine: an attractive, modern, correcting typewriter which doubles as a correspondence quality Daisy-wheel printer when used with your micro-computer.

How good is it? - This part of our advertisement was typeset using an ET-121 driven by a TRS-80. Write and ask for full details.



ONLY \$1995 INC. S.T.

MPI DISK DRIVES

MPI is the second biggest manufacturer of mini floppy disk drives in the world. They produce a family of high quality 5 1/4" drives with super-fast track-to-track access times (5ms!)

40 TRACK SINGLE HEAD \$339
40 TRACK DUAL HEAD \$449
80 TRACK SINGLE HEAD \$499
80 TRACK DUAL HEAD \$599

Dual head drives use both sides of the disk and occupy two drive positions - It is like having two drives for little more than the price of one!

Prices quoted are for bare drives. Add \$10 per drive for a cabinet and \$30 per drive for a power supply.

SYSPAND 80 FOR THE SYSTEM 80 \$119.00

SYSPAND 80 is a self-contained module which connects to the expansion port on your SYSTEM 80 and gives you a CENTRONICS parallel port to drive a printer PLUS the TRS-80 40 line bus. SYSPAND 80 allows you to connect all Tandy peripheral, including the expansion interface, disk drives, MICROTEK MT-32 memory expansion unit and the fabulous EXATRON STRINGY FLOPPY.

TRS-80 MEMORY EXPANSION UNIT MT-32 ... \$149.00

The MT-32 is manufactured by MICROTEK Inc., USA. It provides a CENTRONICS printer port and sockets for up to 32K of dynamic RAM. It comes complete, ready to plug into the expansion port of your Level II 16K machine. (Will also work with your SYSTEM 80 via SYSPAND 80).

MT-32A without RAM \$149.00
MT-32B with 16K RAM \$179.00
MT-32C with 32K RAM \$209.00

16K MEMORY EXPANSION KIT

ONLY \$30 incl. p&p

These are prime, branded, 200 ns (yes, 200 ns!) chips. You will pay much more elsewhere for slow, 350 ns chips. Ours are guaranteed for 12 months. A pair of DIP shunts is also required to upgrade the CPU memory - these cost an additional \$4.00. All kits come complete with full, step-by-step instructions, no soldering is required. You don't have to be an electronic type to instal them.

DISK DRIVE HEAD CLEANING DISKETTES

\$29.00 plus \$1.20 p & p

Disk drives are expensive and so are diskettes. As with any magnetic recording device, a disk drive works better and lasts longer if the head is cleaned regularly. In the past, the problem has been, how do you clean the head without pulling the mechanism apart and running the risk of damaging delicate parts. 3M's have come to our rescue with SCOTCH BRAND, non-abrasive, head cleaning diskettes which thoroughly clean the head in seconds. The cleaning action is less abrasive than an ordinary diskette and no residue is left behind.

DISKETTES FOR TRS-80

NASHUA 40 track single side . . . \$4.50 ea
VERBATIM 40 track double side . \$5.90 ea
VERBATIM 77 track single side . \$5.90 ea

THE FABULOUS NEWDOS 80 IN STOCK NOW!

ND-80 \$149

The disk operating system that gives:

- New basic commands that support variable record lengths up to 4095 bytes long.
- Mix or match disk drives - supports any number of tracks from 18 to 80. Use 35, 40 or 77 track 5" mini disk drives or 8" disk drives, or any combination.
- A security boot-up for basic or machine code programs. User never sees "Dos-ready" or "Ready" and cannot "break" clear screen or issue any direct basic statement including "List" and much, much more

77 TRACK DISK DRIVES DOUBLE YOUR CAPACITY

DD-7S \$775

Micropolis Floppy Disk, 77 Track, 100% larger capacity than most mini-floppy drives, complete with cable, power supply, chassis, and includes NEWDOS '80.

AUSTRALIAN SOFTWARE

We have a wide range of Australian software available. Send for a free catalogue

To: MICRO-80
P.O. Box 213, Goodwood, S.A. 5034

Please rush me the items checked below:

- 12 month subscription to MICRO-80 and my free software cassette \$24.00
- 12 month subscription to MICRO-80 and the cassette edition, plus my free software cassette \$60.00
- The latest issue of MICRO-80 \$2.50

PLUS THE ITEMS LISTED BELOW

DESCRIPTION	PRICE
TOTAL ENCLOSED	

Name

Address

Post Code

bankcard No.
welcome here

Please debit my Bankcard \$

Expiry date

Signature

ETI

MICRO 80 PRODUCTS

(08) 272 0966

433 MORPHETT STREET,

ADELAIDE S.A. 5000

TRS 80 and SYSTEM 80 OWNERS TRS 80 and SYSTEM 80 OWNERS

LOW PRICES FOR TOP TOOLS

SAVE!!

12V ECONOMY IRON

This superb iron works on 12 volts AC and 12 volts DC, so it can be used in the home, car, boat etc. Comes complete with car cigarette-lighter plug attached to a lead.

Cat. T-1910
\$3.95

DICK SMITH
1000's SOLD!

LOW COST IRON

DON'T PAY \$13.00!
ONLY **\$9.75**

Professional quality iron at a low cost! This iron plugs into 240V AC mains and gives 25 watts of heat very quickly. More than enough for most jobs around the home! Stainless steel with copper tip, complete and ready to use. Cat. T-1300

DICK WICK

Specially treated copper braid used to remove solder from PC board. Clean and efficient. Cat. N-1682

NOW ONLY **\$2.00**

SOLDER HOBBY PACK

\$1.00

VALUE!

Yes! We have large rolls of solder for the serious hobbyist or professional! Just ask at your nearest Dick Smith Centre.

CABINET OF DRAWERS

This cabinet is ideal for small components, screws, nuts and bolts plus many other items. 16 drawer cabinet measures 300 x 180 x 140mm. Cat. H-2588

~~\$17.50~~

\$12.95

TOOLBOX

This rugged polypropylene toolbox has a multitude of uses for the fisherman, technician, tradesman or automotive bits and pieces. A generous 427 x 230 x 200mm size with 2 trays, 15 compartments. Rustproof and lightweight.

Cat. H-2600
GREAT VALUE
\$26.50

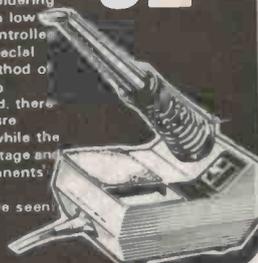
BUILDING THE SUPER 80? YOU NEED THIS SUPERB

WELLER SOLDERING STATION

\$62.50

Transformer powered soldering station, complete with a low voltage, temperature controlled soldering pencil. The special Weller 'closed loop' method of controlling maximum tip temperature is employed, thereby protecting temperature sensitive components while the grounded tip protects voltage and current sensitive components e.g. CMOS. Definitely the best we've seen.

Cat. T-1000



SOLDER SUCKER
ONLY **\$13.50**

Rugged, all metal construction solder sucker, complete with Teflon tip and nozzle sweeper. Light thumb release mechanism for easy removal of solder from your board. Don't pay twice the price elsewhere! Cat. T-2560

GENUINE TULLEN SNIPS
\$2.95

EVEN CUT TINPLATE!

Dick Smith now stocks the famous Tullen Snips. This tool will cut almost anything! Working on the principle of shearing rather than cutting, this ensures a neat cut every time. Never needs sharpening! Cat. T-4930

HOBBYIST SOLDERING CENTRE

If you're going to build a super 80 one of these is a MUST! Holds your PCB securely & firmly, while being able to turn over. Also holds a roll of solder and your iron. No more burnt fingers! Cat T-5700

\$19.50



NEON TEST DRIVER

Ideal tool to carry in your pocket (it has a pen clip!) for testing the presence of AC. At this price, why take chances? Completely Insulated. Cat. T-4005

\$1.00



PLIKE

4 tools in one! Long nose plier, 3/8" cutter, built-in crimpier, multise wire stripper. A must for your toolbox! Cat. T-3165



\$8.50

NIPPERS \$5.50

Transistor Nipper. Ideal for PC work. Cat. T-3200

Mini Diagonal Cutting Nipper. Drop forged steel construction.

\$3.95

Cat. T-3561



DICK SMITH Electronics

- AUBURN 648 0558
- BLAKEHURST 546 7744
- BROADWAY 211 3777
- BROOKVALE 93 0441
- CHULLORA 642 9822

- GORE HILL 439 5311
- PARRAMATTA 683 1133
- SYDNEY 290 3377
- NEWCASTLE 81 1896
- WOLLONGONG 28 3800

- CANBERRA 80 4944
- BURANDA 391 6233
- CHERMSIDE 59 6255
- ADELAIDE 212 1962
- MELBOURNE 67 9834

- RICHMOND 428 1614
- SPRINGVALE 547 0522
- PERTH 328 6944
- CANNINGTON 451 8666

MAIL ORDER CENTRE: P.O. Box 321 North Ryde, NSW, 2113. Ph. (02) 888 3200



NOW IS THE TIME TO BUY!

★
**SPECIAL
 INTRODUCTORY
 OFFER!**

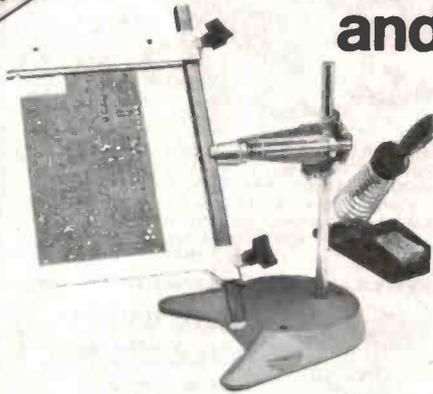
The New★
**Televideo 950
 Terminal** **\$1,250**

Telephone: (02) 331 3033.

dataware

NEW!

**Hold your P.C. board in any position ...
 and LOCK IT THERE with the new**



SCOPE PANAVISE

THE NEW MODEL 333

- Rotates and locks in 45° increments.
- Tilts and locks at 4 angles — vertical, 45° - 90° - 120°
- Offers 200mm of vertical adjustment to the work height.
- Has a heavy cast iron base with bench mounting holes as option.
- Retains the quick load facility of spring mounted arms to hold the P.C.B.
- Offers cross bars to 750mm for large or multiple board work using extra sets of arms.



SCOPE
 BOX 63, NIDDRIE,
 VIC., 3042
 TEL.: (03) 338-1566

**FOR FURTHER
 INFORMATION
 CONTACT :**

SYDNEY, N.S.W.
 (02) 546-6144
 ADELAIDE, S.A.
 (08) 223-2261

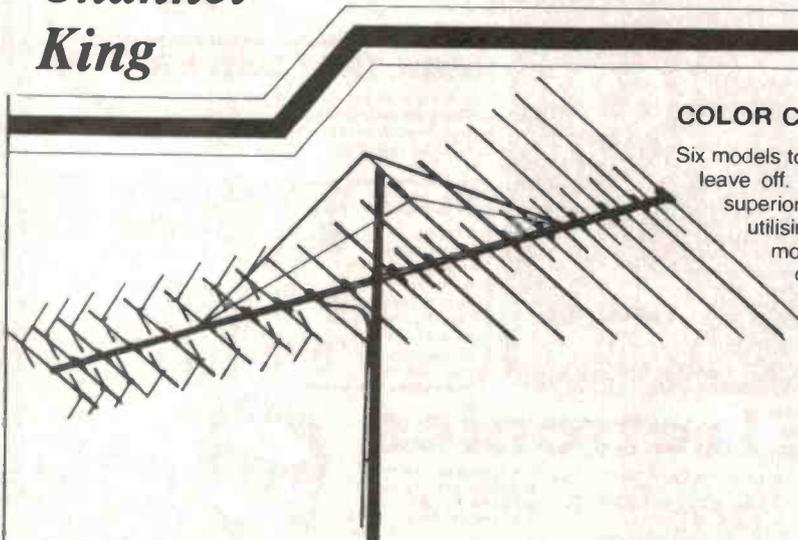
BRISBANE, QLD.
 (07) 221-1933
 TOWNSVILLE, QLD.
 (077) 71-3448

ROCKHAMPTON, QLD.
 (079) 27-3370
 HOBART, TAS.
 (002) 34-2811

LAUNCESTON, TAS.
 (003) 31-5545
 PERTH, W.A.
 (09) 381-4155

WELLINGTON, N.Z.
 85-9578
 AUCKLAND, N.Z.
 57-4037

**Channel
 King**



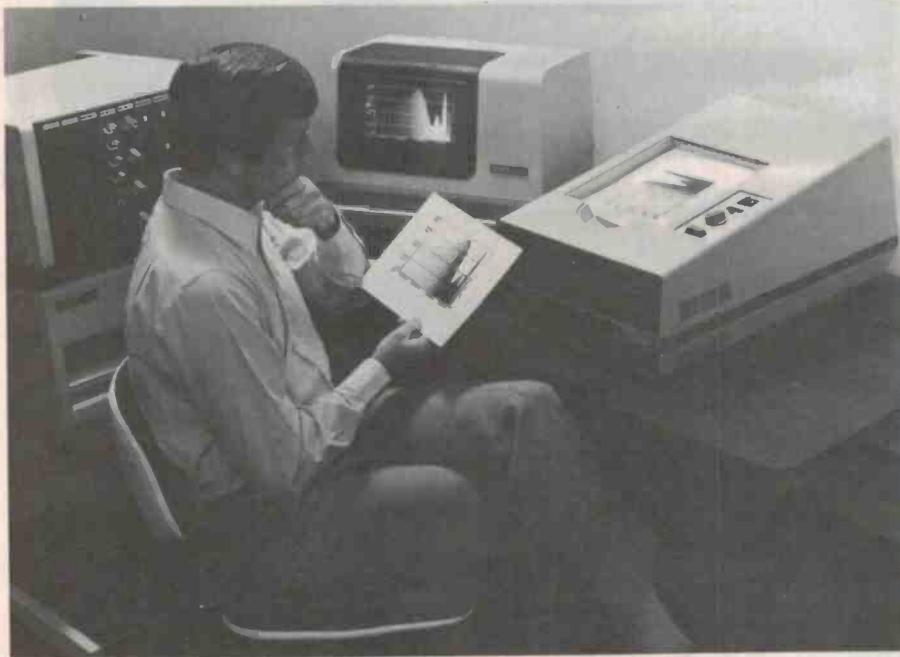
COLOR CROSSFIRES — MODELS CX9 to CX28

Six models to choose from. The aerials take over where the colorays leave off. The famous Color Crossfire series set a standard for superior broadband performance. Of logical periodical design, utilising the Channel Master Energy Absorption principle to put more elements to work for flatter response, higher gain and directivity across the VHF TV/FM spectrum.

Also available from Channel King is an extensive range of hardware Cables, Amplifiers and M-A-T-V Distribution Equipment which can be seen at our showroom.

1117 Burwood Highway,
 Ferntree Gully, Victoria 3156
 Telephone (03) 758-9111

Electronics devotees will find DATA '81 a treat



Home computer equipment to handle everything from sex to tax will be on display at DATA '81, Australia's premier exhibition of computers and related information technology, to be held at Sydney's Centrepont from August 25 to 27.

A HUGE ARRAY of equipment from both Australian and overseas manufacturers aimed at both commercial and home use will be on display. Enthusiasts will be able to view and discuss the most sophisticated systems and the simplest – and there will be no shortage of consultants both for software and hardware.

One of the cheaper models on display for the home computer operator will be the System 80 series from Dick Smith.

The basic computer, which plugs into the home television set, costs \$695 with 16K of main memory, and can be bought with extras such as disk drives, printers and extra memory. The System 80 series comes with a large series of programs designed for Australian conditions. According to Dick Smith spokesman Ross Tester, the 1981 income tax program has more information

than the 1981 tax form. "It will tell you how much you will get back – or have to pay – something we understand the new form will not," he said.

Dick Smith also provide other useful and/or educational programs for their home computer. Locally designed programs, costing from \$9 up, can teach you speed reading, typing, provide a flight simulator for trainee pilots, encourage reading and maths work in children through entertaining educational games, and help the businessman do his ledger work on the home computer.

But as well as the usual run of computer 'spaceship' games – plus others so interesting and complicated they can be played for weeks – this year's game programs include one called 'Interlude'.

"In this game the computer operates

as the third partner in a 'menage a trois,'" said Mr. Tester. "It asks intimate questions and from the replies either directly suggests an 'interlude' or refers the players to the manual. This program won't be on display at DATA '81 – it's for adults only."

The Tandy stand will also have displays for both the home user and businessman.

The basic computer for home use is the 16K version of the TRS80 model 3, costing \$1399. This cassette-based computer can be used for accounting and record keeping, but also comes with the availability of more than 100 programs sold directly by Tandy, plus over 3000 available from outside programmers written for Tandy computers.

More ambitious home users can move up to the 32K version of the TRS80 model 3 for \$3299.

Programs for these computers include mailing list, accounting, word processing, educational and games, although some require disk storage.

Also on display by Tandy will be a typewriter-quality daisy wheel printer.

Dick Smith and Tandy are but two of the many companies offering equipment to interest enthusiasts and businessmen. For those who want a computer but don't know which to choose, help is at hand.

On sale at DATA '81 will be the latest edition of the Computer Reference Guide's Australian Microcomputer Handbook. The handbook, at \$23, will save the prospective computer buyer "countless hours of comparison", according to co-director Mr. Tony Webster.

"The new edition, which comes out in July, contains detailed information on what sort of computers are available, what software can be used and what additions are on the market. We also give details of price and local distribution, and each computer section has a three to four-page summary of its attributes and abilities.

"It took us a long time to prepare, so it would probably take the home buyer even longer to make the same comparisons. Furthermore, a browse through the handbook by the uninitiated could save a very costly mistake." ▶

LIST OF EXHIBITORS

Adler Business Machines Pty Ltd,
Cnr Lane Cove and Waterloo Roads,
North Ryde NSW 2113.
Tel: (02)887-7644

Stands 1, 2

Adler's display will cover its vast range of equipment designed for the electronic office, ranging from typewriters and calculators to sophisticated word processing and small business computer systems.

International Computers (Australia) Pty Ltd,
100 Arthur St,
North Sydney NSW 2060.
Tel: (02)929-0411.

Stands 3, 4

ICL, which offers on-line real time systems and commercial applications, will have a number of products on display.

ICL's packages include STARS, a sales and general accounting package with particular emphasis on order entry; SAFES, a production control system; and SPARES, a high-volume package for the spare parts industry with sophisticated re-ordering facilities.

ICL also provides specialised solutions for individual problems.

Cooley Douglas and Associates,
100 William St,
Kings Cross NSW 2010.
Tel: (02)357-3377

Stand 5

Cooley Douglas and Associates, established since 1969, is an independent software house and therefore prides itself on giving independent advice as regards the implementation of computer systems.

A team of consultants will be on hand at the stand to talk about systems development and other services.

Mitsui Computer Systems (Australasia) Pty Ltd,
7 West St,
North Sydney NSW 2060.
Tel: (02)929-9921

Stand 6

Overseas Telecommunications Commission (Australia),
32-36 Martin Place,
Sydney NSW 2000.
Tel: (02)230-5827

Stand 7

Adaps Ltd,
97 Pacific Highway,
North Sydney NSW 2060.
Tel: (02)929-4599

135 Inkerman St,
St. Kilda Vic. 3182.
Tel: (03)536-0141

Stands 8, 9

Adaps supplies software for mainframe and microcomputers and will be demonstrating software on microcomputers at DATA '81. It will also have information on hand about the McCormack and Dodge ranges of financial software for large mainframes.

Computer Supplies (Aust.) Pty Ltd,
54 Alexander St,
Crows Nest NSW 2065.
Tel: (02)439-5533

Stand 10

Dicker Data Projects Pty Ltd,
24 Woodfield Boulevard,
Caringbah NSW 2229.
Tel: (02)524-5639

Stands 11, 12



Sord systems are marketed in Australia by Mitsui Computer Systems. This is the M200 Mark VI, which features a 4 MHz Z80A CPU, 64K RAM and 8K ROM.

Dick Smith Electronics Pty Ltd,
396 Lane Cove Road,
North Ryde NSW 2113.
Tel: (02)888-3200

Stands 13, 14

Dick Smith Electronics will be featuring the Exidy Sorcerer and Dick Smith System 80 computers. The Sorcerer is the only computer that converts to a word processor or assembly language development system by changing a simple plug-in 'ROM-PAC'. The System 80 is the latest and lowest-priced personal computer on the market. With prices beginning at under \$700, it is the ideal computer for hobbyists or small-scale business use.

The computers on display will range from low-cost hobbyist set-ups to full-scale business systems capable of handling an entire business's accounting and word processing functions. A wide range of programs will be running on the computers - everything from sophisticated games to a complete accounting package for a small business.

As well as the computers, Dick Smith will display a wide range of calculators and other related products, plus an extensive collection of books on computers and computing. Trained Dick Smith staff will be on hand to answer questions and to demonstrate the equipment. All the equipment on display is available at Dick Smith stores around Australia.

Digital Electronics Pty Ltd,
31 Bridge St,
Pymble NSW 2073.
Tel: (02)449-4400

Stands 15, 16

Digital Electronics Pty Ltd is an Australian company which designs and produces computer systems and other microprocessor-based equipment. Its work covers a number of areas, including special research-oriented project work, data logging and process control and commercial systems.

DE recently received acclaim for its work with the CSIRO to produce a microprocessor-based system for automatically measuring the fineness of wool. The system, known as the Fibre Fineness Distribution Analyser (FFDA), uses a laser beam as part of the measuring process.

Hanimex Pty Ltd,
108 Old Pittwater Road,
Brookvale NSW 2100.
Tel: (02)938-0275

Stand 17

Hanimex is a long-established Australian importer of a wide range of products from cameras and microfilm to sporting equipment. At DATA '81 its office equipment division will be displaying Zilog and Sanders equipment, including the Zilog MCZ 1-05 micro-computer and Sanders Media 12-7 multi-font printer, as well as other equipment.

The division deals in micrographics, pagers, fax machines, computers, printers and copiers.

Computer Reference Guide,
Suite 204, 284 Victoria Ave,
Chatswood NSW 2067.
Tel: (02)411-2576

Stand 18

The Computer Reference Guide provides a number of publications relating to computer and associated industries in Australia. Three of these are 'up-date-able' subscription services with the following titles: Minicomputers, Microcomputers and Peripherals Word Processing

Data Communications and Terminals.

These services summarise and report on computer hardware, systems and application software associated with the above three areas. An additional publication entitled The Australian Microcomputer Handbook has proved to be a very popular low-cost publication for people in the small system area.

All the publications will be on display.



The Vector MZ, marketed by Dicker Data Services, is a powerful, versatile S-100-based system.

Keyboard Training,
6th Floor, 22 St. John Young Lane,
Woolloomooloo NSW 2011.
Tel: (02)357-1933

Stand 19

'KEYTRAINER', an audio visual training aid, which provides a number of ways to improve the performance of data entry operators, terminal operators, programmers, typesetters and word processors, will be exhibited.

Developed in the UK as a means of providing high-quality instruction when person-to-person training is not available, it can be used for initial training or as a permanent in-house means of providing a refresher course.

For the duration of the course an instructor remains on the client's premises and works with the client's operators on its equipment. Training also includes instruction in machine functions and programming.

Microsystems Pty Ltd,
140 Arthur St,
North Sydney NSW 2060.
Tel: (02)922-3494

Stand 20

Microsystems is actively involved in micro publishing and microcomputers.

It specialises in filming commercial documents on to microfiche and has a computer output microfilm bureau at Parramatta, with the source document bureau located in North Sydney.

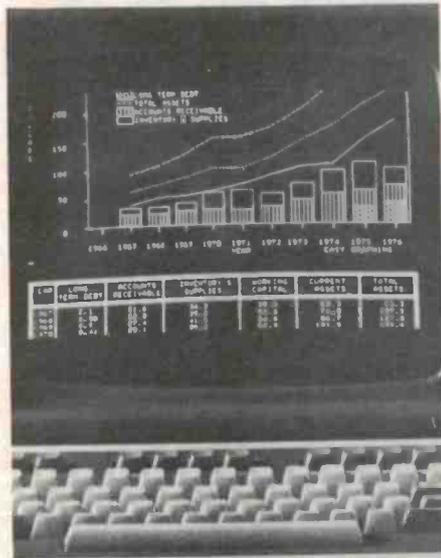
It also sells products such as microfilm readers and filing for microfiche.

Tektronix Australia Pty Ltd,
80 Waterloo Road,
North Ryde NSW 2113.
Tel: (02)888-7066

Stand 21

A world leader in computer graphics, Tektronix will be exhibiting a selection from its computer graphics products including high resolution graphics terminals, colour terminals, desk-top computer graphics, mini-computers and associated peripherals.

A special feature will be the recently released 4110 series of computer display terminals, which have set a new standard of speed associated with power in computer graphics. The 4110 series consists of the 4114, a 19-inch, high resolution, direct-view storage



Tektronix are the industry leaders in computer graphics. This display is typical of what you can get on their 4025.

tube with refresh and fast local redraw capabilities; and the 4112, a moderate resolution 15-inch faster scan model featuring the high addressability of the storage tube.

Computer Tape Storage,
5 Nathan Lane,
Willoughby NSW 2068.
Tel: (02)958-1799

Stand 22

Calidad Magnetics Pty Ltd,
100 William St,
East Sydney NSW 2000.
Tel: (02)357-1355

Stand 59

Metropolitan Business College,
5th Floor, AMP Centre,
50 Bridge St,
Sydney NSW 2000.
Tel: (02)232-7666

Stand 24

Kenelec (Aust.) Pty Ltd,
48 Henderson Road, Clayton Vic. 3168.
Tel: (03)560-1011

Stand 25

Kenelec has had 19 years' experience in the supply and service of computer peripherals and scientific Instruments in Australia. With offices in most states, it distributes a wide range of printers, VDU displays, flexible disk drives and paper tape punch and reader units.

At DATA '81 Kenelec will be displaying both new and well-established products including:

The R2E, a new and powerful Z80-based computer system made in France by the Honeywell-Bull organisation, with a major feature the availability of a 5 1/4-inch Winchester fixed disk drive with 5 Mbytes capacity.

The Teletype Model 43 printer with dual RS232 ports to allow connection of auxiliary equipment such as paper tape punch and readers.

Visual Technology VDUs with a selection of four screens.

The Data Royal '5000' series printer offering 80/132 column, bi-directional printing.

The IBM System 34 plug-compatible Decision Data serial printer model 6541-04 and the visual work station 3571-11.

The Remex single and double-sided eight-inch flexible disk drives with on-board controllers and provision for up to three slave drives. Also on display will be a range of Remex paper tape punch and reader peripherals.

Kwikasair Express,
30 Beaconsfield St,
Alexandria NSW 2015.
Tel: (02)698-0011

Stand 26

Kwikasair Express 'Computer Delivery', the official carrier for DATA '81, has a unique service in the transportation of computers and other delicate equipment.

Interstate vehicles are equipped with air ride suspension and are fully insulated to control temperature variation.

Electric stair crawlers, hydraulic tailgate trucks and two or three-man crews are used on all pick-ups and installations. All computer and other delicate units are wrapped in 'bubble plastic' for protection against dust and moisture.

Kwikasair offers express transit times nation-wide with overnight deliveries between adjoining eastern states, a next-day service between Sydney and Adelaide and a two-day service between Melbourne and Perth. 'Computer Delivery' also features an easy-to-calculate pricing formula based on weight and destination.



Tandy's latest — the TRS-80 Model III.

Tandy Corporation,
280-316 Victoria Road,
Rydalmere NSW 2116.
Tel: (02)638-6633.

Stand 27

Tandy will have microcomputer systems and related equipment on view, both for the businessman and the home user. The TRS-80 series has already proven popular among the latter.

The cassette-based computer can be used for accounting and record keeping, but also comes with the availability of more than 100 programs sold directly by Tandy plus over 3000 from outside programmers written for Tandy. The display will also include a typewriter quality daisy wheel printer along and many other electronics products for which Tandy is famous.

Datael,
3rd Floor, 80 Chandos Street,
St Leonards, NSW 2065.
Tel: (02)439-4211.

Stand 28

Ibex Computers Australia Pty Ltd,
1st Floor, 127 York Street,
Sydney NSW 2000.
Tel: (02)29-6755.

Stand 29, 30

Ibex will be exhibiting a section of the range of micro-computers it manufactures, including the Ibex 7201 model which is used for medical and dental applications. Also on show will be the Datasouth DS 180 high speed dot matrix printer.

United Data Centres Pty Ltd,
127 Bowden Street,
Meadowbank, NSW 2114.
Tel: (02)807-3666.

Stand 31

Magnetic Media Services Pty Ltd,
5 Apollo Place,
Lane Cove NSW 2066.
Tel: (02)428-1100.

Stand 32

W. E. Hoskins,
PO Box 255,
Cronulla; NSW 2230.
Tel: (02)523-1002.

Stand 33

Wilson Bros (Printers) Pty Ltd,
28 Louis Street,
Chippendale NSW 2008.
Tel: (02)699-9933.

Stands 35, 36



In the world of personal computers there is just one that is known as the best: the PET

**NOW
16K RAM
AT 8K PRICE
\$999**

The Commodore PET has become the standard for the Personal Computer Industry.

The Pet is completely integrated, with the processor, memory, keyboard and visual display unit contained within a robust housing, allowing easy transportation with no interconnecting cables necessary. In order to retrieve and save your data and programs, a storage device is used which operates like a cassette recorder, with your information recorded reliably on standard cassettes. The PET has 16k bytes of RAM. Optional equipment permits expansion to 32k. Also, it has 14k bytes of ROM.

The Pet communicates in BASIC—the easiest computer language. Easy to learn and easy to use, BASIC has now become the standard for personal computers, with literally thousands of programmes available. The PET is also programmable in machine language, allowing more efficient use of the system.

The full-size keyboard is capable of producing letters, numbers and graphic symbols. Upper and lower case is standard. Characters appear

on the screen in a pleasant green colour designed to reduce eye fatigue and may be displayed in normal or reverse print.

PET's IEEE-488 Bus—just like H.P.'s mini and full size computers—permits direct connection to over 200 pieces of compatible equipment such as counters, timers, spectrum analysers, digital voltmeters and printer plotters from H.P., Philips, Fluke, Tectronix and others.

The full range of Commodore Disk Drives and Printers are plug-compatible with the PET and a comprehensive range of cassette and disk based programmes are available through the extensive network of Commodore Dealers.

APPLICATIONS

The Commodore PET is a creature of many faces. Its applications are limited only by the user's imagination.

The future of the PET is virtually unlimited; its present capabilities are already many and impressive. As a personal computer, the PET can teach languages and mathematics; play games; create graphic designs; store meal recipes and change

number of portions; maintain budgets, personal records and checkbooks; operate appliances and temperature controls.

As a management tool, it delivers the information the executive needs, in the form he can use, and available to him alone. Trend analyses charts and graphs can be almost instantly available.

The professional may use the PET for maintaining appointment schedules, recording income and expenditures and filing all the specialized information and forms he may need to make his work more efficient—from medical records for a doctor to income tax computations for an accountant.

The engineer, mathematician, physicist, has a tool far superior to the very best programmable calculators yet developed... at a cost that is comparable... and with almost infinitely greater versatility.

And the businessman has a computer that can maintain inventories, keep payroll records, operate accounts payable and receivables, issue cheques and handle correspondence.

Commodore PET 4016 Computer Technical Specifications.

Computer/Memory

Read/Write Memory (RAM) 16K bytes available to the user.

Read Only Memory (ROM) 14K bytes in total, divided into:

8K BASIC interpreter available immediately you turn on your PET.
5K Operating System
1K Test Routine

The 6502 micro-processor chip makes the PET one of the fastest and most flexible BASIC systems. Significant features of Commodore BASIC are:

- 960 simple variables
- 960 integers
- 960 string variables
- 960 multi-dimensional array fields for the above 3 types of variables
- Up to 80 characters per program line with several statements per line
- Upper/Lower case characters and graphics capability
- Built in clock
- 9-digit floating point binary arithmetic
- True random number generator
- Supports multiple languages: machine language accessibility

Keyboard

74-Key professional keyboard.
Separate calculator/numeric pad.

Upper-case alphabetical characters with shift key to give 64 graphics characters. Can be set for lower case and shifted upper case characters.

Screen
40 characters wide by 25 lines (1000 characters in 8 X 8 dot matrix).
23 cm screen phosphor screen.
Brightness control.

64 ASCII plus 64 graphics characters.
Blinking cursor with full cursor control, including programmable control.

Screen editing capabilities

Full cursor control (up, down, left, right).
Character insert and delete.
Reverse character field.
Overstriking.

Return key sends the entire line to the CPU regardless of cursor position.

Input/Output

8 bit parallel input/output port.
IEEE-488 Bus (HP-IB and IEC Bus) allows up to 12 other peripherals to be connected.

Two cassette ports.
Video signals for additional displays.
Serial output port.

Technical Data

Dimensions: Height 355 mm (14"). Width 419 mm (16.5"). Depth 185 mm (18.5"). Shipping Weight 20.9 kg (46 lbs). Power requirements 240V ± 10%. Frequency 50 Hz. Power 100 Watts.

Commodore BASIC

APPEND	GOSUB..RETURN	STOP	SPC
BACKUP	IF..THEN	SYS	LEFTS
CLOSE	INPUT	VERIFY	RIGHTS
CLR	INPUT *	WAIT	MIDS
CMD	LET		CHRS
COLLECT	LIST	SGN	ASC
CONCAT	LOAD	INT	LEN
CONT	NEW	ABS	VAL
COPY	ON..GOSUB	SQR	STR\$
DATA	OPEN	SIN	TI
	POKE	COS	TIS
DEF/FN	PRWT	TAN	ST
DIM	READ	ATN	DS
DIRECTORY	RECORD	LOG	DS\$
DLOAD	REM	EXP	+
DOPEN	RENAME	AND	-
DSAVE	RESTORE	OR	*
END	RUN	NOT	/
FOR/NEXT	SAVE	TAB	↑
GET	SCRATCH	POS	π

Commodore

microcomputers

Anderson Digital Equipment Pty Ltd,
Unit 1, Pioneer Avenue,
Thornleigh NSW 2120.
Tel: (02)848-8533.

Stands 37, 38

Anderson Digital Equipment will be emphasising two areas at DATA '81. The terminals group will be showing models of the newly acquired Centronics printer range up to the 600-lines-a-minute line printer and other data terminals. The systems group will display the North Star micro-computer system and ADE business microcomputer systems with supporting terminals, storage and memory devices to suit these and other major minicomputer suppliers.

Moore Paragon Australia Ltd,
The Boulevard,
Richmond Vic. 3121
Tel: (03)429-3411.

Stand 39, 40

Moore Paragon is Australia's largest business forms manufacturer and is closely linked to the application of computers through its wide range of products and services.

American Micro Systems Pty Ltd,
275 Alfred Street,
North Sydney NSW 2060.
Tel: (02)922-3099.

Stand 41

American Micro Systems will be unveiling a number of software and hardware packages new to the Australian market covering market research, the short term money market, bill of materials, financial modelling, word processing and data communications and data base.

Each of these has been developed in Australia through co-operation with the respective industries. AMS claims to be the largest seller in Australia of commercial microsystems.

John G. Stevenson & Co Pty Ltd,
221 O'Riordan Street,
Mascot NSW 2020.
Tel: (02)669-6033.

Stand 42

Australia's largest locally-owned freight forwarders and customs agents, John G. Stevenson, will have a special display featuring FACS (facilitated air clearance service) equipment which enables importers to reduce significantly the time it takes to air freight goods from the US.

The stand will be manned by John G. Stevenson's staff and by Ms Karen Guide, a US expert in the transportation of computer equipment.

The Computer Resources Company Pty Ltd,
32 Huntley Street,
Alexandria NSW 2015.
Tel: (02)516-4099.

Stands 43, 44

Computer Resources has updated and extended its complete range of computer room furniture, tape and storage systems and mobile terminal tables. All this will be amply displayed along with a new 26-page computer supplies product guide.

AM Jacquard,
204 Botany Road,
Alexandria NSW 2015.
Tel: (02)699-8555.

Stand 45, 46

AM Jacquard will display its J500 standalone word processing system, its J100 shared logic system and OCR and will demonstrate its latest software.



Anderson Digital Equipment base their systems and software around the acclaimed Northstar micro.

Amalgamated Wireless (A/Asia) Pty Ltd,
132 Arthur Street,
North Sydney, NSW 2060.
Tel: (02)922-3300.

Stand 47

AWA will be demonstrating the Micromax small business computer system as part of its commitment to small business, an indication of which is a 12-months full parts and labour warranty on Micromax.

AWA boasts that within all State capital cities, it can supply service at the user's site within four hours of a fault being reported. Outside the metropolitan areas, a cross-over replacement unit is despatched as quickly as possible.

The Micromax is a versatile microcomputer sold through a network of authorised dealers around Australia, all of whom have been selected for their ability to serve the needs of the first-time computer user.

Micromax has as a key feature the STARDOS multi-user operating system, enabling it to handle several tasks at the same time. It also offers a wide and varied range of software applications.

Commercial Computer Centre Pty Ltd,
10 Pitt Street,
Parramatta NSW 2150.
Tel: (02)635-4544.

Stand 48

Commercial Computer Centre claims to be the largest data entry organisation in Australia, operating with five divisions. Among the products on display will be Syncrom magnetic media.

Hartley Computer,
39 Sherwood Road,
Toowong QLD 4066.
Tel: (07)371-5444, (02)816-1155.

Stands 49, 50

Hartley is best known for developing the public accountants' package HAPAS and general accounting package SHEILA. It will be demonstrating both on its successful 3900 series computer.

M.S.C.O. Computer Sales,
Suite 6, Willunga Place,
3 Old Castle Hill Road,
Castle Hill NSW 2154.
Tel: (02)680-2161.

Stand 53

M.S.C.O. is a Cromemco dealer specialising in application software, mainly for public accounting. Its systems range from a public accountants system to small to medium sized commercial systems.

It will be displaying the Flexicount package for public accountants and a complete manufacturing package. Flexicount is a highly flexible accounting and management system allowing for a single user or up to seven users. M.S.C.O. will be releasing new products at DATA covering manufacturing, multi-user debtors, creditors and stock control packages and a number of smaller specialised taxation packages.

Memorex Pty Ltd,
61 Barry Street,
Neutral Bay NSW 2069.
Tel: (02)908-2211.

Stands 54, 55

Memorex, a leading supplier of IBM compatible communications equipment and computer media, plans to have a comprehensive display, including the Memorex 2076 communications controller, the 2087 printer and 2078 VDU. There will also be a dynamic display hooked up to a system in the company's office in Neutral Bay.

Racal Electronics Pty Ltd,
47 Talavera Road,
North Ryde NSW 2113.
Tel: (02)887-3666.

Stand 56

Established in Australia almost 20 years ago, Racal Electronics is part of the rapidly expanding Racal Group of Companies.

With vast experience in data communications Racal prides itself on providing a comprehensive service to both first-time users and industry "giants".

Equipment includes time division multiplexers, modems, modem sharing devices, frequency division multiplexing, statistical multiplexing, network management and diagnostic systems, line drivers, lineplexers, patching equipment, data link monitors and testers.

Sigma Data Corporation Australasia Pty Ltd,
157 Walker Street,
North Sydney NSW 2060.
Tel: (02)922-3100.

Stand 57, 58

Sigma Data distributes Datapoint data processing and communications management systems, Wordplex word processing, Applied Digital Data Systems (ADDS) peripherals and terminals, Centronics printers and Maxell computer supplies. Among its many products on display will be the new Series 80 word processors.

Liveware Pty Ltd,
19 Boundary Street,
Rushcutters Bay Sydney 2011.
Tel: (02)33-4268.

Stand 60

Wilke Business Forms Pty Ltd,
41-45 Lorraine Street, Peakhurst NSW 2210.
Tel: (02)53-0771.

Stand 61

Wilke Business Forms, in conjunction with its associated companies, has production facilities in four States and sales offices in every Australian State. It manufactures a wide range of continuous stationery, business forms and multisets for the computer industry. In addition it also markets the "UARCO" range of forms handling equipment. The range includes bursters and delevaers for both mini-users and larger mainframe establishments. Among equipment on display will be the new table top Model 2202 delevaer.

O'Reilly Computer Pty Ltd,
6 Ryde Road,
Hunters Hill NSW 2110.
Tel: (02)896-2799.

Stand 83

O'Reilly Computer (formerly GM O'Reilly & Associates) is best known for developing the highly successful financial and management accounting package FAMAS. O'Reilly Computer have added DOCCEN, a word processing package, CHEMPAC, a chemical formulae bill of materials package and a real estate package.

These and one or two others still under wraps will be demonstrated on the powerful Japanese ABC series of microcomputers which O'Reilly is marketing under licence.

Omni Office Furniture Systems,
23 Monro Avenue,
Kirrawee, NSW 2232.
Tel: (02)521-8333.

Stand 66

The Omni Office display will demonstrate the potential of well designed modular furniture to provide for a happier VDU work environment.

Omni believes too little thought has been given to the ergonomic and productive needs of VDU operators and associate staffing, including analysts, programmers and professionals.

Omni Office furniture is a free-standing system of linked panels onto which are hooked desks, storage modules, pinboards, drawers, whiteboards, lamps and power outlets, etc. Staff can easily re-arrange the layouts after hours, to keep pace with changing needs.

Omni Office will be releasing a fully adjustable VDU work station incorporating an L-shaped desk and fully adjustable seating. All necessary media is stored within convenient reach of the operator and ducting for power, signal and Telecom lines is built in.

Task lights and ambient lighting are designed into the system to minimise eye strain and power consumption. Special adjustable stands are also available for

printers and the Omni Cabinet has interchangeable modules for storing and displaying disc packs, floppy discs, microfiche, aperture cards, tape seals and cassettes.

Syfar Pty Ltd,
Box 2154,
GPO Sydney NSW 2001.
Tel: (02)922-7222.

Stand 67

Syfar is a North Sydney software house specialising in providing solutions for a variety of individual problems. It provides solutions covering such areas as real estate management and manufacturing and production control. It is also a dealer of AWA's Micromax, an integrated business package.

The Computer Company Pty Ltd,
4 Cliff Street,
Mills Point Sydney NSW 2061.
Tel: (02)436-1733.

Stands 68, 69

The Computer Company will be exhibiting its recently-released comprehensive computer system which includes hardware, software and training with a price tag of less than \$10 000.

The price puts the system, based on the Panasonic 740 computer, into the bracket once occupied by hobbyist computers, yet offers a full range of business applications. The model 740 is one of the Panasonic family of microprocessor based computers for which TCC is sole Australian distributor.

The package includes well-proven applications software for order entry, invoicing, accounts receivable, accounts payable, stock control and sales analysis.

Graphic Directions Pty Ltd,
8th Level, 28-36 Foveaux Street,
Surry Hills NSW 2137.
Tel: (02)212-4199.

Stand 70

Creative designers and exhibition promoters, Graphic Directions, which is responsible for DATA, will have its own stand to show its annual reports and printing section.

Caringbah Sheet Metal (Aust) Pty Ltd,
42 Cawarra Road,
Caringbah NSW 2229.
Tel: (02)524-0791.

Stand 71, 72

Caringbah Sheet Metal will display a full range of EDP storage systems, which it has specialised in developing over a number of years.

Datacraft Pty Ltd,
Cnr Lincoln and Croydon Roads,
Croydon Vic. 3136.
Tel: (03)725-5477.

Stand 73

Fliway Computer Transport,
Cnr William and Banksia Streets,
Botany NSW 2019.
Tel: (02)666-4700.

Stand 74

Fliway Computer Transport offers total transport and installation services to all areas of the electronics industry. With 18 years' experience, it has built a reputation as a leader in the handling and transportation of high value equipment throughout Australia and New Zealand.

The company services interstate haulage, metropolitan installation, storage and staging rooms and site inspections and supervisions of installations at any location within Australia.

Control Data (Aust) Pty Ltd,
508 St Kilda Road,
Melbourne Vic. 3004.
Tel: (03)51-0351.

Stand 75, 77

Control Data Australia offers software targeted at specific industries and areas, including education, mining and petroleum, government, weather and environment, electric utilities, banking and finance, engineering and manufacturing.

Sola Basic Australia Ltd,
109 Alexander Street,
Crows Nest, NSW 2065.
Tel: (02)439-1503.

Stand 78

McGraw Hill International Training Services,
PO Box 253,
Forestville NSW 2087.
Tel: (02)406-4288.

Stand 79

McGraw Hill International Training Services is an international division of McGraw Hill incorporated in the US and has combined a number of products to aid the data processing and business systems markets.

One of the better known of these is the Datapro range of directory services which have been used in Australia for many years by the data processing community. Other products to be on display will be the Edutronics range of data processing training course materials, the Tratec range of marketing and sales training programs, the Medsy Reports on hospital and pathology computer systems, and related books of interest to the industry.

J. Saunders & Sons Pty Ltd,
62-64 McLachlan Avenue,
Rushcutters Bay NSW 2011.
Tel: (02)357-6661.

Stand 80

Saunders is a company specialising in raised printing and will be promoting the business card side of its operations with an attractive display and a "lucky draw" prize of \$500. The winner will be drawn on the last day of DATA '81 from the collection of business cards that visitors will have pinned to a special display board in the Saunders stand, with the result appearing in the Sydney Morning Herald of September 2. The display will also show raised printed letterheads, both loose and mounted for word processors.

IBM Australia Ltd,
100 Walker Street,
North Sydney 2060.
Tel: (02)923-5829.

Stand 81, 82

At time of writing IBM was not too prepared to reveal what was to be displayed.

M.I.M.S.,
Suite 5, 1st Floor,
163 Commercial Road,
Prahran Vic. 3000.
Tel: (03)241-6571.

Stand 84, 85

Pacific Computer Weekly,
73 Commonwealth Street, Sydney NSW 2000.
Tel: (02)212-2077, (03)51-8431.

Stand 86

The Australian,
2 Holt Street,
Surry Hills Sydney NSW 2000.
Tel: (02)2-0924.

Stand 93

See article in this months E.A.
KIT AVAILABLE THIS MONTH

UNBELIEVABLE!

THIS MUST BE AUSTRALIA'S BEST VALUE COMPUTER!



- Full size keyboard
- Video modulator
- 9K Super Basic
- 16K RAM
- Cassette Interface
- S-100 Expandable

THE
EA/DICK SMITH
**SUPER
80**

Are you
fed up with 'built up' projects?
- why not build this professional
quality computer & save over 50%
on equivalent built units!

A FULL SIZE 16K COMPUTER KIT

You are supplied with a full
board including power-on
EPROM monitor, 16K of RAM,
cassette interface (relay
activated) for universal control
of any tape recorder, TV
modulator and direct video
output PLUS full size
professional keyboard

Above photo shows
some parts which are optional
- not supplied in basic kit



ALL THIS
FOR ONLY **\$289.50**

SHORT FORM KIT
Cat. K-3600

P & P
\$5.50

PROFESSIONAL
QUALITY
KEYBOARD

DON'T PAY
OVER \$600 FOR A
BUILT UP 16K COMPUTER
WITH BASIC!

THE
FANTASTIC
**SUPER
80**

EXTRAS
Transformer M-2325 \$22.50
BASIC interpreter on tape... K-3602 \$24.50
IC socket set (Recommended) K-3603 \$12.50
Yes, this would make the full
computer with 9K BASIC &
16K RAM

ONLY \$349.00

THAT'S
\$50
LESS

than our advertised
price 12 months ago!

Supplied with re-print of EA article.
● Combined large Assembly and Technical manual \$12.50 B-3600
● 'Super' Basic Reference Manual \$14.50 B-3602

**DICK SMITH
ELECTRONICS**



See our other advertisements in this
publication for store addresses, phone
numbers, post and packing etc.

935M/AH

APPLE AND NORTHSTAR
COMPUTER BUYERS
APPLE AND NORTHSTAR
COMPUTER OWNERS

COME TO COMPUTER COUNTRY

AT COMPUTER COUNTRY — We have always believed our customers are entitled to quick delivery and total and comprehensive after-sales service and advice. We have based our whole business on providing quick and efficient delivery and professional after-sales support. So if you are thinking of purchasing a micro-computer system or adding to the one you already have, make a good investment — invest in a little bit of time to talk to the professionals at Computer Country. Remember the quality of the after-sales hardware service and continual after-sales software and hardware advice you get is just as important as the price of the system you buy. Come and have a chat with the professionals of Computer Country just once and you'll realise how much help we can be in enabling you to get the most out of your microcomputer system.

Computer Country stocks a wide range of microcomputer hardware including the Apple, Northstar, Commodore, Texas Instruments, NEC, Impact data and many more. We carry a wide range of software for many systems including the TRS-80. We can also help you in customising software for your specific application.

Our service department not only completely backs up all hardware purchased from us, but invites enquiries from those who have purchased elsewhere and have hard-to-fix problems.

Make a Smart Move — Come to

COMPUTER COUNTRY

338 QUEEN STREET,
MELBOURNE, 3000, VICTORIA
(03) 329 7533

(Authorised Apple Service Centre)

in Queensland contact:

COMPUTER CITY

600 OLD CLEVELAND ROAD,
CAMPBILL, BRISBANE, QLD.
(07) 398 6759

- Enquire now about our National Adventure Tournament.

COMING SOON

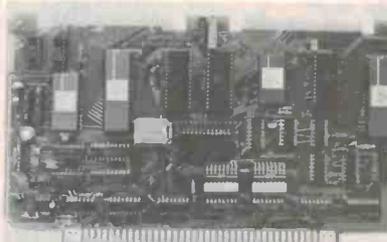
68PDC04

Processor and Disc Controller Card.

- Accepts Motorola 6802 and 6809 micro-processors
- Single 2716 (+5V) or 2732 EPROM for each microprocessor
- 1k scratchpad RAM
- Extended addressing range
- Software/Hardware trace facility
- Full RS232 with handshaking
- Parallel port with control lines
- Single density/Double density, 5 inch/8 inch, single sided/double sided Floppy Disc Controller interface

68GPB03

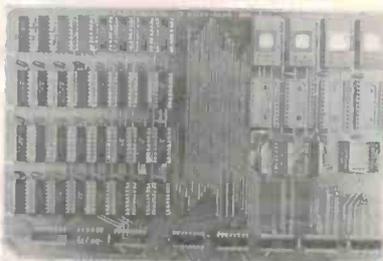
The ultimate in microprocessor I/O.



- 16 channel ADC (with 12 bit resolution).
- 2 channel DAC (with 8 bit resolution).
- 32 bit programmable I/O (2 x MC6821).
- 6 programmable timers (2 x MC6840).
- 2 serial synchronous/asynchronous interfaces.
- Hardware and software programmed baud rate generation.
- High quality double-sided PCB.
- Motorola Exorciser Bus and outline compatible.
- Occupies only 32 consecutive bytes.

68MBO2

Two boards in one



- 16K RAM (2114) expandable in 1K increments.
- 16K EPROM (2716, plus 5V) expandable in 2K increments.
- Two 8K RAM blocks selectable in 8K increments.
- Two 8K EPROM blocks selectable in 8K increments.
- High quality double-sided PCB.
- Motorola Exorciser Bus compatible.

MICRO GEAR

3 Coora Place, Churchill, VIC. 3842
Phone (051) 67-1498 A.H. (051) 22-1157

SME SYSTEMS

STOCK CLEARANCE SALE

16K STATIC RAM



2114 low power RAM chips, 4K addressable boundary, standard bank select (40H), 4MHz operation with no wait state required when using our chips, wait state generator for above 4MHz, plated thru holes, solder resist, optional 300ns RAMS available.

KIT \$250 A&T \$290
BARE PCB \$45

2708 16K EPROM



Switch selectable as 8 or 16K card, 8K address boundary, wait state generator, suits industry standard, 2708's standard S100, plated thru holes, solder resist.

KIT \$85 A&T \$98
BARE PCB \$45

SD MPB-100 Z80 CPU

KIT \$250 A&T \$280

NEW PRODUCT

\$599 PRINTER

80 COL. DOT MATRIX TRACTOR FEED.
CENTRONICS INTERFACE, 80 CPS,
BI-DIRECTIONAL GRAPHICS.
ASK FOR DATA SHEET

THESE PRICES VALID UNTIL CURRENT STOCK RUNS OUT

22 Queens Street, Mitcham, Vic. 3132.
PO Box 19, Doncaster East, 3109. Telex AA37213.
PHONE (03) 874-3666

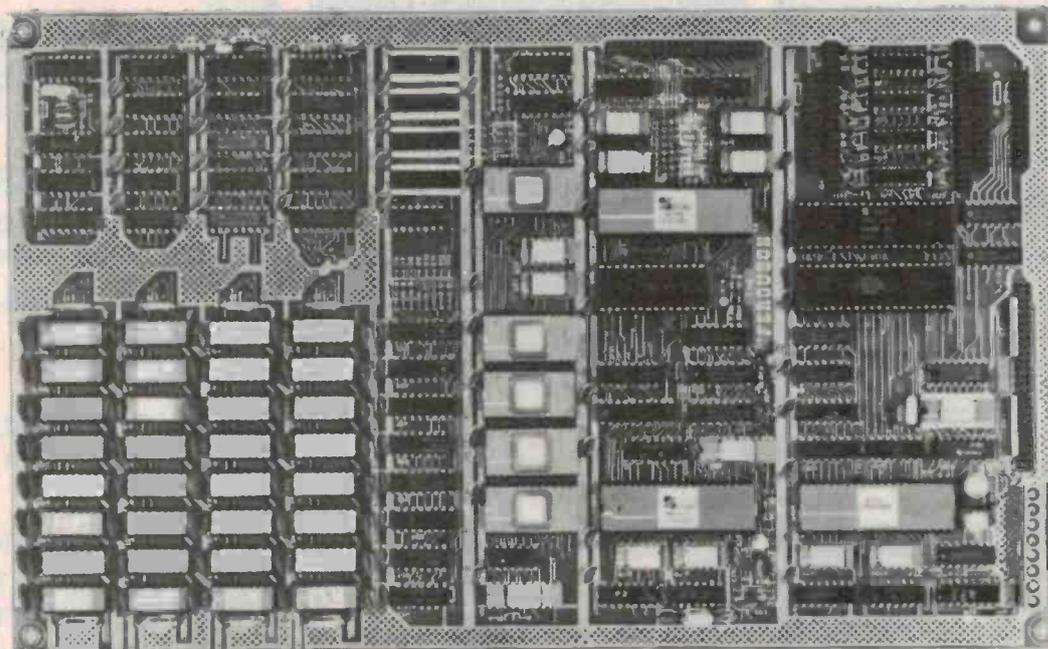
Send 66c in stamps for COMPUTER PRINTOUT CATALOGUE for more details.

ALL PRODUCTS AUSTRALIAN MADE AND IN STOCK (ALMOST)
DEALER ENQUIRIES WELCOME
Prices and specs subject to change without notice
All prices tax free. for retail prices add 15 percent.

NEW!

**"THE BIG BOARD"
OEM - INDUSTRIAL - BUSINESS - SCIENTIFIC
SINGLE BOARD COMPUTER KIT!
Z-80 CPU! 64K RAM!**

NEW!



THE FERGUSON PROJECT: Three years in the works, and maybe too good to be true. A tribute to hard headed, no compromise, high performance, American engineering! The Big Board gives you all the most needed computing features on one board at a very reasonable cost. The Big Board was designed from scratch to run the latest version of CP/M*. Just imagine all the off-the-shelf software that can be run on the Big Board without any modifications needed! Take a Big Board, add a couple of 8 inch disc drives, power supply, and an enclosure, and you have a total Business System for about 1/3 the cost you might expect to pay.

\$695.00 (64K KIT BASIC I/O)

SIZE 8 1/2" x 13 1/4" IN
SAME AS AN 8 IN. DRIVE
REQUIRES 5V @ 3 AMPS
12V @ 5 AMPS.

FEATURES: (Remember, all this on one board!)

64K RAM

Uses industry standard 4116 RAM'S. All 64K is available to the user, our VIDEO and EPROM sections do not make holes in system RAM. Also, very special care was taken in the RAM array PC layout to eliminate potential noise and glitches.

Z-80 CPU

Running at 2.5 MHZ. Handles all 4116 RAM refresh and supports Mode 2 INTERRUPTS. Fully buffered and runs 8080 software.

SERIAL I/O (OPTIONAL)

Full 2 channels using the Z80 SIO and the SMC 8116 Baud Rate Generator. FULL RS232C. For synchronous or asynchronous communication. In synchronous mode, the clocks can be transmitted or received by a modem. Both channels can be set up for either data-communication or data-terminals. Supports mode 2 Int. Price for all parts and connectors: **\$95**

BASIC I/O

Consists of a separate parallel port (Z80 PIO) for use with an ASCII encoded keyboard for input. Output would be on the 80 x 24 Video Display.

24 x 80 CHARACTER VIDEO

With a crisp, flicker-free display that looks extremely sharp even on small monitors. Hardware scroll and full cursor control. Composite video or split video and sync. Character set is supplied on a 2716 style ROM, making customized fonts easy. Sync pulses can be any desired length or polarity. Video may be inverted or true.

FLOPPY DISC CONTROLLER

Uses WD1771 controller chip with a TTL Data Separator for enhanced reliability. IBM 3740 compatible. Supports up to four 8 inch disc drives. Directly compatible with standard Shugart drives such as the SA800 or SA801. Drives can be configured for remote AC off-on. Runs CP/M* 2.2.

FOUR PORT PARALLEL I/O (OPTIONAL)

Uses Z-80 PIO. Full 16 bits, fully buffered, bi-directional. User selectable hand shake polarity. Set of all parts and connectors for parallel I/O **\$45**

REAL TIME CLOCK (OPTIONAL)

Uses Z-80 CTC. Can be configured as a Counter on Real Time Clock. Set of all parts: **\$25**

PFM 3.0 2K SYSTEM MONITOR

The real power of the Big Board lies in its PFM 3.0 on board monitor. PFM commands include: Dump Memory, Boot CP/M*, Copy, Examine, Fill Memory, Test Memory, Go To, Read and Write I/O Ports, Disc Read (Drive, Track, Sector), and Search. PFM occupies one of the four 2716 EPROM locations provided. It does not occupy any of the 64K of system RAM!

CP/M* 2.2 FOR BIG BOARD

The popular CP/M* D.O.S. modified by MICRONIX SYSTEMS to run on Big Board is available for \$150.00.

TERMS CASH CHEQUE OR BANKCARD (MIN \$100 DEP)

ALL PRICES PLUS TAX IF APP

REGISTERED PACK & POST \$5.00



RITRONICS WHOLESALE

425 High Street, Northcote, VIC.
Phone (03) 481-1923, 489-7099.
PO Box 235, Telex AA 38897.

Copy of manual and assembly instructions \$15. Refundable on purchase of board. Photocopy exchanged for original. Delivery ex stock.

Bankcard Mail Orders Welcome

Please debit my Bankcard

Bankcard No

Expiry Date

Name

Signature

ET18/81

WOW!

SORCERER MAGIC

THE LATEST!

THE BEST IN THE WORLD

BASIC DAZZLER Becomes part of your BASIC PROGRAM! 23 features including recall of screen, Keyboard scan. **NO MORE WASTED PRINTOUT!** Turns printer on/off from within program. Change cursor or even make it vanish. Change **BAUD RATE**, move **STACK**, dump memory, set **OUTPUT/INPUT**. Change header, auto exec. etc. Yes, all from within your program or **DIRECT MODE**. Includes comprehensive manual. **\$39.95**

SYSTEM 3. The ultimate **TOOLKIT!** Editor, renumber, tape merge, auto line numbers, trace, search, delete, recover crash and more. **\$29.95**

STRING MAGIC SAVER. Becomes part of your program. Allows **INPUT/OUTPUT** of alphanumeric **DATA TO TAPE!** 3 fantastic **MODES** with preferential **SORTING AND ASSIGNING** of data. Includes manual. **\$29.95**

GALAXIANS Makes Space Invaders look second rate. With fantastic sound. **\$19.95**

GROTHNIK WARS — WOW! 3-D effects. Unbelievable. For those who have mastered Galaxians. With sound. **\$19.95**

GAMES PACK — Racing, Warlord and great Lunar Lander. Special 3 for **\$17.95**

FOOLPROOF. Prevents crashes if wrong data entered or wrong key is pressed. Will only allow desired input. With manual. **NEW!** **\$16.95**

SPEEDREADER. Fantastic speed reading course on your screen. With graded exercises. Also checks your comprehension. **BRAND NEW!** **\$19.95**

BASIC TUTORIAL PACK **\$24.95**

MACHINE CODE TUTORIALS **\$24.95**

(All above are a must)

SCOPE New fantastic **EDITOR** **\$14.95**

SCOTE DEV. PAC EDITOR **\$24.95**

TOUCH TYPE TUTOR A must for all computer addicts. Easy. **\$18.50**

SCREEN GENIE Beaut. **\$16.00**

NEW INVADERS GAME **\$14.95**

MANY MORE. FREE POSTAGE.

QUICK DELIVERY (ESP. INTERSTATE)
BANKCARD WELCOME

STOP PRESS! COMPUTER SHOW OFFER!

Buy Basic Dazzler, System 3, Foolproof and receive free **STRING MAGIC SAVER**. Saving \$29.95. Or buy any 12 programs at 25% discount!

RUSH TO PJB SYSTEMS
24A Simpson St, Bondi 2026.

Name
Address
P/code

Send me
and **TICK FOR FREE CATALOGUE**

BANKCARD Quote number, expiry date, and signature.

ATTENTION ALL APPLE, TRS80, PET SYSTEM, 80 SORCERER USERS! WE HAVE THE FANTASTIC EPSON RANGE OF PRINTERS.

Lothlorien Farming

Cultivating new concepts
PROUDLY PRESENT

THE CAVERNS OF MORDIA

Truly the most sophisticated computer game of adventure and strategy yet devised!

For the Apple II, II plus Computer (48k & disk drive req'd.)

- | | |
|----------------|---------------------|
| Dungeons | Traps ... and more! |
| Drop-offs | Dagger |
| Dwarf Trade | Sword |
| Passages | Mithril Armour |
| Ascent Shafts | Flares |
| Tunnels | Dragon Net |
| Maps | Charm Ring |
| Caving Reports | Dragon Occular |
| Teleportation | Orb of Power |
| Dragons | Tremors |
| Orcs | Spider Web |
| Balrogs | Holes |
| Serpents | Evil Spirits |
| Vampire Bats | Demon Curse |
| Goblins | Gold |
| Giant Spider | Vitality Exchange |
| Demons | Chests |

- Different kind of combat with different monsters
- Complex combat/retreat with variety of equipment & situations
- Game can be interrupted & saved on disk for continuation later
- Game never repetitious
- New Maps generated on re-start

Comprehensive, illustrated, 60 page Manual
Membership in the Caverns of Mordia Club
Disk, Manual & Club Membership \$59 (Aust.)
(Postage & handling Incl'd.)

Please specify: DOS 3.2 DOS 3.3
American Express Mastercharge
VISA Bankcard Cheque

Name
Address
Card No.
Expiry Date
Signature

Send to: Lothlorien Farming,
Box 1033,
GPO Sydney 2001,
Australia

MOSS COMPONENTS

PO BOX 324, FAIRFIELD, NSW 2165.

RESISTORS

1/2W Carbon Film 5% 4¢
1/4W Carbon Film 5% 3¢

DIODES

IN4004 8¢ IN4007 ... 14¢
IN5404 ... 38¢ IN4148 5¢

5mm RED LED.. 15¢

Mounting Holder..... 4¢

TAG TANTALUMS

60¢ each

Write for Catalogue
Pack & Post 10%
Min \$1.00 Max \$5.00
Office. 68 Dawson St.,
Fairfield. NSW.

WANTED: A copywriter who can think like Dick Smith . . .

You know the ideas Dick comes up with: zany - attention grabbing - some even say ridiculous! But they work!

Trouble is, Dick is so busy and the company so big, we need more of these ideas. We need, in fact, a promotions wizz-kid: just like Dick.

But we need more than this: we also want a superman who can write good selling copy. Dick Smith style copy - from someone who has a reasonable technical knowledge, but still has a sense of humour.

You must be able to type - and you'll be expected to do all sorts of things you wouldn't expect a copywriter to do.

Intrigued? Why not come up and see me sometime. It could be the start of a beautiful friendship.

But first of all, give me a call:

Ross Tester,
Advertising Manager
Dick Smith Electronics
Phone (02) 888 3200



MAIL ORDER TO AUSTRALIA

32 Lloyd Avenue, Cremorne,
Sydney 2090.
(02) 908-2235. Tlx AA20149.

BUSINESS HOURS: Our office is open between 9 and 5 weekdays and also 7 to 10pm Monday through Thursday so that our Australia wide clients can use STD when it's cheap (after 9pm save 60 percent on your call).

SERVICE: We provide full service, equal to any in the business, on all our lines. We support fully the manufacturer's warranty and provide complete after warranty service.

PAYMENTS: 1. Bank cheque
2. Local Letter of Credit — ask your bank.
3. Personal cheque — allow time to clear.
4. For organizations who must receive delivery before payment we are strictly 7 days with a surcharge of 3 percent of the total invoice value applying for 30 days.

A receipt will be issued immediately for all monies received.

If you desire the protection of a written contract between us we can issue you with a Proforma Invoice (or quote).

DELIVERY: (door to door)

1. Customer pick-up (by arrangement) from our premises.
2. To capital cities — everything except big printers, colour monitors and peripheral cards — \$15.00 each article. To all other places — NSW \$20; Vic, Qld, SA \$27; WA \$38; Tas \$30; each article.
3. Peripheral cards — \$4.00 each by certified mail.

These prices include full insurance and also apply each way for goods returned for post warranty service.

APPLE DISCOUNTED AND NOW ...

FREE FREIGHT ON WARRANTY REPAIRS

This measure is another step in our scheme to sell Australia-wide. The barrier for all Australians to buy from us is indeed small since we offer:

- Large discounts on Apple products and substantial discounts on other products.
- Freight and insurance at \$15 per article to any capital city and between \$20 and \$38 for anywhere else.
- Two day despatch on most items.
- Free freight and insurance on any warranty repair for everyone except Sydney-siders.
- An increasing amount of informative written material available on request.
- Phone contact when STD is cheap.

Our free software and hardware catalogue contains helpful information and all our prices. Here's just a few:

THIS MONTH'S SPECIAL

(order this month
deliver next)

16k Apple II plus	\$1220	Disk	\$630
16k Apple II plus + 32k	\$1340	Disk Add On	\$476
Trendcom 200 Printer	\$630	MX-80 Printer/Interface	\$900
Z80 Softcard	\$333	Graphics Tablet	\$744
M.H. Clock	\$245	CCS Serial interface	\$157
M.H. Music System	\$458	Apple H.S. interface	\$175

For tax paid prices add
15 per cent.

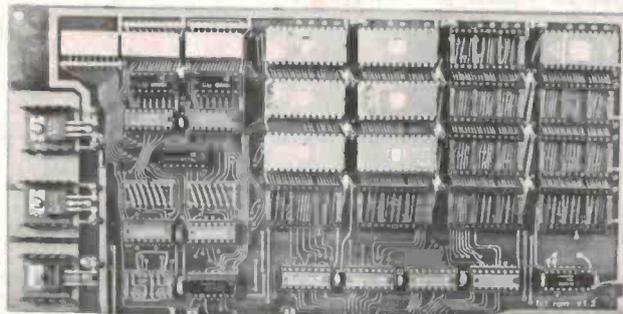
Prices subject to change and
exclude delivery charges.

APPLE CLOCK CARD

(by California Computer Systems)
\$148 tax free \$170 tax paid

PLEDGE: If there are any orders that we cannot supply from stock, a despatch date will be specified on your receipt. Failure to despatch by this date will require us to immediately and automatically issue a full refund, unless otherwise instructed by yourself.

48k RAM FOR \$295*



GOODBYE STATICS

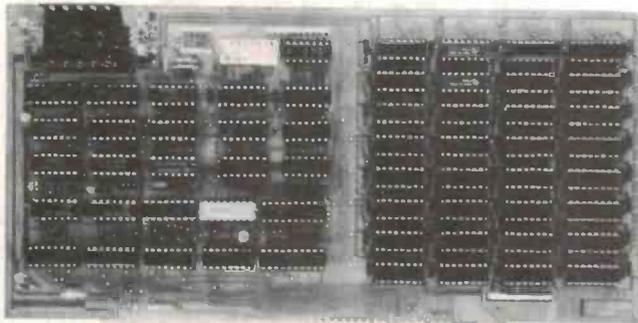
Just look at these kit prices for our
64k S100 Dynamic memory board.

	inc. tax	ex. tax
16K bytes	\$259	\$225
32K bytes	\$299	\$260
48K bytes	\$339	\$295
64K bytes	\$379	\$330
8 x 4116 (200ns)	\$ 40	\$ 35
Manual only	\$ 7	

2716 (+5V) \$6.10*

Yes! We sell the TCT "Universal" Prom board (ETI-682.) Take a look at these prices!

	inc. tax	ex. tax
Complete kit	\$115	\$100
Board only	\$ 69	\$ 60
2716 (+5V,450ns)	\$ 7	\$ 6.10
Manual only	\$ 7	



TCT Micro Design Pty. Ltd.

P.O. Box 263 Wahroonga, 2076, N.S.W.

Phone: (02) 48-5388

Please add \$3 for post and packing.

* Plus sales tax.

THE

LOGIC

SHOP PTY. LTD.

Computer Systems

- BUSINESS COMPUTERS
- PRINTERS & TERMINALS
- PERSONAL COMPUTERS
- DISKETTES & CONSUMABLES

A range available on display
in our retail stores —

MELBOURNE:

(03) 51-1950

SYDNEY:

(02) 699-4910

BRISBANE:

(07) 31-2330

PERTH:

(09) 328-7345

CUSTOMIZED TECHNOLOGY

(A MEMBER OF THE GLOBAL SOFTWARE NETWORK)

SORCERER SOFTWARE

UTILITIES:

GRAPHICS 1

Resolution of 128 X 90. Fantastic demonstration includes screen motion, X-Y-Z plotting, bar charts, circles and stars. Figures can occupy the entire screen if desired. **\$25.95**

GRAPHICS 2

Resolution of 512 X 240 using X and Y coordinates. It is parsimonious. May be accessed from other BASIC's besides Exidy's Rom-Pac Basic. A dedicated Interface is provided for the convenience of Rom-Pac users. Includes superb demonstration. **\$25.95**

Both Graphics 1 and 2 include point and line drawing features in machine code.

SUPER DISASSEMBLER

This is a very fast two pass disassembler written in machine code. It produces a Z-80 assembly language source file with labels that is directly compatible with the Sorcerer Development Pac.

The disassembler has a Displacement function which allows any program residing anywhere in memory to be decoded, whether it is at its normal address or has been moved to be decoded.

The output can be sent to video, printer or cassette. The cassette file can be read into the Editor or Assembler of the Development Pac.

Several versions on tape at different memory locations. (N.B. Development Pac not necessary). **\$21.95**

GAMES:

CONCENTRATION

Flip cards to match the hidden objects. You will be pleasantly surprised by the way this program makes use of the Sorcerer's graphics. **\$12.95**

BASEBALL

You play against the computer in this highly graphical game. **\$15.95**

HEAD-ON COLLISION

You must avoid the computer controlled car. Three levels of play. **\$16.95**

ARCADE GAMES WITH SOUND:

SORCERER ASTEROIDS

Using keyboard or joysticks try to keep safely from moving asteroids and flying saucers that fire at you. **\$21.95**

SORCERER GALAXIANS

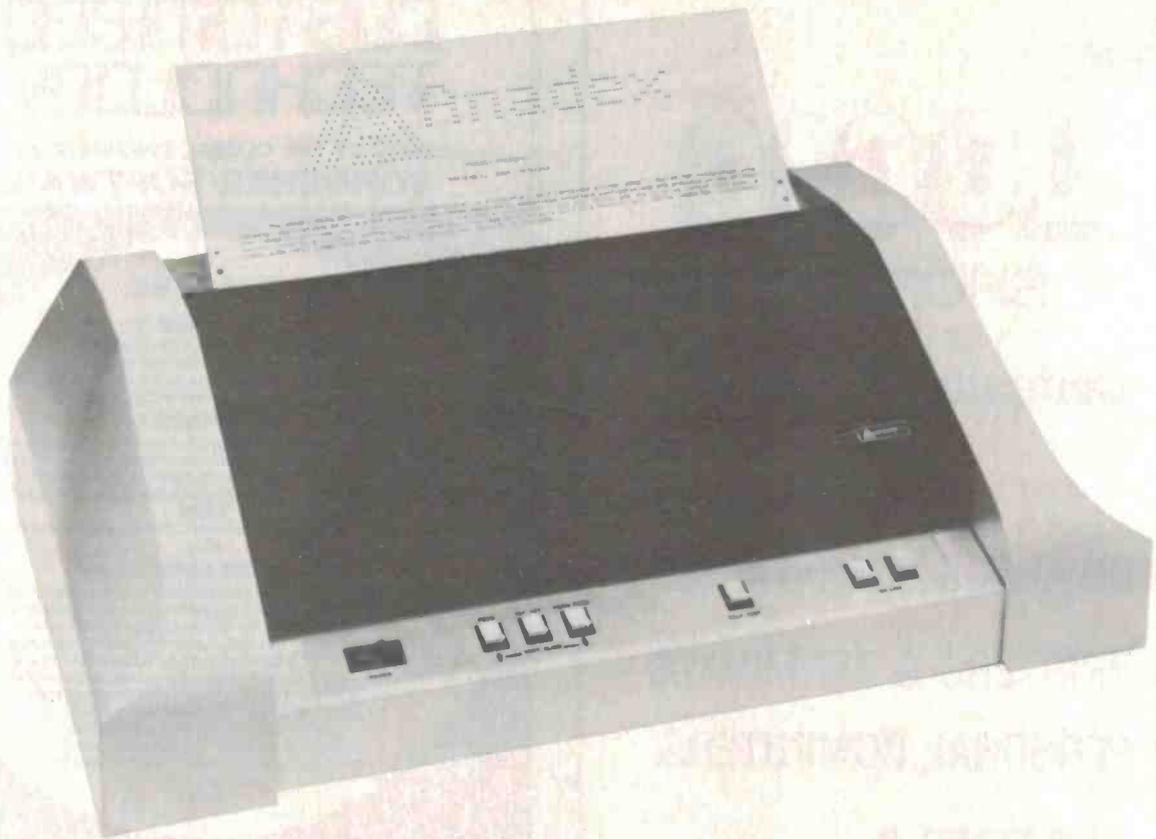
Ships peel out of formation zipping across the screen firing at you. **\$19.95**

These programs
and more are available from:

P.O. Box 461
ASHFIELD, N.S.W. 2131

or:

City Personal Computers, David Reid
Electronics, Dindy Marketing,
Electronic Agencies and other outlets.



A look at the Anadex DP-9500 printer

Next to the CRT terminal, the second most popular input/output device is a printer. Elaine Ray looked at the Anadex DP-9500 printer for us, and found it a reliable and versatile machine, with particularly good graphics capability.

Elaine M. Ray

A COMPUTER is of very little use without a good quality hard-copy device, and with a huge range of makes and models to choose from it often becomes a bewildering task for users to choose the printer that is best suited to their specific application.

Changes in technology over the last twelve months have caused the price of printers to fall considerably, while at

the same time there has been a rise in the quality and reliability of models offered.

A large number of printers offered for use with microcomputers do not have keyboards and cannot be used for entering data into the computer. Most models offered have a number of switch selectable and communication selectable features that give the end user a wide

range of printing and formatting options.

In view of the large numbers of different brands and models available ETI was delighted when Bell and Howell offered their Anadex Model DP-9500 alphanumeric line printer for review. With no effort it was up and running, being completely plug compatible with the Vector Graphics VIP

(see June '81 issue) that was used to put the printer through its paces, and the two combined to make a very compact and efficient unit for the small business user.

Anadex Inc. of Chatsworth, California, is a high technology company manufacturing products for the industrial instrumentation and computer peripheral market. Bell and Howell is the Australian and South East Asian distributor for Anadex and is represented by offices in all Australian capitals along with New Zealand, and a growing number of O.E.M. distributors.

The Model DP-9500 is a 96-character ASCII alphanumeric dot matrix line printer designed for all printing applications including those requiring high-density graphics. The standard printer contains a 600-character buffer of true First In First Out storage. An additional plug-in 2K buffer is available for applications requiring increased buffer storage such as CRT dump. Data can be accepted continuously or in bursts.

Pricing places this model in the mid-range of printers offered and it is

certainly well worth the asking price of \$1850 (excluding sales tax).

Print features

In reviewing a printer it is very difficult to look at anything other than its printing capabilities and features and the best way to go about this is to present the printer with a variety of print formats, graphics and document pagination requirements. Using a number of documents and the various switch and communications commands the Anadex behaved very well indeed.

Three dot matrix print densities are available:

- 10 characters per inch (cpi), printing at a rate of 150 characters per second (cps) with a 9 x 9 dot matrix format.
- 12 cpi, printing at a rate of 180 cps with a 7 x 9 dot matrix format.
- 13.3 cpi, printing at the rate of 200 cps in a 7 x 9 dot matrix format.

The 10 and 13.3 cpi printing densities are both switch selectable and communications selectable. The 12 cpi print density can be selected by communications command only. All three densities can be printed double width by com-

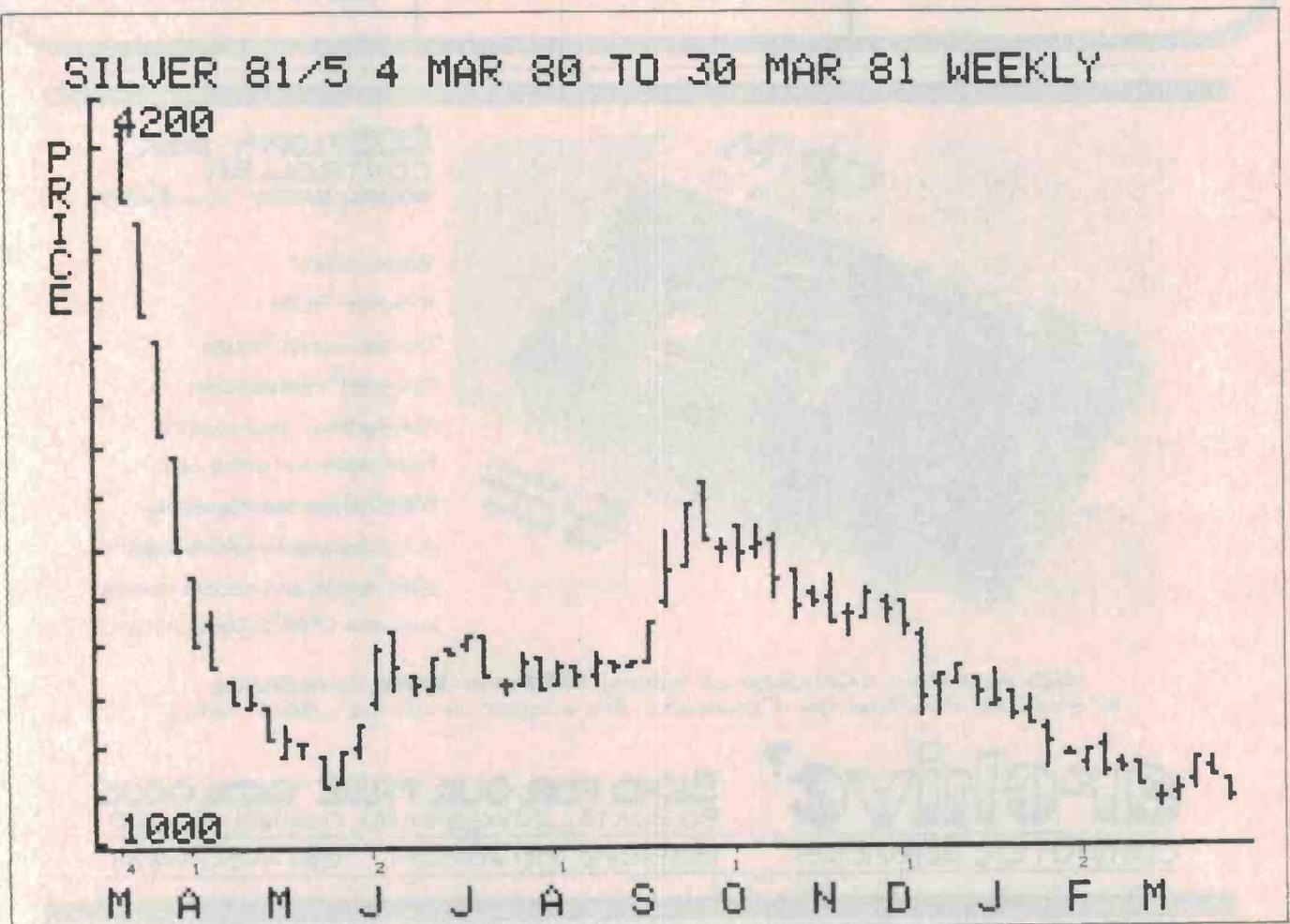
munications command. Character fonts are selectable by switch or communications control.

We noted the 132, 158 and 176 character width columns can be set and printed using the printer's nine-wire print head. The heavy duty print head is claimed to have an average life expectancy of 350 million characters. Printing is bidirectional with 'shortest distance' sensing logic. Up to eight horizontal and 15 vertical 'tab set' or 'cleared' formatting is available using communications controls.

Forms control and line feed

The Anadex offered easy to use and very efficient forms control and line feed. The stepper-motor-driven incremental paper movement was smooth and never faltered. Vertical spacing is offered at six or eight lines per inch, communications and switch selectable. Manual control of vertical registration is possible in 1.4 mm (0.056 inch) increments. Additionally, front panel switches allow bidirectional registration in 0.36 mm (0.014 inch) increments. Forms length is initially established in 13 mm increments by

This graph illustrates the sort of character construction and graphical capabilities possible on the DP-9500.

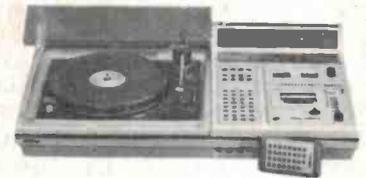


Experience in Australia the Quality of European Sound at

GERMAN HI-FI International



When in Germany you expect a lot!
In Australia you will get a lot . . .
— In Affordable Quality from —



UHER & KÖRTING

- Maxi Sound System —
- Compact Sound Systems —
- Mini Set Sound Systems —
- Loudspeakers from WHD, ISOPHON, HECO.

Available at:

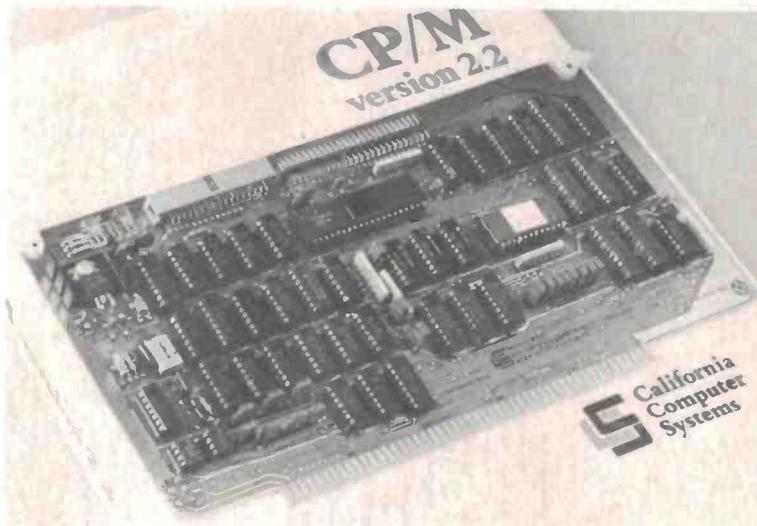
GERMAN HI-FI International Pty. Ltd.
5 McLaren Street
NORTH SYDNEY NSW 2060
Phone: (02) 924178

Sole Australian Importer & Distributor:

ATRAM ELECTRONICS
5 McLaren Street
NORTH SYDNEY NSW 2060
Phone: (02) 924177

Now in SOUTH AUSTRALIA from:

MILTRONIX
129 Payneham Road
ST. PETERS S.A. 5069
Phone: (08) 423781



**CCS FLOPPY DISK
CONTROLLER**
MODEL 2422 Price \$450

- Bank select
- Monitor ROM
- Double sided drives
- Shugart[®] compatible
- Assembled and tested
- Fast seek for voice coils
- 5^{1/4} & 8^{1/4} drives simultaneously
- Auto-disables for full 64k system
- IBM[®] single and double density
- Includes CP/M[®] 2.2 and utilities

CCS also make a full range of quality S100 and Apple components
All prices are plus Sales Tax if applicable and subject to change without notice

archive[®]

COMPUTER SERVICES

SEND FOR OUR FREE CATALOGUE
PO. Box 13, 23 Wagner Rd. Clayfield 4011 QLD

Telephone (07) 262 2911 Telex 41150WATWIL

The Superboard

Ready to go, ready for more

Cassette interface, 300 Baud Kansas City standard, so you can swap programs, ask your dealer how to double the speed!

Printer port and sound generation.

All you need is a 5v power supply.

RF Modulator Connection.

24 x 24 or 12 x 48 Display

4MHz crystal

Character generators giving a full 256 characters from Alpha-numerics to planes, guns and spaceships.

4K of RAM on-board space for a further 4K ready socketed. Just plug in the chips.

6502 processor or chip as in four out of five of the top selling personal computers.

Monitor ROM, allowing you to enter machine code.

Your connection to the expansion facilities, up to 32K or RAM, dual disks and the outside world.

8K BASIC available on power up with floating point, trig functions, multi-dimensional array, and full string facilities.

Full 53 keyboard with upper case, lower case and graphic elements. Drive it in polled mode and you can detect up to eight keys pressed simultaneously — how's that for real-time games?

Joystick interface. It gives a 'natural' feel to game manoeuvres like driving a tank, firing a rocket.

Our Superboard lets you suit yourself, offering a ready to go configuration that you can add to as needed. The Superboard is the first complete personal computer system contained entirely on a single board.

This is a major electronic breakthrough and we at Ohio Scientific accomplished it by using custom state-of-the-art LSI micro circuits. The Superboard offers you more features than many of the more expensive alternatives.

We designed the Superboard specifically with versatility and economy in mind. It is suitable not only for the serious computer user, but also for first time users, the student or the hobbyist. The Superboard gets you off to the right start, and you can add to it later — saving money all along the line. If you're just starting, get the ready-to-go CI model, then all you'll need is your cassette and television set and you're into the world of computers in a really serious and flexible way.

- EXPANSION CAPABILITIES:
- UP TO 32K MEMORY
 - DUAL MINI-FLOPPY DRIVES
 - FULL COLOUR VIDEO
 - PROTOTYPING BOARDS
 - A/D AND D/A CONVERSION



OHIO SCIENTIFIC



SPECIAL OFFER!! — direct from ETI



HERE IS A MOST UNUSUAL SPECIAL OFFER.

Our company has for sale 1500 of the most superbly made binders you've ever seen in your life!

We bought them for a data service which has since closed down. They are specifically intended to hold data sheets and similar material which must be referred to constantly. All those for sale are brand spanking new — but we can show you some old ones that have been in constant hourly use for over 20 years and they are still as new!

We know this sounds like hyperbole, but these devices can only be described by using superlatives. They're made (like a Rolls-Royce!) by the Swedish company Aggripa.

For example, the hinge assemblies are made of heavy-gauge plated steel. The spine and all outer edges of the covers are heavy-gauge enamelled steel. Apart from the steel hinges holding the covers, the spine itself is hinged down the centre, enabling the binder to lie completely flat for easy insertion and removal of material.

As may be seen from the pix, material is held in place by an eight-hole pin mechanism — actuated by a remote control trigger at the bottom of the spine. They hold paper measuring approximately 230 mm x 300 mm, and will take a stack about 45 mm thick.

These binders are ideal for housing valued reference material, data sheets, etc, etc.

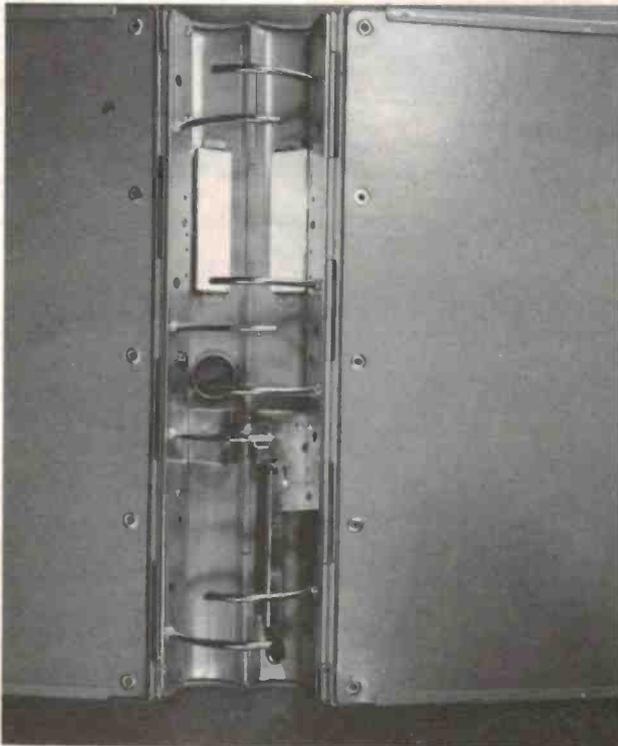
These binders are not normally obtainable in small numbers — if they were the retail price would be at least \$25 each.

We are offering them exclusively to ETI readers for the absolute bargain price of \$10 each (plus \$2.00 post and packing). See also inset table for quantity prices.

These binders may be inspected at our Sydney and Melbourne offices during normal working hours.

UNCONDITIONAL MONEY-BACK GUARANTEE.

ETI guarantees to return the purchase price in full and without query to any reader/s not totally satisfied with their purchase, providing the goods are undamaged and returned within seven days of receipt.



PLEASE FORWARD (QTY) OF BINDERS.

I ENCLOSE CHEQUE/POSTAL NOTE FOR

Name

Address

..... Postcode

Please make out cheques to ETI and forward together with order to BINDER OFFER, Electronics Today International, 15 Boundary St, Rushcutters Bay NSW 2011.

PRICES

1 - 5	\$10 each	plus \$2.00 each p & p.
6 - 24	\$9.00 each	free
25 plus	\$8.00 each	free

switch setting and modified by communications control in single line increments to 255 lines. This allows for quality printing of large, specialised documents.

By adjusting the tractor positioning, forms widths can be set from 1.75 to 15.6 inches (44.5 to 396 mm). Printable line width is communications controllable from 1.0 to 13.2 inches (25.4 to 335 mm) in 0.1 inch (2.5 mm) increments. The skip-over perforation is established initially by switch selection. However, it can also be modified by communications control, giving great printing flexibility.

Automatic line feed is both switch and communications selectable to provide an automatic line feed after a CR code, which will terminate printable data only upon receipt of an LF, VT or FF code. The switch selectable truncate/wrap-around mode is useful to allow either truncating lines containing more characters than the selected Form Width and Character Width Font allow, or print the excess characters on the next line. Forms feed is commanded from communications or the front panel switch.

An original document may be printed with up to five copies. Paper loading is very easy and alignment no problem.

Graphics

True high density graphics are available under direct control of the data source. The resolution of 72 dots per inch vertical (about 28 per cm) and 60 dots per inch horizontal (about 24 per cm) is excellent for most graphics requirements. Dots may be printed in groups of up to six vertical dots simultaneously across the page on a per line basis. The paper can be advanced unidirectionally in 0 to 9 increment steps per instruction byte. By printing a six-dot vertical group and stepping six increments, a continual vertical line is printed.

Graphic dots are transmitted in seven-bit bytes, six of which directionally control the six print needle solenoids normally used in printing graphics. These graphics bytes are transmitted on a single line basis by transmission of a control code at the beginning of each line of graphics data. If alpha characters are to be printed in the graphics mode, the data source must map the characters, or the line must be overprinted on the next pass of the printhead.

Communications

Three ASCII-compatible interfaces are standard with the Model DP-9500:

- Serial ASCII, RS-232-C interface, which accepts Serial ASCII asynchronous input data. The printer may

be programmed to function at any of the standard rates between 50 and 9600 bits per second. Data rate is switch selectable. Input character codes of either seven or eight-bit words are accommodated. A handshake signal indicates when the internal buffer storage can accept data.

- Serial ASCII, Current Input — this interface can accept serial ASCII asynchronous input data at rates from 50 to 4800 bits per second. The interface is compatible with either the 20 mA or 60 mA current loop required by Teletype printers.

- Parallel Bit, Serial Character Synchronous. This interface accepts input data in parallel bit, serial character form at a closed loop rate in excess of 1000 characters per second. Data bits are accepted on receipt of an internally generated strobe signal. Internally generated ACKNOWLEDGE and BUSY signals indicate the minimum time interval between strobe signals and when the internal buffer storage is full. Two alternative signals are available, INPUT BUSY and BUFFER EMPTY, for those applications having a single handshake signal capability. Input data and all interface control signals are Centronics-compatible.

Communications control includes the following features:

- DEC protocol simulation.
- STX/ETX: full point-to-point communications capability is available and is switch selectable. In this mode, data preceded by ASCII code STX is accepted but not printed. Upon receipt of the ASCII code ETX, the printer responds to the data source with an ASCII ACK or NAK code. If the data was unsatisfactory, the code is NAK, the data block is cancelled and the data source can retransmit the data. If the code was ACK, the data source can transmit either ASCII code EOT or STX and the data will be printed. By switch-selection the ETX may be followed by an LRCC character.

- CAN: receipt of the ASCII CAN code causes any unterminated data to be cancelled.

Conclusion

The Anadex DP-9500 is a sophisticated and reliable quality dot matrix printer suitable for a number of different applications. Its graphics capability is particularly impressive. Any small businessman looking for a printer would be well advised to consider the Anadex closely. ●



Microcomputers?

MACROSERVICE

283 CLARENCE ST
SYDNEY NSW 2000

TEL: 29-2402, 922-1709

ASSOCIATED WITH QT USA

CALIFORNIA COMPUTER SYSTEMS PRODUCTS U.S. Price in Aust. Dollars

CCS 2422 DISK CONTROLLER \$376.00
INCLUDING CP/M 2.2 on either 8" or 5¼" diskette
RECOMMENDED U.S. RETAIL PRICE \$425.00

• Z80 CPU	\$310.00	• 16 STATIC RAM 450ns	\$349.95
• 64K DYNAMIC RAM	\$720.00	• MAINFRAME	\$434.50
• 4 PORT SERIAL I/O	\$340.00	• SERIAL/PARALLEL I/O	\$360.00
• 4 PORT PARALLEL I/O	\$250.00	• MOTHERBOARD 12 slots	\$130.00
• SOLDER TAIL BOARD	\$ 29.95	• WIRE WRAP BOARD	\$ 45.00
• ETCH BOARD	\$ 21.00	• EXTENDER BOARD	\$ 38.00

HARD DISKS COMING SOON

Please allow 10% for freight, and 15% for sale tax if applicable

27 MHz RADIO CONTROLS

If you are looking for REMOTE CONTROLS for garage door controls, security systems, alarms etc.,

TALK TO US FIRST!

We are Australia's leading maker. Our range covers most of your requirements.

ELSEMA

PTY. LTD.

73 Kootingal Street,
Greystanes, NSW. 2145.
Phone (02) 636-3162

HIGH QUALITY

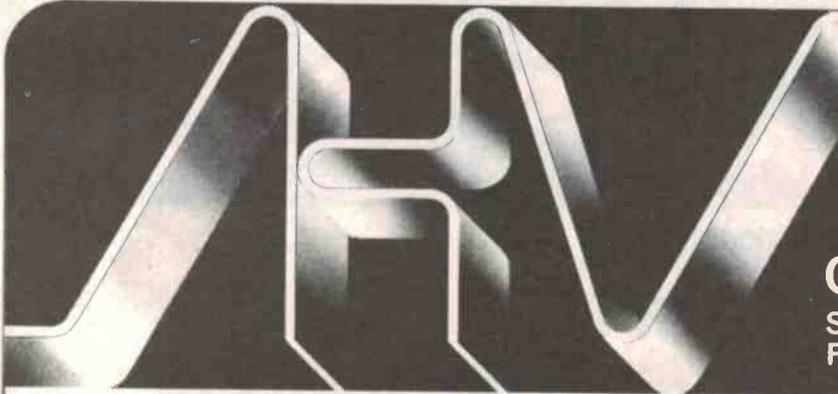
Baked Enamelling
Hammertone
Wrinkle etc.

SPECIALIST IN ALL
OFFICE EQUIPMENT
AND INDUSTRIAL
SPRAY PAINTING

COUGAR INDUSTRIAL SPRAY PAINTERS

86 Robey Street,
Mascot, NSW 2020
Phone (02) 667-1325

Commodore 4016.....\$875.00 + \$101.25 S.T.
Apple Programs by Progressive Software
• Roster — complete records for teachers requires 48K and disk\$64.00
• Mailing list — on disk\$24.00
• NEW •
Memory expansion board for SYSTEM 80 add 16K.....\$150.00 + \$22.50 s.t.
add 32K.....\$175.00 + \$26.25
Apple 11 plus 16K.....\$1240.00 = \$186.00 S.T.
COMDATA — Commodore Data Retrieval 32K
State BASIC version.....\$150.00
Epson MX-80 printer.....\$820.00 + \$123.00
Paper Tiger printers..... call for prices
XYMEC HY-Q 1000 printer.....\$2700.00 + \$405
Superboard series 11 4K.....\$355.00 + \$42.00
Superboard series 11 8K.....\$385.00 + \$46.50
Commodore & Apple Computers..... call for OUR SPECIAL prices
VIC-20 — available shortly — may be ordered now
Memorex Disks 5¼" 10/\$4.20ea 50/\$4.10 100/\$4.00 includes s.t.
Sorcerer 32K, used, inc. BASIC, W.Pro, Dev Pack, S-100 Exp. unit, Itoh 9X7 printer, Micropolis disk drive, programs.....\$3450
Prices subject to change without notice
COMPUTERWARE
305 LaTrobe St., Melbourne 3000
Telephone (03) 602 1006



1982 Australian Home Video Convention

Sydney Hilton
February 13/17, 1982

Australia is the world's fastest growing market for home video software and hardware.

Both the general public and the trade are invited to participate in the 1982 Convention which will include extensive display areas featuring the latest in video software and hardware available from Australian and International exhibitors.

The 1982 Convention will feature top Australian and International speakers who will lead workshop sessions on a variety of areas including:

- Copyright law
- Pirating
- Censorship
- Retailing
- Merchandising
- Promotion
- Closed circuit applications
- Software Developments
- Hardware Developments
- Video for education and training
- Video for recreation and pleasure
- Video production
- Video resources

For further information about attending and/or promotional facilities contact the Convention organisers:—

L.D. Graham & Associates Pty. Ltd.
Management Consultants,
155 Drummond Street, CARLTON,
Vic.3053.

Tel. (03) 347 3437 or (03) 347 5076

Name: _____

Address: _____

P/Code: _____

City Personal Computers

Personal and Small Business Computer Systems

C.P.C. has established itself as Sydney's leading supplier of Microcomputers for business or home use.

We stock the most popular systems, together with a complete range of accessories and the widest selection of software in Australia. We have everything from disk drives and printers to full business packages, education systems and game programs.

So whatever your computer needs — from business forecasting and analysis, to games and education — rely on us for the best Microcomputing.



75 Castlereagh Street, Sydney 2000.
Phone (02) 233-8992.

AUTHORISED DEALERS FOR:

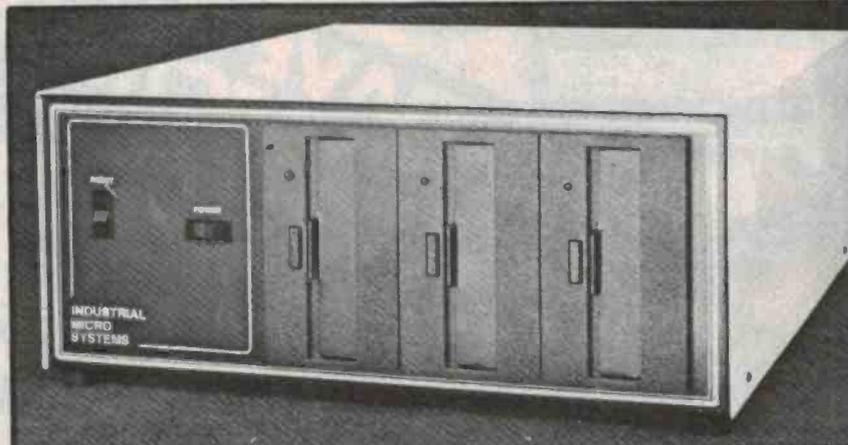
- APPLE
- COMODORE
- ATARI
- SORCERER
- SYSTEM 80
- SINCLAIR

Micro Computers From INDUSTRIAL MICRO SYSTEMS DON'T LET ITS SMALL PRICE AND SIZE FOOL YOU

SERIES 5000

The Series 5000 System requires very little money or space. But there's nothing small about the way it performs. Regardless of the size of machine you choose, there's room inside for up to 256k of IMS RAM with memory management. And the integrated floppy disk capacity is pretty impressive too — more than a million bytes! You can start with a single 5.25" drive, then install one or two more when you need them — all in the same cabinet. The Series 5000 System's power supply and disk controller are made with this kind of expansion in mind so growing is simple. And our Z-80 computers have features like serial and parallel I/O's, clocks, PROMs on board so that less slots are used on the S-100 12 slot motherboard, giving more space for extra RAM or special purpose boards.

Because the system is S-100 and CP/M based you can run all of the programs written for use with CP/M systems. (Like CBASIC, FORTRAN, COBOL, PASCAL, C, ALGOL, WORDSTAR etc.) And you can go multi-user as well!
CALL US FOR MORE INFORMATION ABOUT THIS SYSTEM OR ITS BIG BROTHER WITH THE 8" DISKS — THE SERIES 8000.



S.I. MICROCOMPUTER PRODUCTS PTY LTD

GPO BOX 72 SYDNEY 2001 92 PITT ST SYDNEY (02) 231 4091 232 6804

Melbourne (03) 26-5522. Brisbane (07) 52-8455. Hobart (002) 28-6288.

... AND NOW A PLOTTER FOR YOUR COMPUTER!

Announcing the WATANABE DIGILOT from AED, featuring:

- A3 Sized paper • Solid and Broken Lines
- Character Generator • Simple codes to plot point to point • Self Test function
- Centronics style parallel interface
- Multi-pen model also available



\$1198 + Sales Tax*

Suitable for AED Starter & Supercomputers Sorcerer, TRS-80, System 80, Apple etc. Price does not include any cables or interfaces required.



MICROCOMPUTER PRODUCTS

130 MILITARY ROAD GUILDFORD 2161 NSW
PHONE (02) 632-6301, 632-4966 Telex: AA70664

OPEN MON — SAT 9AM — 6PM

* Prices and specifications subject to change without notice.

TAKE ADVANTAGE OF LATEST TECHNOLOGY—YOUR OWN CAR COMPUTER

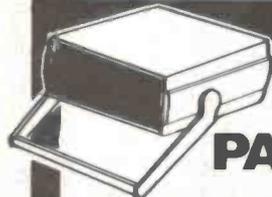
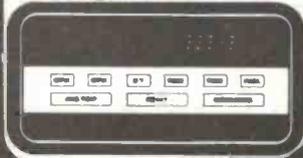
Zemco 28 Driving Computer.

- 18 Readouts boost driving efficiency, cut costs.
- Includes all sensors, hardware.
- Easy to install, detailed manual.
- Monitors fuel, speed, distance, time.
- Truly programmable.

\$159

ZEMCO 28

Zemco, Inc.



A new generation of high quality electronic enclosure kits.

PAC TEC

GIVE YOURS PRO QUALITY FINISH WITH A PACTEC ENCLOSURE KIT.

- Attractive, heavy duty.
- Six position handle.
- Multipurpose PC rails.
- Customise with card guides, vertical guides.

Models
HP \$4.85
CM5-125 \$13.45
CM6-300 \$18.76
C-23 \$31.00
CH-23 \$41.23

HI-FI • AKG • SANSUI • CHADWICK
• B&W • TOSHIBA • HARKSOUND
• JVC • EMPIRE • THORENS

DAVE RYALL ELECTRONICS

657 PITWATER ROAD, DEE WHY, N.S.W. PH (02) 982-7500.
MAIL ORDER PO BOX 176, Dee Why, NSW 2099.

TOSHIBA KT-S2 STEREO CASSETTE PLAYER WITH FM TUNER PACK

GO ANYWHERE STEREO CASSETTE WITH FM TOO!

- Unique FM Tuner Cassette.
- 40-12kHz response.
- Includes super-light headphones.
- Cue and review
- Talkline control

\$190

Metal

10% OFF TOP NAME SPEAKERS

★ Plessey Foster

C300L05 H025H02
C250L05 H016N17
C130M08 D025N15
C100M02 C050N08

★ Philips-Full Range

★ Etone

518 618 619

★ Jenzaki

200/13 13oz magnet

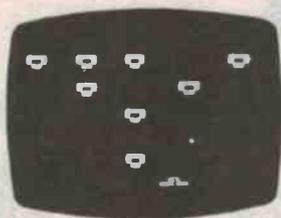


'SUPER INVASION' PROGRAM TO WIN FOR YOUR ZX80 COMPUTER!

20 PROGRAM CASSETTES FOR 20 WINNERS!

(can also be run on
the MicroAce)

Melbourne House (Australia) Pty Ltd, who are supplying software for the Sinclair ZX80 in Australia, recently released a Super Invasion program cassette for ZX80 enthusiasts. This enables you to play a version of the popular 'space' games where you have a 'ship' on screen under your control which can be knocked out by a group of invader ships. You can fire missiles from your ship to knock out the invaders, meanwhile dodging their barrage by moving your ship left and right across the screen.



To promote the newly released Super Invasion games cassette, Melbourne House (Australia) have offered 20 cassettes as prizes for this contest to go to twenty winners. The cassette normally costs around \$20.

Here's your chance to win one of these Super Invasion games cassettes so you too can play one of the most popular computer games on your ZX80 or MicroAce. Just complete the entry form and send it in.

This contest is jointly sponsored by ETI and Melbourne House (Australia) Pty Ltd — who have generously donated the prizes. Melbourne House are the publishers of '30 programs for the Sinclair ZX80:1K', reviewed in Printout in the March 1981 issue of ETI.

The Super Invasion program has the following features: • flicker-free display • three levels of play in each game • moving graphics — no hardware modifications required, just load the cassette and off you go! • available for standard or 8K ROM machines (tick box on entry form to indicate which ROM you have) • each cassette has 2K version on other side featuring automatic reset which will challenge you for hours!

You may enter as many times as you wish but you must use a separate entry form for each entry and include the month and page number cut from the bottom right hand portion of this page. You must put your name and address on the entry form and sign it where indicated.

Please read the contest rules carefully, especially if sending multiple entries.

RULES

This contest is open to all persons normally resident in Australia with the exception of members of the staff of Melbourne House (Australia) Pty Ltd, Modern Magazines (Holdings) Ltd, K.G.Murray Ltd, Australian Consolidated Press, Offset Alpine Pty Ltd and/or associated companies.

Entries should be addressed to ETI/Super Invasion Contest, Electronics Today Int., 15 Boundary St, Rushcutters Bay, NSW 2011.

Closing date for the contest is 30 September 1981. Entries received within seven days of that date will be accepted if postmarked prior to and including 30 September 1981.

The winning entries will be judged by the Editor of ETI, whose decision will be final. No correspondence can be entered into regarding the decision.

Winners will be advised by telegram the same day the result is declared. The names of the winners, together with the winning answers, will be published in the next possible issue of ETI.

Contestants must enter their name and address where indicated on each entry form. Photostats or clearly written copies will be accepted but if sending copies you must cut out and include with each entry the month and page number from 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 in each entry.

This contest is invalid in States where local laws prohibit entries.

Entrants must sign the declaration accompanying this contest that they have read the above rules and agree to abide by their conditions.

ENTRY FORM

- Name three games for the ZX80 included in '30 Programs for the Sinclair ZX80:1K' published by Melbourne House.
- Tell us in 50 words or less why you would like to play Super Invasion on your ZX80 (or MicroAce).

.....

I have a standard ROM
 an 8K ROM (tick appropriate box)

Name

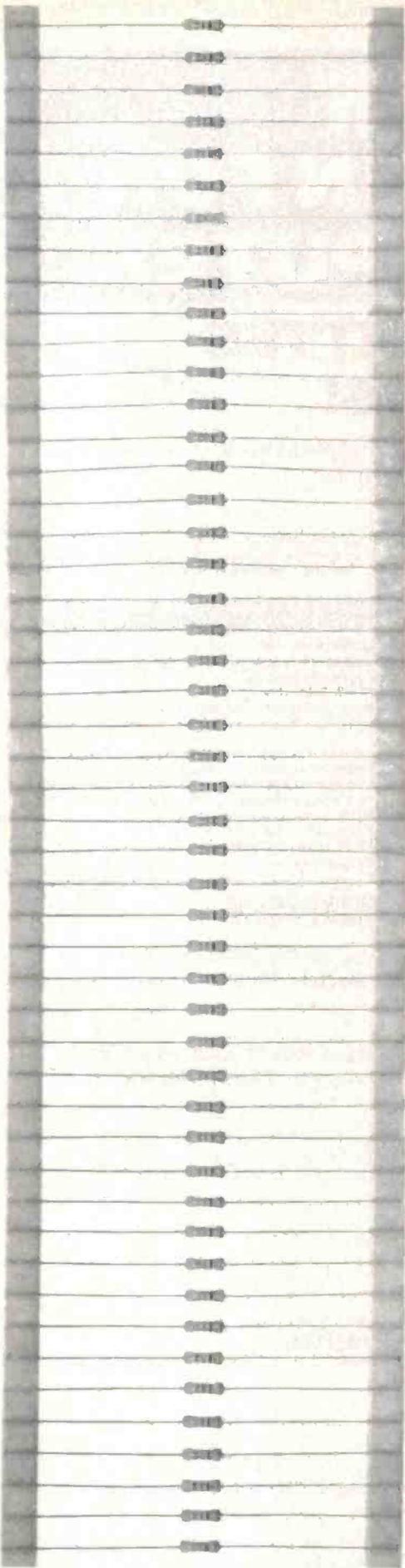
Address

Postcode

I have read the rules of the contest and agree to abide by them

Signed

Date



Metal Film technology at carbon prices

SFR Standard Film Resistors PHILIPS

At last. A range of metal film resistors with improved performance over carbon film types, at the low prices you'd expect to pay for carbon film resistors!

We're talking about Philips' new SFR25 range of 5% tolerance — $\frac{1}{4}$ W metal film resistors. With a quality and price made possible only by advancements in metal film technology and the massive scale of our automated manufacture.

SFR25s feature a 'clean lead' finish and are constructed to the same high standard as the Company's 'MR' series. Resistance coverage from 1Ω to $1M\Omega$ (E24 values) with a tolerance of $\pm 5\%$ is assured. Maximum power dissipation is 0.33W at 70°C ambient.

They have a noise figure of less than $0.1\mu\text{V}/\text{V}$ (a tenth of the carbon film noise figure) and a temperature coefficient of less than 250ppm/ $^\circ\text{C}$. Even more important, neither parameter shows degradation with increasing ohmic value. These improvements stem primarily from the homogeneity and stability of the resistive deposition.

So there you have it. Another quality product, ahead of its time, from Philips.

For further information phone:

Philips Electronic Components and Materials,
P.O. Box 50, Lane Cove, 2066. Phone: Sydney 427 0888,
Melbourne 544 2444, Adelaide 45 0211, Brisbane 44 0191 Perth 277 4199.



**Electronic
Components
and Materials**

ZX80 NIM

J. McCartney

Beats 'Matchsticks' any day of the week!

WHILST THIS GAME makes no claims for its originality, it does illustrate just how much you can expect to cram into the ZX80's 1K of RAM. This version of NIM displays three rows of markers, each of which contains a random number of elements from two to seven. You can take any number of elements from any row in your turn but whoever removes the last element loses.

Fitting it in

The program just fits into the 1K of RAM; the listing does show through in some cases but at least it doesn't crash. If you are in proud possession of the extension memory units or the new 16K module then you can probably improve the commenting and instructions.

To play the program once loaded, simply key RUN and NEWLINE. The program will prompt for the number of

elements you wish to remove (line 130) and from which row (row 160); each of these should be followed by NEWLINE. The game is programmed never to produce identical rows (in line 90) and will also check to ensure that it never gives you a winning combination to start with; the subroutine at 400 checks for this.

All entries are validated, so an attempt at cheating will lose you the game. Because you have the first move you should be able to win every time.

Five consecutive wins gives you the match.

Strategies

The game routine is contained in the subroutine at 400, so if you like you can work it out. It is worth remembering the ZX80 only works with integers.

The scoreboard is produced by lines 430 to 490 and the screen display is produced in the routine from line 500. The graphics character is in the standard code; i.e. it's the graphic on the 'Q' key. ●



Program Listing

```
10 CLEAR
20 LET B=0
30 LET C=0
40 PRINT "NEW MATCH"
50 DIM A(2)
60 FOR J=0 TO 2
70 LET A(J)=RND(6)+1
80 NEXT J
90 IF A(0)=A(1) OR A(1)=A(2) OR A(0)=A(2) THEN GOTO 60
100 GOSUB 400
110 IF J=4 THEN GOTO 60
120 GOSUB 500
130 PRINT "YOUR TURN. HOW MANY?"
140 INPUT Y
150 PRINT
160 PRINT "WHICH SET?"
170 INPUT X
180 CLS
190 IF X<1 OR X>3 OR Y<1 THEN GOTO 430
200 LET A(X-1)=A(X-1)-Y
210 IF A(X-1)<0 THEN GOTO 430
220 IF A(0)+A(1)+A(2)=0 THEN GOTO 440
230 GOSUB 500
240 PRINT "MY TURN. KEY 0,NEWLINE."
250 INPUT Q
260 CLS
270 FOR H=1 TO 7
280 FOR J=0 TO 2
290 LET A(J)=A(J)-H
300 IF A(J)<0 THEN GOTO 350
310 IF Q=1 THEN GOTO 120
320 GOSUB 400
330 IF J=4 THEN GOTO 120
340 IF M=0 THEN GOTO 460
350 LET A(J)=A(J)+H
360 NEXT J
370 NEXT H
380 LET Q=1
390 GOTO 270
400 LET M=A(0)+A(1)+A(2)+(A(0)/2+A(1)/2+A(2)/2)*8
+ (A(0)/4+A(1)/4+A(2)/4)*80
410 IF M=222 OR M=220 OR M=202 OR M=200 OR M=220 OR
M=20 OR M=3 OR M=1 THEN LET J=4
420 RETURN
430 PRINT "CHEAT"
440 LET B=B+1
450 GOTO 470
460 LET C=C+1
470 PRINT "SCORE: ZX80 ";B;" PLAYER ";C
480 IF B=5 OR C=5 THEN GOTO 10
490 GOTO 50
500 PRINT
510 FOR J=0 TO 2
520 PRINT J+1
530 IF A(J)=0 THEN GOTO 570
540 FOR H=1 TO A(J)
550 PRINT " Q";
560 NEXT H
570 PRINT
580 PRINT
590 NEXT J
600 RETURN
```

Take it easy

Hobby Electronics
AN ETI PUBLICATION
AUG. 1981
95c
NO. 8125

**Build your own
ELECTRONIC DICE**

—and this fantastic
GUITAR PHASER

—and a POWER SUPPLY
and a PHOTO FLASH TRIGGER!!

Getting into CB RADIO — it's easy and it's fun!

If you like electronics but you sometimes find you're a bit out of your depth in ETI, we've got good news for you. There's a new electronics magazine called **Hobby Electronics** that makes things a lot easier.

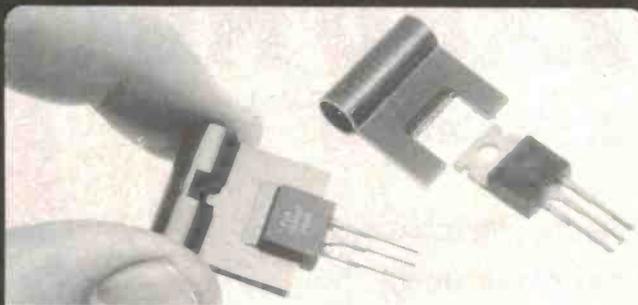
Hobby Electronics is specially designed for easy reading. That doesn't mean we use extra big print and treat you like an imbecile — it just means that we explain everything you might not already know.

Every month **Hobby Electronics** has complete, detailed instructions for building several projects, as well as fascinating features on all aspects of electronics. And because it's published by the same people as ETI, you can be sure that everything has been done properly — all the projects have been tried and tested, all the features double and triple-checked for accuracy and authenticity.

On sale now at all newsagents
only 95¢

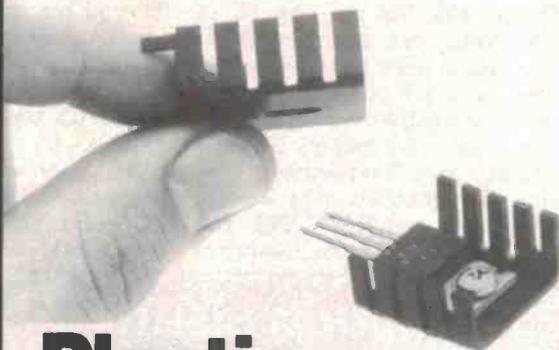
Hobby Electronics
AN ETI PUBLICATION

HEAT SINKS



Clip and Save

Clip-on Thermalloy "Slip Clip" heat sinks and save assembly time, board space, and heat sinks costs. They require no mounting hardware, PC board drilling, or adhesives, and clamp firmly to the device for maximum heat transfer. "Slip Clips" are available for TO-202, TO-220, TO-126, Motorola case 90 and most other popular case styles.



Plastic Power Coolers

New low profile heat sinks save board space

The 6073B is 19 mm square and just 9.5 mm high. It cools SCR's and transistors in TO-220, Motorola Case 70 and Case 90 packages. Dissipates 21° C/watt in natural convection. Available in Black Anodized and Pre-Black Anodized finish.



Thermalloy

Number one in Semiconductor Accessories.

TECHNICAL INFORMATION AVAILABLE ON REQUEST.



SOANAR

Soanar Electronics Pty Ltd

A member of the A & R Soanar Electronics Group
30 Lexton Road, Box Hill, Vic., 3128. Australia

VICTORIA: 890 0661
N.S.W. 789 6733
Sth. AUST: 51 6981

QUEENSLAND: 52 1131
WEST. AUST. 381 9522
TASMANIA: 31 6533

SIGHT & SOUND

The bilateral turntable arrives



Sharp's new design in record players allows music lovers to play both sides of their favourite record without having to turn it over — a development that could effectively make every other turntable now on the market seem like obsolete equipment.

Designated the VZ-3000, the home stereo set built around the new design was unveiled at the Museum of Applied Arts and Sciences in Sydney, where the Museum director, Dr. Lindsay Sharp, accepted the first set released in Australia for the Museum's collection.

The bilateral player is already being produced as part of a compact home stereo system that includes cassette tape and radio components. The complete unit will sell for less than \$1000 — reflecting Sharp's determination to make the most advanced equipment available to everyone.

The bilateral design is based on a simple concept made practical through microcomputer technology.

Instead of being in a horizontal position, the new record player is housed in a slim, vertical console. The front of the console opens and

the record is placed in vertically, then the microelectronics take over.

Once the door is closed the In-built computer automatically centres the record, recognises its size, and sets the playing speed. (Using two linear tracking tonearms (one on each side of the record), the new player allows continuous play of both sides of any size record, random play of either side and endless repeat of one or both sides, all via soft-touch controls and without the need to handle the record.

To repeat one side, a 'repeat' button is pushed, and to repeat both sides in sequence, the repeat button and 'dual play' buttons are pushed. No matter which way the record is programmed, one can switch sides immediately at the touch of a button. To momentarily interrupt play, a touch of a cue control lifts the tonearm from the groove.

Either of the linear tracking arms

can be moved from one track to another, and the system includes a host of safety factors that make it impossible to damage the record surface once the turntable door is closed.

Apart from the bilateral turntable, the VZ-3000 also features an AM/FM stereo tuner, Dolby cassette with Auto Programme Search System, 25 watt channel amplifier and matching speakers.

Club for video owners

A 'club' to assist video recorder owners and buyers to get the most from their equipment with the minimum hassle has been set up by Video Tape Network of Melbourne.

Video Tape Network offers a catalogue with a selection of all pre-recorded video tapes presently available in Australia, a wide range of exclusive new titles from overseas, a large variety of accessories not generally available in Australia, and a special members' purchase price on items like large-screen TVs, personal computers and portable video cameras.

Members receive a regular update of the catalogue and a

newsletter, and can use a special search service to help them locate a particular video tape or tapes in a particular interest area.

One year's membership normally costs \$20, but at present Video Tape Network is offering membership plus a package of tape tracker indexes for only \$10.

Contact G. Alpert on (03)329-7998 for further information.

TWICE THE FUN

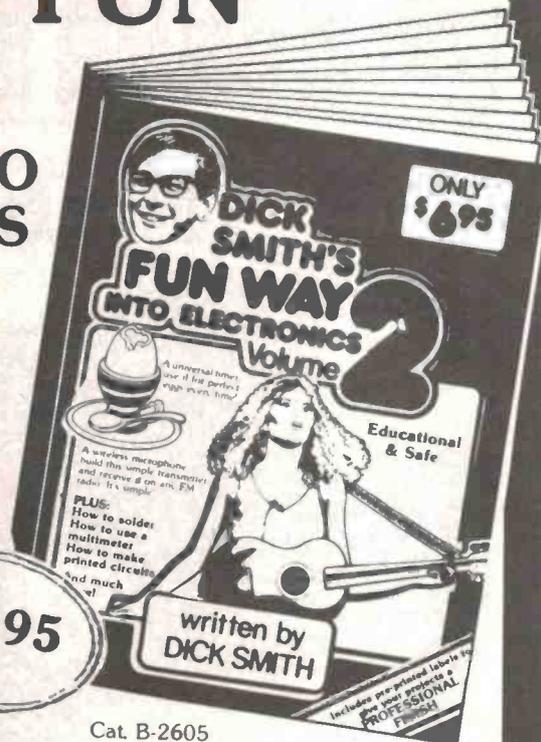
WITH DICK SMITH FUN WAY INTO ELECTRONICS Vol.1 & Vol.2



Cat. B-2600

Post and packing: \$1 per book.

\$4.95



Cat. B-2605

\$6.95

For the absolute beginner this book is a must. 20 projects from a beer powered radio to a continuity tester, all built without the need to solder. The unique 'breadboard' method of construction enables you to follow the circuit via the wires and because every project is battery powered they are perfectly safe! Learn electronics the FUN WAY.

Kits for Fun Way 1. For projects 1-10 all the parts to build any one of the projects, including breadboard. Cat. K-2600 @ \$6.90. For projects 11-20 Cat. K-2610 (this is used in conjunction with Kit 1) @ \$7.50. Buy the book and both kits for only \$17.50 Cat. K-2615 and save \$1.85 on the individual prices!

Our 7 day money back guarantee means you can not loose. If you're not completely happy with either book, you may return the book in its original condition within 7 days for a full refund of the purchase price. What could be fairer?

We now have the second print run of this superb book in stock again. Packed with 20 exciting projects to build (see kit list below) this book not only provides a lot of fun but it educates as well! From printed circuit boards to how to use a multimeter, it's all there - and it's fun.

SCHOOLS, RE-SELLERS ETC:

Ask about our incredible discounts for bulk quantities on either books or kits or both!

FUN WAY TWO KITS: EASY, SAFE & ECONOMICAL!

MULTI-PURPOSE LED FLASHER . . . \$2.75

A really simple kit that can be used as a warning device, electronic jewellery, etc. Cat K-2621

DING DONG DOORBELL . . . \$4.00

Welcome visitors to your home with this integrated circuit doorbell! Cat K-2622

MORSE CODE TRAINER . . . \$4.00

This simple oscillator circuit lets you learn Morse code the easy way! Cat K-2623.

UNIVERSAL TIMER . . . \$5.00

Use it as an egg timer, a dark-room timer, etc. in fact, it's got a lot of applications! Cat K-2624

ELECTRONIC DICE . . . \$4.75

Throwing a dice is old hat: do it electronically! Simple circuit has other uses too. Cat K-2625

MONOPHONIC ORGAN . . . \$7.50

Easy to build, and easy to play! And it even has 'vibrato' - just like the big ones! Cat K-2626

POCKET TRANSISTOR RADIO . . . \$7.50

Simple to build, and it's nice and small. Listening is so much more fun! Cat K-2627

TOUCH SWITCH . . . \$4.90

One touch on, next touch off - or 'on while touched'. Dozens of uses in the home. Cat K-2628

MOSQUITO REPELLER . . . \$4.50

Don't get eaten by mozzies: scare them away electronically. Take it anywhere. Cat K-2629

SIMPLE AMPLIFIER . . . \$6.00

A useful little amplifier for all those projects needing audio amplification. Cat K-2630

WIRELESS MIC. . . \$6.50

A tiny transmitter that can be received on any FM receiver. A great little kit! Cat K-2631

LIGHT ACTIVATED SWITCH . . . \$4.90

Highly useful for alarms, night light switches, etc etc. Sensitive and reliable. Cat K-2632

METAL/PIPE LOCATOR . . . \$6.00

A simple BFO circuit you can use to find metals, pipes, wiring, etc - maybe gold! Cat K-2633

SOUND ACTIVATED SWITCH . . . \$8.50

Picks up sound waves and trips a relay. Use as a telephone bell extender, too. Cat K-2634

HOME/CAR BURGLAR ALARM . . . \$6.00

Learn how burglar alarms work when you install your own! For home or car. Cat K-2635

ELECTRONIC SIREN . . . \$4.50

Great for alarm use - or where any warning is required. Good for kids toys, too! Cat K-2636

LED LEVEL DISPLAY . . . \$8.50

This fascinating project shows you the audio level of any amplifier. Cat K-2637

INTERCOM UNIT . . . \$8.50

Communicate! Build this intercom and talk between rooms, etc. Cat K-2638

LED COUNTER MODULE . . . \$7.50

Learn how digital circuits work by building a counter. Count slot car laps, etc. Cat K-2639

SHORTWAVE RECEIVER . . . \$6.50

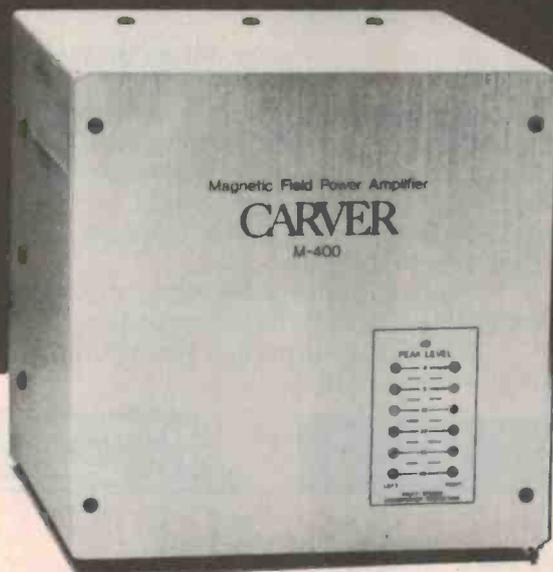
Listen in to the exciting world of shortwave radio: amateurs, foreign countries! Cat K-2640

DICK SMITH ELECTRONICS



SEE OUR OTHER ADVERTS IN THIS MAGAZINE FOR OUR STORE ADDRESSES AND RESELLERS

The audio experts are raving about the Magnetic Field Amplifier



M-400 Magnetic Field Amplifier

"Its distortion and noise levels are entirely negligible . . . it's hardly conceivable that a small, inexpensive lightweight cube such as this could deliver as much clean power as any but a few of the largest conventional amplifiers on the market."

That's what Julian Hirsch reported in Stereo Review about the Carver M-400—the unique magnetic field power amplifier. It's a cube that weighs around 4 kgs and delivers 200 watts per channel. And costs a lot less than you think.

Equally startling, the M-400 can safely drive speaker-load impedance as low as 2 ohms. And in mono it can deliver more than 500 watts into an 8-ohm load, with peaks to 900 watts! (Bring on digital audio!)

To hear for yourself why all the audio experts have flipped over Carver, ask for a demonstration and descriptive literature. It will be a totally new experience for you.

CARVER
CORPORATION

DISTRIBUTED BY CONVOY SYDNEY (02) 358 2088

Available from:

N.S.W.: LEISURE SOUND City • Parramatta • Artarmon 29 1364
VIC: TIVOLI HI-FI Hawthorn 818 2872
QLD: STEREO SUPPLIES Brisbane 221 3623
S.A.: SOUNDCRAFTSMEN Hawthorn 272 0341
W.A.: THE SOUNDCRAFTSMAN Subiaco 381 5114

Not Just Speaker Wire



Conventional speaker wire limits the performance of your sound system by decreasing power output, restricting dynamic range, and reducing clarity and definition. You can significantly improve the performance of your audio system by switching from your present speaker wire to Monster Cable.

Constructed of over 500 strands of high purity copper in a unique configuration, Monster Cable is specifically engineered for low resistance, low capacitance, and low inductance. The Results?

- Deeper, tighter bass.
- Maximum power transfer.
- Increased clarity and definition.
- Wider dynamic range.

Even low-powered systems show a remarkable improvement. Recommended by leading audio manufacturers, Monster Cable is safe to use with all amplifiers and receivers, regardless of design.

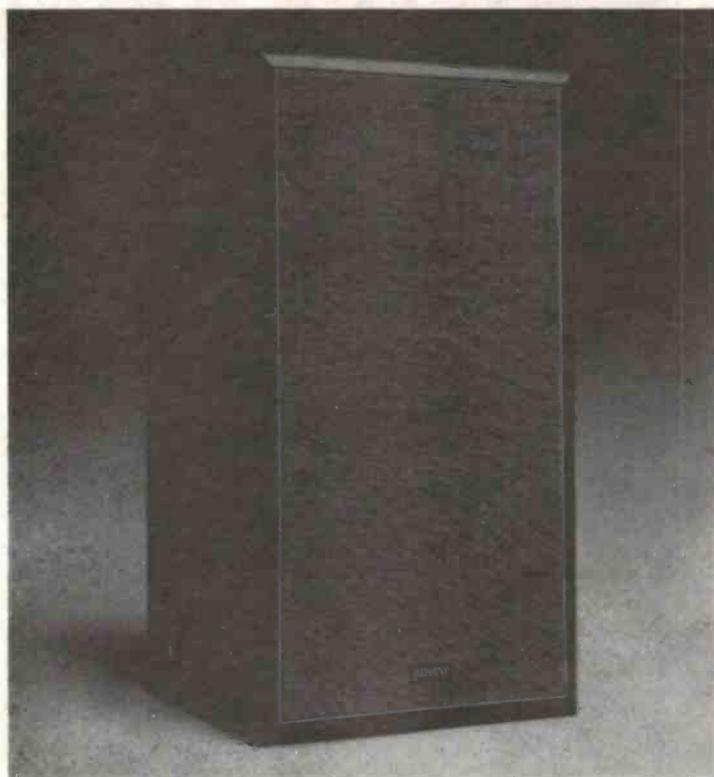
Don't be deceived by imitations. If it doesn't say Monster Cable you're not getting all the performance you paid for.

MONSTER CABLE

DISTRIBUTED BY CONVOY SYDNEY (02) 358 2088

Available from: N.S.W. Leisure Sound, City • Artarmon • Parramatta 29 1364 • Russin Electronics, Ashfield 799 2421 • Woollahra Electronics, Woollahra 389 9625 • Pitman's, Wagga Wagga 25 2155 • Wollongong Hi-Fi, Wollongong 28 3773; A.C.T. Duratone Hi-Fi, Phillip 82 1388 • Kingston Hi-Fi, Kingston 95 7895; VICTORIA Tivoli Hi-Fi, Hawthorn 818 2872 • Natsound, Melbourne 67 3484; QUEENSLAND Stereo Supplies, Brisbane 221 3623 • Disco & Stereo Supplies, Townsville 72 4226; SOUTH AUSTRALIA Sound Craftsman, Hawthorn 272 0341 • Track Hi-Fi, Adelaide 223 7285 • Grenfell Plaza Hi-Fi, Adelaide 51 5017 • Blackwood Sound, Blackwood 278 0341; WESTERN AUSTRALIA The Audio Centre, West Perth 322 5177 • Japan Hi-Fi, Victoria Park 362 1466 • Soundcraftsman, Subiaco 381 5114; NORTHERN TERRITORY Radio Parts, Darwin 81 8508.

THE NEW ADVENT RANGE.



There is a new range of Advent speakers in Australia.

While it seems that anyone these days can build a great expensive speaker, only Advent can build a great affordable speaker.

While the new range utilizes the proven acoustic suspension designed woofer with its awesome deep bass capability, the tweeter is new. This new "Direct Response" tweeter reduces overall system distortion, has an even higher end response and produces sharper focused imaging. The theories behind the design of the new tweeter are complex, but they appear to be spot on.

The new range is a positive improvement on what was an already very respectable marque.

For more information phone Chadwick today on (02) 647 1103.

ADVENT



Chadwick Audio Furnishings Pty Ltd

G/M + ASSOC/Eti/3/81

**CASSETTE
SPECIALS**

PHILIPS LOUDSPEAKERS

Price per
Box of 10

AMPEX 20/20 C90	\$19.00
AMPEX GMI C90	\$33.00
AMPEX PROF C45	\$7.50
AMPEX PROF C90	\$14.90

Mall order charges:

Up to 20 — \$2.75
20 to 50 — \$3.50
Over 50 — \$5.00

PROFESSIONALLY DESIGNED SPEAKER KITS

See us at Northpoint Hi-Fi for the new range of Philips Loudspeakers. We have the ETI-designed Series 4000 on display. Both the 4000/1 and 4000/2 can now be supplied fully assembled in timber veneer, or if you prefer to make your own boxes, we can supply the speaker components and networks.

We now also have a very efficient 50 watts 12" 3-way set of speakers available, ready to go, for only \$249 per pair.

Come in for an audition or write for further information.



northpoint hi-fi

100 Miller St, North Sydney.
Phone 922-7780.

New Quad electrostatics — finally!

We note from advertisements appearing in the June issues of various British hi-fi and technical publications that Quad have at last put an end to the rumour and speculation that have swept the industry for the past year, and released their new electrostatic speakers.

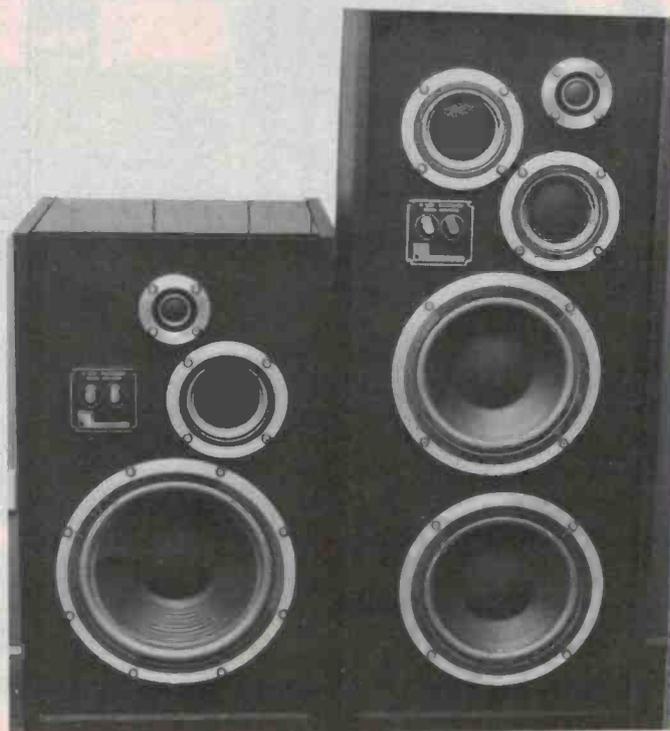
Called the ESL-63, the speakers are described as a "... full range electrostatic double ...". Here's what Quad claim:

"The Quad ESL-63 has a very light plastic diaphragm positioned between two sets of acoustically transparent concentric annular electrodes. Signal is fed to the electrodes sequentially via a delay line. The resultant sound pressure pattern is a facsimile of that which would be produced by an ideal point

source positioned some 30 cm behind the plane of the diaphragm; completely phase true, very aperiodic, with a level response and near perfect directivity index devoid of all side lobes.

"The result with a good programme source is a stereo picture of an acoustic event which we believe to be significantly superior to anything previously available."

Some claim! We'll believe it when we hear it. How soon for us, Quad?



Videotape accessories from Bib

A range of maintenance accessories for VHS and Beta format VCRs is now offered by Bib, who are well known for their audio tape maintenance accessories.



The Bib VE-2 Video Recorder Maintenance kit includes: • five special video tape head cleaning tools • tape head cleaning fluid • a can of patented 'dust-away' air blast • an inspection mirror • anti-static cleaning cloth • an illustrated maintenance manual. Bib advise that this kit is for simple, routine maintenance and claim its use will prevent and reduce undue wear on the critical tape contact points.

Bib also have cleaning tape cassettes for both VHS and Beta

machines. The VE-11 (VHS) and VE-12 (Beta) tape cassettes work by inserting the cassette and playing it for about 15 seconds to clean the heads. Bib claim each cassette has sufficient tape included to provide 20 cleaning operations.

For more information on these and other Bib video tape maintenance products, contact Bib Hi-Fi Australia, 43 Birmingham St, Alexandria NSW 2014. (02) 667-2750.

A for Andromeda

Peterson Speaker Laboratories were established in 1974, and have since made a good name for themselves as leading Australian manufacturers in the domestic and semi-professional hi-fi markets.

In their new premises in Clayton South, Peterson not only manufacture and assemble the speakers, but also the enclosures and centre console cabinets. Design engineer Bob Peters and the staff have also developed the Andromeda series of professional hi-fi speakers.

Aware of the competition from imported brands, Peterson set out to make a top range of speakers that was at the same time inexpensive in terms of value for money and aesthetically attractive. They claim to have achieved this with the Andromeda series.

Andromeda I costs around \$750 rrp and comprises a 30 cm (12") driver with matching mid-range and tweeter, both the latter being attenuated on the front panel. Standing 79 cm high x 39 cm wide x 39 cm deep, the speakers have timber joints and a removable glass top, and the whole is a finely tuned reflex system. This is a 100 W RMS unit.

Andromeda II is similarly styled but 100 cm high, with two mid-ranges and twin ports. It is also a

tuned reflex system giving 150 W RMS and sells for around \$1000 rrp.

Andromeda III is a dual 25 cm (10") driver, dual reflexed six-element speaker, 120 cm high and of a squared timber structure. It gives 200 W RMS and sells at around \$1400 rrp.

The Rolls Royce of the series is the subwoofer system, which is four speakers in all in two 100 cm enclosures, to be placed at the rear or the side of the room. Peterson claim that listening to this system is "nothing short of an auditory experience", and describe its effect as "dramatic". Rrp for this system is \$2000.

All the Andromeda series have been designed and developed over six years, keeping in mind the new generation of dc amps, digital recordings and modern compandor techniques.

For further information contact Peterson Speaker Laboratories, 11 Fury Court, Clayton South Vic. 3189.

Bosch. The Pedigreed Family in Broadcasting Equipment

The Bosch family of broadcasting equipment is renowned worldwide for its high quality professional range, and compatibility for every application. Let us introduce you.

BCN 100 VTR

automatic MULTIC ASSETTE VTR — the decisive high order extension of the BC'N system. Capable of 16 hours continuous replay on 30 min. cassettes.

BCN 5 VTR

studio quality cassette recorder, battery operated with a 20 minute recording time. Also available, the BCN 20 portable reel to reel VTR which can be mains or battery operated.

MONITORS

a wide range of fine quality precision monitors for every application.

BCN 51 VTR

studio editing unit which can be optionally equipped for full digital video effects.

KCA 100

is an ENG/EPF camera and includes fibre optic cable for shoulder or tripod operation.

KCP 60

a new concept 2/3" Diode Gun studio/O.B. camera. It's compact, plus weight and space saving.

Other broadcasting equipment in the BOSCH RANGE:

- FDL 60 — CCD Telecine
- HD SY DIGITAL SYNCHRONIZER

the only name an operator needs —

BOSCH
ELECTRONIC PRODUCTS DIVISION

SYDNEY (02) 660 1133
MELBOURNE (03) 544-0655

The Highest Fi on Wheels.

Close the car door, turn on your Sony car stereo and let us give you the finest sound on wheels.

Imagine your car filled with the sound of the Sony XR-77 car Hi-Fi with built-in 20W + 20W power amplifier and loudness control. Imagine the cassette player with Dolby noise reduction, metal tape capability, an automatic music sensor, locking fast-forward and rewind.

Imagine the sound of the powerful AM/FM receiver with quartz-locked PPL synthesizer tuning, a digital frequency readout, 5FM + 5AM station memory presets, and auto-scan tuning. Top it all off with a built-in quartz clock, and you have a hi-fi set-up that will fill your car with some of the finest sounds money can buy.

Listen to it, and imagine how good it would sound in your car.



SONY®

BONE FONE

SPECIAL OFFER — EXCLUSIVE TO READERS OF ETI

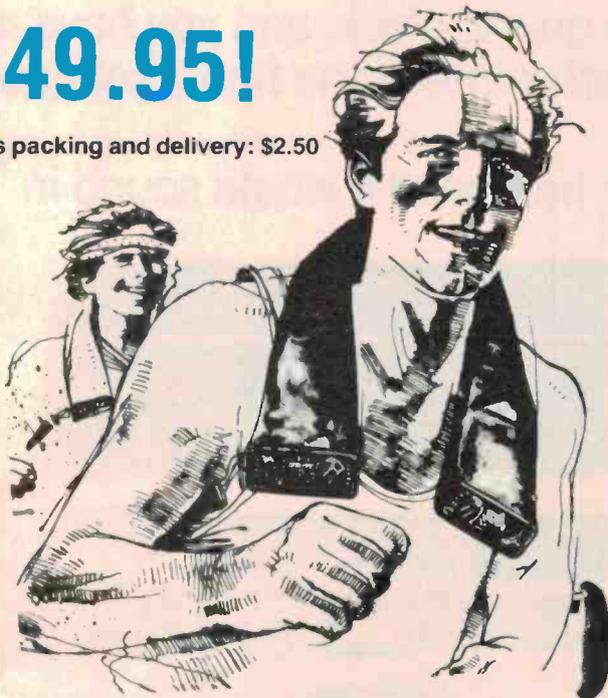
CONVOY INTERNATIONAL PTY LTD were recently appointed sole Australian distributors for the **BONE FONE** — an AM/FM stereo receiver that you wear like a scarf — and they have agreed to make a number available at a special price to ETI readers to promote the unit as it has only just been released here.

Recommended retail price: normally \$79.95

SPECIAL OFFER PRICE:

\$49.95!

plus packing and delivery: \$2.50



The **BONE FONE** is an AM/FM stereo receiver constructed so that you can wear it like a scarf. The integral speakers provide stereo sound that the manufacturer claims is heard, or rather experienced, through your body by 'bone conduction'. The **BONE FONE**, unlike headphones or earpieces, does not block out external sounds. If you're active in any sport — jogging, ski-ing, cycling, horse riding, skating, etc — the unit can be secured by straps that permit free body movement. You can wear the **BONE FONE** whilst working, gardening or mowing the lawn — or just relaxing. The **BONE FONE** is powered by four penlight batteries. The sleeves may be changed (various colours available); a blue lycra spandex sleeve is supplied with these units.

The unit is warranted by Convoy International for 90 days after purchase and is supplied with a bone-shaped storage bag, straps, warranty card and instruction booklet.

OFFER CLOSES 30 SEPTEMBER

NOTE: This offer is made by Convoy International Pty Ltd and ETI is acting as a clearing house for orders only. Cheques or money orders should be made out to Bone Fone Offer and sent to:

ETI/Convoy Bone Fone offer
ETI Magazine
15 Boundary St
Rushcutters Bay NSW 2011

We will then process the order and pass it on to Convoy, who will send you the goods. Please allow up to four weeks for delivery. Offer expires 30 September.



Please supply Bone Fone(s)
I enclose \$ plus \$2.50 each post and handling.
TOTAL \$
Name
Address
..... Postcode
Cheque or Money Order No:
Signature
(Please allow up to four weeks for delivery).

Electronics Show for Perth

The 1981 Perth Consumer Electronics Show is to be held over 3 to 6 September at the Ascot Racecourse, a new venue this year.

Last year's show was a roaring success and this year's show promises to better it, according to pre-show publicity. Admission charges have been set at \$1 per adult, children under 14 free. The Perth Sunday Times and Channel 9 are major sponsors.

The show will be housed on three floors at the Ascot Racecourse buildings, covering some 2000 square metres of floor space. If you're swanning around Perth in September, don't forget the third to the sixth, at the Ascot Racecourse.

Cheapest video colour yet?

Hitachi's recently introduced video colour camera, the VKC750, is claimed to be the cheapest colour camera available today, and is intended to appeal to both the newcomer to video and to the enthusiast.

The VKC750 employs a tri-electrode single pick-up tube, which minimises bulk and weight. This tube uses separate electrodes for each of the three primary colours, and is claimed to produce just as high quality pictures as would be expected from a more expensive professional camera.

The VKC750 weighs about 8.5 kg and is no larger than a conventional 8 mm cine camera; this compact-

ness is made possible by extensive use of ICs. Battery drain is only 5.8 W.

The built-in double-image optical viewfinder is linked to a 2.8:1 zoom lens with a focal length of 13.5 mm to 37.5 mm. If the images are lined up in the viewfinder, perfectly focused pictures should always be obtained. A colour temperature control button is also fitted to operate in conjunction with a



balance meter to ensure correct colour tone reproduction under varying light conditions.

A letter 'V' in the viewfinder indicates that recordings are being made; 'L' shows that there is insufficient light for optimum results; 'B' lets you know that the battery is

low. A special ASC circuit automatically adjusts the sensitivity so that filming under an extremely wide range of light intensity (from 100 to 100 000 lux) is possible.

A built-in microphone is provided, with provision for the addition of an external mic.

Best bass yet from a kit!

Now Peerless introduces another major advance to kit-set loudspeaker technology: A bass speaker with a rigid polypropylene cone that clearly outperforms traditional paper composite cone speakers, providing:

- cleaner, tighter bass sound reproduction
- low colouration and distortion
- high efficiency, suiting 25W to 100W amplifiers
- consistent rigid panel, low mass speaker cones.

Other outstanding features of Danish built Peerless speaker kit-sets are:

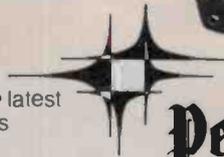
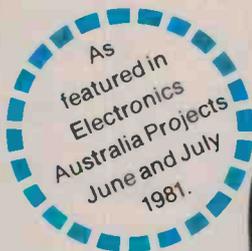
- sealed back mid-range with excellent linearity and low distortion
- latest Peerless 1" soft dome tweeter
- state-of-the-art crossover networks
- exceptionally flat response extending to 25,000 Hz.

Choose from these EA/Peerless speaker projects:

PAS 100 12" 3 way 100W (100L) \$364.00 pr
 PAS 60 10" 3 way 90W (60L) \$214.00 pr
 PAS 25 8 1/4" 2 way 60W (25L) \$166.00 pr

Includes drivers, crossover, wiring and instructions. Enjoy finer sound and avoid import duties by asking your nearest dealer for Peerless polypropylene loudspeaker kits or contact:

G.R.D. GROUP Pty. Ltd. 698 Burke Road,
 Camberwell, Victoria 3124 Phone: 82 1256



Peerless

Please send me full details of Peerless Kit-set speakers and the name of my nearest dealer.

Name _____

Address _____

Postcode _____

CONCORD/P4106

RARE ADDITIONS FROM MARANTZ. SLIMLINE AMPLIFIERS.



Rare: very valuable.

Additions: the things added.

Marantz: a range of ultra-high performance Slimline and three-quarter size Amplifiers which blend state-of-the-art engineering with operational versatility.

Although all units in a hi-fi system must be compatible in order to achieve optimum sound quality, there is no question that their final standard of performance relates directly to the main amplifier. It is the heart of the system and the point at which distortion is most likely to be introduced.

Marantz engineers have developed special techniques for reducing the various forms of distortion to miniscule levels. This is achieved by the use of a highly efficient negative feedback system and operation in class AB, with the careful selection of "shortest path" wiring to avoid interaction between different stages in circuitry and with the other channel.

The more powerful models are equipped with a heat-loop cooling system for the output stage transistors. This NASA invention enables the heat dissipated at high power levels to be rapidly removed so that a considerably improved power-to-size ratio is obtained.

If you see your hi-fi as an investment and, if you demand critical performance standards as well as the best value for money, listen to the future.

Listen to Marantz.

marantz.
Now you're listening.

Distributed by MARANTZ (AUST) PTY. LTD.
19 Chard Road, Brookvale, N.S.W. 2100
Telephone (02) 939 1900 Telex AA24121
Melbourne (03) 544 2011 Brisbane (07) 44 6478
Adelaide (08) 223 2699 Perth (09) 276 3706

Shopping for speakers?

Your 'one-stop speaker shop' is Electronic Agencies, according to proprietor Bill Edge, because you can choose from a wide variety of drivers from the Coral, Philips, Motorola and Foster ranges.

Apart from the renowned Philips' drivers used in the ETI Series 4000 range of quality build-it-yourself loudspeakers, Bill keeps a good selection of popular drivers from the well-known Coral range.

The Coral 8F-60 is a 200 mm diameter driver featuring a 1.23 kg, 160 mm diameter magnet, an extended frequency range and a die-cast frame. Voice coil impedance is given as six ohms minimum, the lowest resonant frequency as 35 Hz, sensitivity as 93 dB and the programme input as 40 watts. It may be used in a three-way system with Coral's HD-60 hard-dome tweeter or H-60 horn.

The 10F-60 is a 250 mm diameter driver featuring a 180 mm diameter, 1.88 kg magnet. It will handle 60 watts and the sensitivity is quoted as 94 dB. Voice coil impedance is also six ohms and the



fundamental resonance is quoted as being 30 Hz. Again, you can team it with the HD-60 tweeters.

The 10L-60 is a 250 mm driver with a long-throw voice coil, rated at 60 watts, having a 160 mm diameter magnet and a 28 Hz fundamental resonance. Although generally similar otherwise to the 10F-60, it is recommended for use as a bass driver in either a sealed box or bass reflex enclosure.

Big daddy in the Coral range stocked by Electronic Agencies is the 12L-60, a 300 mm driver featuring an Alnico cast magnet and a power rating of 80 watts. The lowest resonant frequency is quoted as 27 Hz and output spl as 95 dB/W-m. Voice coil impedance is a nominal eight ohms and the unit is recommended for use in two-way and three-way systems.

The Coral speakers each come with specifications and application notes on enclosures and systems in which drivers may be used.

For those into the disco and sound reinforcement scene, the range of Foster drivers and Motorola piezo tweeters will be of interest.

To help with selecting speakers, Bill Edge has built up a 'select-speaker' system, with which you can select and compare a whole host of drivers by actually listening to programme material and switching through them.

You'll find Electronic Agencies at 115 Parramatta Road, Concord NSW 2137, or on the end of a 600 ohm line at (02)745-3077.

Concord cartridges available

Phodis recently announced the availability in Australia of Concord's range of low-mass, high performance moving coil and induced magnet cartridges.

There are six cartridges in the range. Two are induced magnet models, which means that they share the fixed coils of moving magnet type cartridges, but the magnetic field presented by fixed magnets is varied by a small moving armature attached to the cantilever.

The other four models are moving coil devices, the CMC-40 being a 'low output' device, the other three being 'high output'. High output cartridges can be interfaced directly with standard phono preamps without the need for trans-

formers or pre-preamps; low output cartridges require a matching device.

Phodis claim that the positive response and sonic qualities, coupled with competitive pricing, make Concord cartridges an attractive investment, and give new, high-class technology to hi-fi enthusiasts previously unable to afford it.

For further information contact Phodis Pty Ltd, Phodis House, 5 Campbell St, Artarmon NSW 2064. (02)439-8900.



Are you into organs?

If you appreciate the sound of modern organs and organ music then you'd undoubtedly appreciate getting right into your instruments. It's easy with a kit, say Cleftronics, who market the Wersi range.

Wersi organs are renowned world-wide and there's a big range from which to choose. You can start at the 'beginners' end with the Entertainer model. This has a full 4-octave keyboard with polyphon voices like 16' horn, 8' tibia and 8' clarinet. Pitch vibrato can be added to these voices with adjustable speed and intensity. The Entertainer also features six automatic rhythms, ranging from march to swing, which can be used individually or in any combination. You can also add bass guitar, three percussion instruments and piano voice. The kit has a 10 W power amp and speaker and can be powered from ac mains or 12 Vdc. It's easy to build, according to Wersi, and makes an ideal practice keyboard.

For something more versatile — and portable to boot — see what the Combo model offers: two manual 4-octave keyboards; seven drawbars (16' to 1'); 15 fixed stops — voices such as cello, horn, trumpet, sax, violin, piccolo, etc; variety of attack/sustain functions; special

effects such as solo/legato percussion, repeat, contraccussion, tremolo, hand wah-wah, variety of autowahs, etc; six piano voices; range of vibratos, reverb; rhythm selection; string orchestra ... and on, and on! The attractive and functional case has steel pedals and base, and covers are vinyl clad, bench is adjustable. The lids close up the organ top and the integral base and leg structure turns into carrying handles (requires two roadies, estimated!).

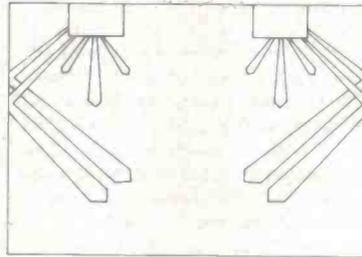
Right at the 'top end' is the Concerto model, W3A. This unit has such an incredible array of features and functions we just haven't enough room to fit it in!

We suggest you contact Cleftronics for a detailed catalogue — which lists a host of other goodies, such as Wersi electronic pianos, rhythm units, auto accompaniment units and even synthesisers! Cleftronics are located at 9 Florence St, Burwood Vic 3125. (03) 288-7899. Demonstrations arranged.



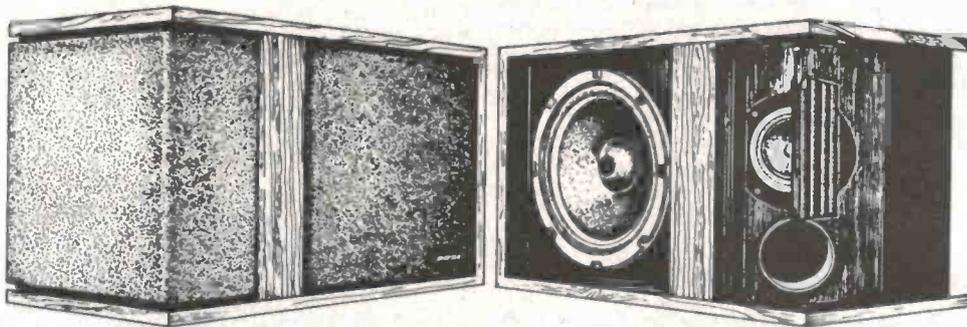
Compare the New Bose® Model 301 Against any Bookshelf Speaker Regardless of Price.

The new Bose Model 301 incorporates a number of exclusive features which put its level of performance way above any bookshelf speaker made. Exclusive Direct/Reflecting® speaker design utilizes a proper balance of reflected and direct sound to give you the spatial realism of a live performance. Exclusive Direct Energy Control lets you shape the sound to fit the acoustics of your listening room. Exclusive tweeter-protection circuit lets you drive the Model 301 really hard. Compare features. Compare performance. Then compare price. You won't find the open, spacious sound of the Model 301 in any other bookshelf speaker. Come in today for your demonstration.



Balance of reflected and direct sound gives the Model 301 the spatial realism of live performance music.

BOSE®



Patents issued and pending.

BOSE AUSTRALIA INC., 11 MURIEL AVENUE, RYDALMERE, NSW 2116.
TELEPHONE (02) 684-1022, 684-1255.

THD analyser for audio circuits

This article describes a spot frequency audio distortion analyser, designed and built by a reader, Laurie Tunncliffe of Mulgrave, Victoria. Measurements can be made at 100 Hz, 1 kHz and 10 kHz, and the final resolution of the instrument is 0.01%.

IN RECENT YEARS there has been a trend towards considering the transient behaviour of audio circuits rather than their steady-state behaviour. Although the attention given to this side of circuit design is not unwelcome, total harmonic distortion (THD) analysis is far from redundant.

While the transient behaviour is a go/no go situation, the THD behaviour is a measure of how well a circuit will perform. For instance, it is not a question of to what degree an amplifier will slew limit, or to what extent the internal loop will overload; these transient characteristics are barriers, and until reached will have no effect on the amplifier's performance.

THD measurements are therefore still a valuable analytical tool when developing new circuits or measuring and giving figures of merit to existing circuits.

When a single frequency is passed through an amplifier with a non-linear transfer curve, other frequencies are produced. These other frequencies are integer multiples of the test signal and sum of these is the THD.

There are a number of ways of measuring the harmonic distortion of an amplifier. The most recent is the 'Fourier Analyser', which is a computer-based instrument that samples the output waveform and performs the necessary mathematics (Fourier transform) to break down the waveform into its component parts. These instruments however cost tens of thousands of dollars. A technique becoming popular is the use of a spectrum analyser, which is a swept bandpass filter. The results are displayed on a CRO. THD is then calculated from

$$\text{THD} = \sqrt{\left(\frac{F1}{F}\right)^2 + \left(\frac{F2}{F}\right)^2 + \left(\frac{F3}{F}\right)^2 \dots}$$

N.B. Square root sign in formula applies to sum of all terms.

Another technique used by Quad and described elsewhere¹, compares the input and output of an amplifier (using a differential amp), the difference being distortion. In Quad's experiment, music is used as the source and a monitor amp/speakers are used to listen to the distortion played by itself. This then becomes a 'real-time' distortion analyser, and any non-linearities, whether transient or steady state, are revealed.

The last and most commonly used method is to eliminate the fundamental signal and read the resultant harmonics on a moving coil meter. This is sometimes called 'Noise and THD'

major consideration, as any non-linearities it contributes will be indistinguishable from the signal being tested.

There are a number of options available when designing a notch filter. A derivative of the Wien bridge was chosen due to its simplicity and the fact that it only requires two variable reactances to balance.

Bootstrapping around the filter is necessary to tighten up the notch width. Without this, the attenuation of the second harmonic would be excessive. With the amount of bootstrapping used the second harmonic is attenuated by less than 1 dB.

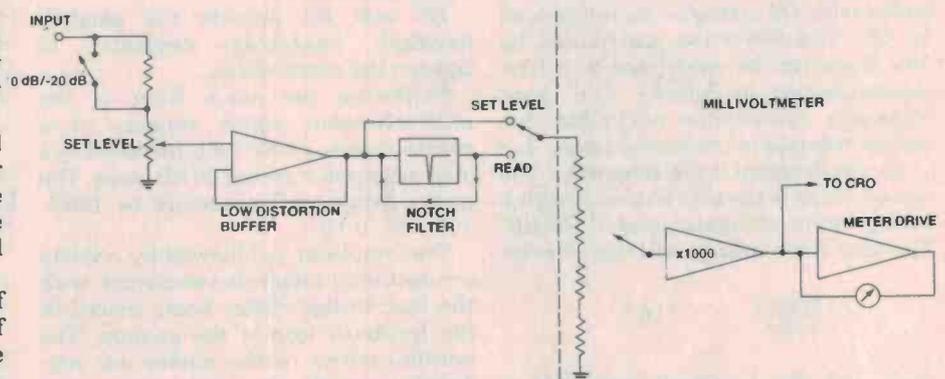


Figure 1. Block diagram of the THD analyser described in this article.

measurement, as hum and 'electronic noise' are lumped together with the harmonics. This is the technique used for the instrument presented here.

Block diagram

Refer to Figure 1 for the instrument's block diagram.

The input is applied to a buffer stage via a 0 dB/-20 dB attenuator. This allows easier control of the 'set level pot' when large signal levels are being measured. The buffer stage provides a low impedance source to drive the notch filter. The design of the buffer is of

The notch filter is followed by a millivoltmeter and reads the average value of the harmonics relative to the fundamental. The meter is calibrated to read full scale for 0.775 V RMS input, and therefore the meter can be used separately to measure dBs into a 600 ohm load, relative dB (dBV) or millivolts, giving the instrument a dual function.

A CRO output is taken after the x1000 amplifier, so that the residual harmonics can be investigated. This will often give considerable insight into the cause of the distortion.

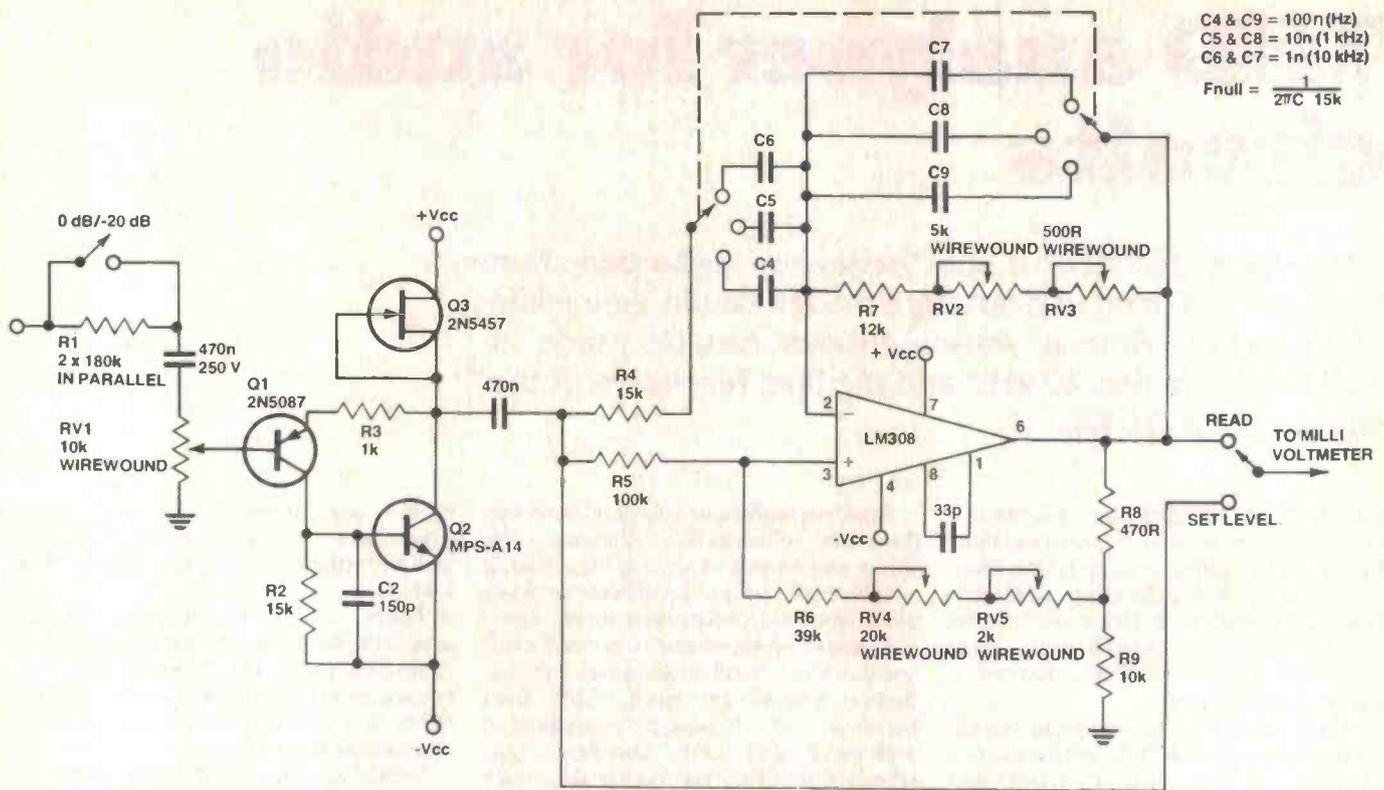


Figure 2. Circuit diagram of the THD analyser (above and opposite).

Circuit description

By examining Figure 2 the complete circuit diagram can be understood.

Q1 and Q2 form the non-inverting buffer with Q3 acting as an active load for Q2. The distortion contributed by this stage can be calculated to a first approximation as follows. The input transistor contributes negligible distortion relative to the second stage, due to the small signal levels it handles. The second stage is the prime mover, with a voltage gain of approximately 60 dB. The base drive voltage will therefore be

$$\frac{.775 \times \sqrt{2}}{1000} = 1.1 \text{ mV}$$

peak and the distortion generated is 1.1% second harmonic². Since the buffer stage has 100% feedback (unity gain), the loop gain is also 60 dB and the distortion is reduced to

$$\text{loop gain} = \frac{1.1}{1000} = .0011\%$$

The buffer feeds the notch filter, which may be looked upon as a frequency dependent differential amp. At the notch frequency, the parallel arm and the series arm balance to give the same impedance ratio as the resistive arms. The input then appears as a common mode signal to a differential amp, and the output is zero. The common mode rejection ratio of the op-

amp is of particular importance; however, most op-amps have a CMRR of at least 80 dB, which is sufficient to give a 0.01% resolution.

R8 and R9 provide the positive feedback (bootstrap) necessary to tighten the notch width.

Following the notch filter is the millivoltmeter, which consists of a constant gain, x1000 amp, preceded by a step attenuator giving 20 dB steps. The meter ranges will therefore be 100%, 10%, 1%, 0.1%.

The amplifier is followed by a fairly conventional meter-driven circuit, with the four bridge diodes being placed in the feedback loop of the op-amp. The non-linearities of the diodes are rendered insignificant and the meter reads accurately, even at the low end of the scale. Diodes 5 and 6 are used to protect the meter from an overload.

In order to achieve a wide enough bandwidth for the x1000 amp, an externally compensated op-amp was necessary. The op-amp used in the meter circuit is a dual low-noise device, and therefore helps to keep the instrument noise level low and reduces parts count.

C12 rolls off the frequency response above 70 kHz. This helps improve the square wave response by reducing any ringing, and also reduces high frequency noise. This will allow measurement up to the seventh harmonic of 10 kHz, and should prove adequate.

Construction

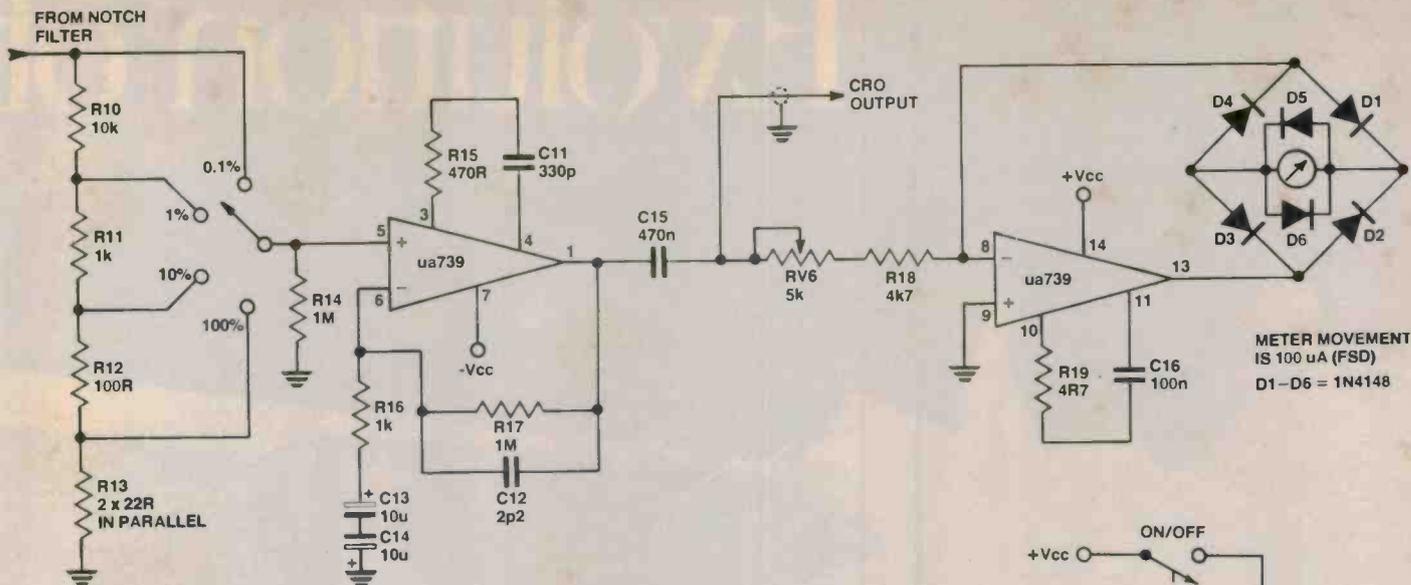
If accuracy and stability are to be reproduced, all components must be close tolerance, high stability. I used ¼-watt metal film resistors, which are available from Dick Smith. The filter capacitors are either styroseal or green caps; ceramic capacitors should be avoided as they are voltage dependent.

Veroboard should also be avoided, as stray capacitance across the strips causes problems when you are looking for one part in 10 000.

I used tagstrip and wire-wrap sockets for the ICs and found this easy to work with, giving satisfactory results.

My prototype was built in a diecast box; however, I had to rewire it three times, using shielded cable for every connecting wire, before a stable layout was found. For this reason I strongly suggest building the instrument as two separate units – a notch filter and a millivoltmeter. This will also give the versatility of being able to use one or the other independently.

The nulling pots are wirewound, having the advantage of a continuous track. The continuity of a wirewound pot is limited by the fact that a step in resistance equivalent to one wire winding is the smallest change possible. Carbon pots are certainly worse, as they sometimes jump resistance value mid-track. The fine control pots are single turn and provide reasonable ease of nulling at low levels. However, if you



feel it is worth the extra cost, ten-turn (spiral wound) pots will alleviate having to be careful when adjusting the controls.

The only adjustment to be done is the calibration of the meter. This is accomplished by applying a 0.775 V RMS, 1 kHz signal to the input with the unit switched to 'set level', and adjusting RV6 for full-scale deflection of the meter. Alternatively RV6 and R18 can be changed to 1k and 6k8 (fixed values) with less than 1% error in meter reading.

Operation

The instrument is operated as follows:

- Set Level/Read switch to Set Level
- Range switch to 100%
- Adjust Set Level pot for FSD of meter
- Set Level/Read switch to Read
- Adjust the nulling pots for minimum meter reading
- THD is now read from the meter and range switch.

The nulling procedure is accomplished by starting with the coarse pots, and alternately adjusting them for

minimum meter deflection until it becomes difficult to proceed. The process is then repeated with the fine pots. If the user has a CRO available, this will assist the nulling procedure.

Figures 3, 4 and 5 show some oscilloscope photographs of the input and output of the meter. Figure 3 is an under-biased class B amplifier and shows spikes in the residual. This is a common waveform from class B amplifiers and the meter can be used to set the bias level for optimum.

Figure 4 shows second harmonic distortion from a voltage-driven common emitter amplifier. The input signal was 1.1 mV peak and the meter reading was 1.1%. This confirms the analysis used for the buffer stage.

Figure 5 is third harmonic caused by a thermistor-stabilised Wien bridge oscillator. THD was 0.02% at 100 Hz. (This is one of the problems encountered when using a thermistor at low oscillator frequencies.)

It should be noted that a low distortion oscillator will need to be used when making measurements. The residual distortion of the oscillator may set the lower limit to the measurements.

Some performance measurements

Final resolution of the meter was 0.005% at 100 Hz and 1 kHz and 0.01% at 10 kHz. Below this, drift in components' values with temperature, circuit noise, distortion introduced by the buffer and the filter stage and CMRR limitations of the filter all take their toll. However, distortion values of less than 0.01% are purely academic in my view, regardless of what hi-fi manufacturers' sales departments would have us believe.

References

1. P.J. Baxandall, *Wireless World*, November 1977, pp. 63-66.
2. E.F. Taylor, *Wireless World*, August 1977, pp. 28-32.

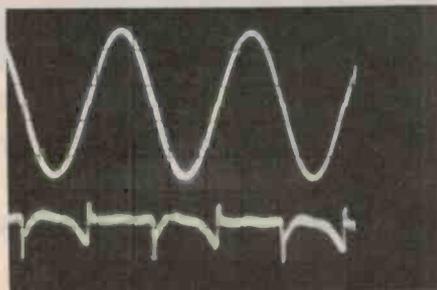


Figure 3. Class B amp, meter reading 1.5%.

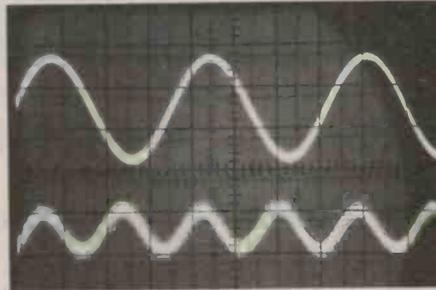


Figure 4. Second harmonic distortion, meter reading 1.1%.

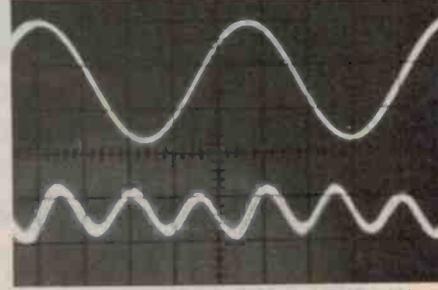
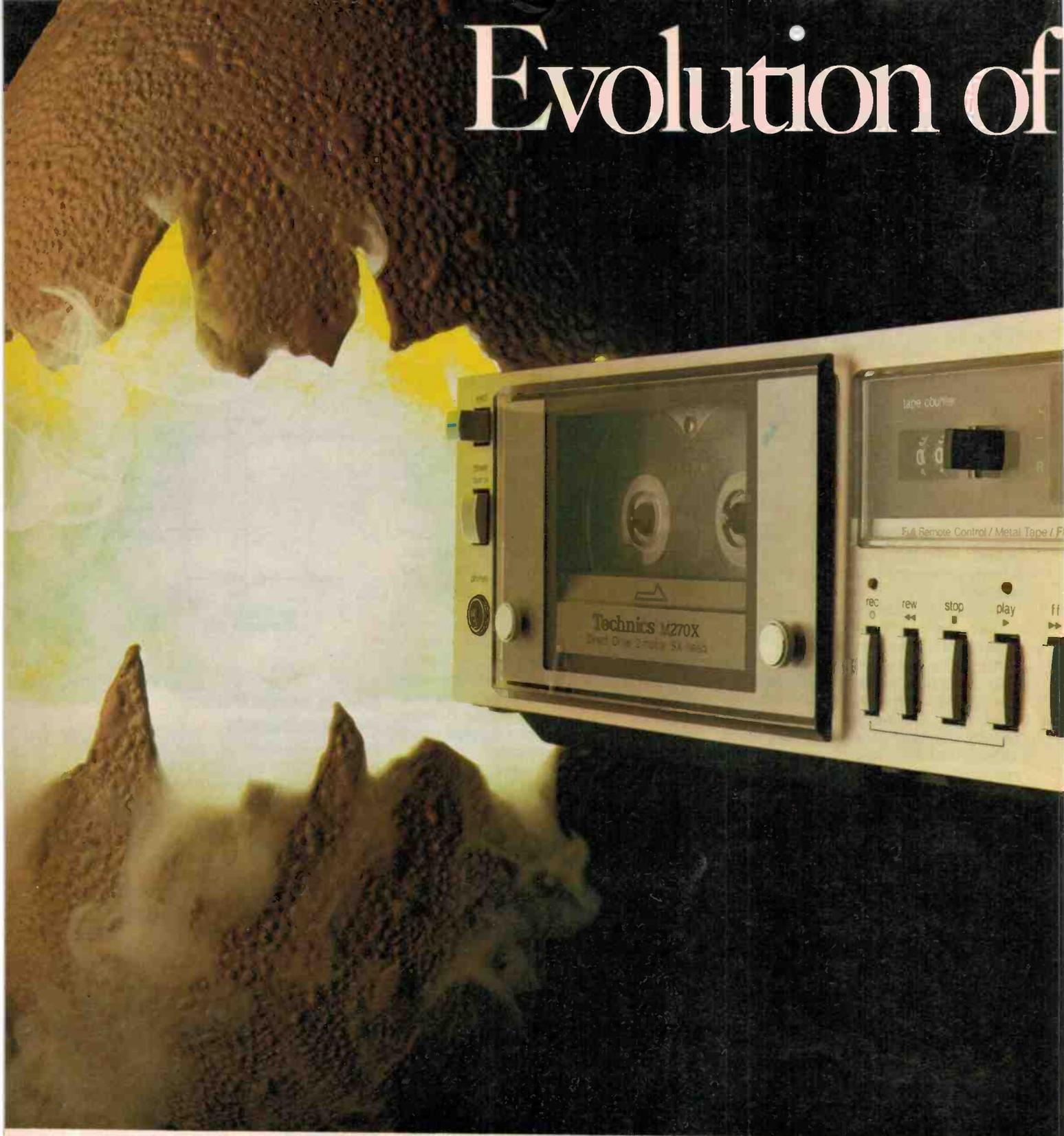


Figure 5. Third harmonic distortion, THD 0.02%

Evolution of



Cassette decks have come a long way to reach their current high standards of performance.

Now, Technics take them to an even more advanced stage of their evolution with a range of cassette decks featuring built-in 'dbx' dynamic range expansion.

At last you can enjoy cassette performance with a full dynamic musical range rivalling that of most reel-to-reel machines.

The 'dbx' system also functions as a very effective noise reduction system that cuts tape hiss by as much as 30db. To your ears that means tape hiss is virtually eliminated.

the species.



The benefits are not limited to cassette tapes either.

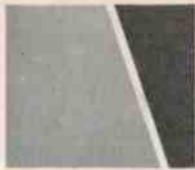
With a 'dbx'-equipped cassette deck like the superb RS-M270X you can also use your present system to play 'dbx'-encoded records as well.

All this plus many other advanced features: metal tape facility, feather-touch controls, 2-colour FL meters and much more.

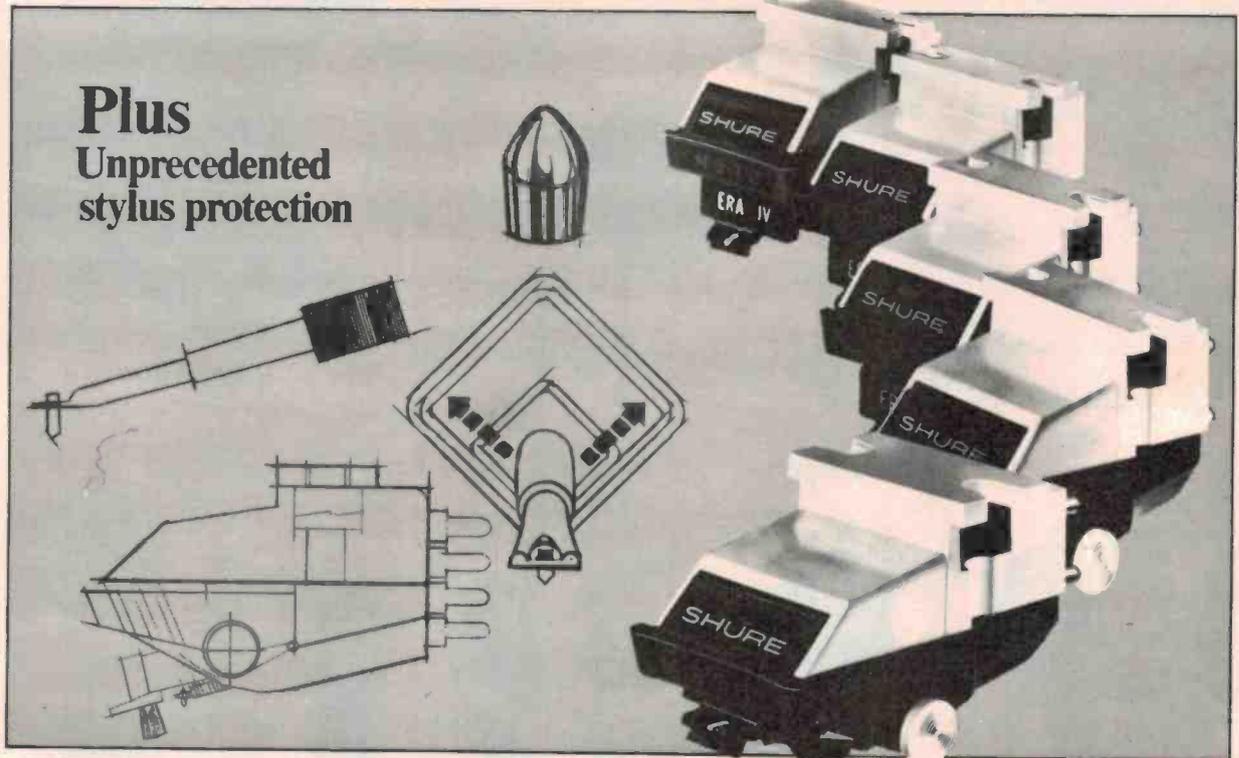
Ask for a demonstration of Technics' new breed of 'dbx' cassette decks at a better hi-fi stockist soon. And join the evolution yourself.

Technics
National Panasonic (Australia) Pty Ltd

Expanding the music experience.



fact: five new Shure Cartridges feature the technological breakthroughs of the V15 Type IV



the M97 Era IV Series phono cartridges

Shure has written a new chapter in the history of affordable hi-fi by making the space-age technological breakthroughs of the incomparable V15 Type IV available in a complete line of high-performance, moderately-priced cartridges: the M97 Era IV Series Phono Cartridges, available with five different interchangeable stylus configurations to fit every system and every budget.

The critically acclaimed V15 Type IV is the cartridge that astonished audiophiles with such vanguard features as the Dynamic Stabilizer — which simultaneously overcomes record-warp caused problems, provides electrostatic neutralization of the record surface, and effectively removes dust and lint from the record — and, the unique telescoped stylus assembly which results in lower effective stylus mass and dramatically improves trackability.

Each of these features . . . and more . . . has been incorporated in the five cartridges in the M97 Series — there is even an M97 cartridge that offers the low distortion Hyperelliptical stylus!

What's more, every M97 cartridge features a unique lateral deflection assembly, called the SIDE-GUARD, which responds to side thrusts on the stylus by withdrawing the entire stylus shank and tip safely into the stylus housing before it can bend.

For Technical service and advice, contact the Audio Engineers representative at the office in your State.



or send this coupon to:

AUDIO ENGINEERS 342 Kent Street
SYDNEY, N.S.W. 2000 Tel: 29-6731

Please send me your 'free' brochure on Shure Cartridges.

(PLEASE PRINT NAME AND ADDRESS)

NAME: _____

ADDRESS: _____

Postcode: _____

ET 481

AUDIO ENGINEERS PTY. LTD.
342 Kent Street
SYDNEY, N.S.W. 2000

NOMIS ELECTRONICS P/L
689 South Road
BLACK FOREST, S.A. 5035

AUDIO ENGINEERS (Qld)
51A Castlemaine Street
MILTON, Qld. 4064

AUDIO ENGINEERS (Vic.)
2A Hill Street
THORNBURY, Vic. 3071

ATHOL M. HILL P/L
33 Wittenoom Street
EAST PERTH, W.A. 6000

AE 161

Slide/tape synchroniser

WITH THE AID of a tape recorder and a slide tape synchroniser it is possible to obtain programmed slide changing with an automatic projector. By using a synchroniser and a stereo tape deck or recorder it is possible to have music and a commentary recorded on one channel and signals to give automatic slide changes at the appropriate points on the other channel.

A slide/tape synchroniser has two sections: a tone generator and an electronic switch. The tone generator is used to record short bursts of tone onto the tape at the points where slide changes are required. The electronic switch is fed with the tone burst output of the tape recorder and closes a pair of relay contacts for the duration of each burst. The relay contacts are used to control the automatic slide change mechanism of the projector. Usually the output of the tone generator is coupled to the input of the electronic switch, so that operating the tone generator causes the relay contacts to close. This is useful when recording a tape.

With the projector loaded with slides, the synchroniser connected to the projector, the output of the tone generator fed to one input of the recorder and the music/commentary signal ready to be fed to the other input, the tape is inserted. Then the music and com-

mentary are recorded and the tone generator is operated at the appropriate times so that the slides are changed and the tone bursts are recorded onto the tape. If the tape is then rewound, the slide magazine brought back to its starting point and the tone burst output of the tape recorder fed to the input of the electronic switch, replaying the tape should give the slide show with accompanying soundtrack and automatic slide changing.

The operator only has to start the tape at the beginning of the show and stop it at the end.

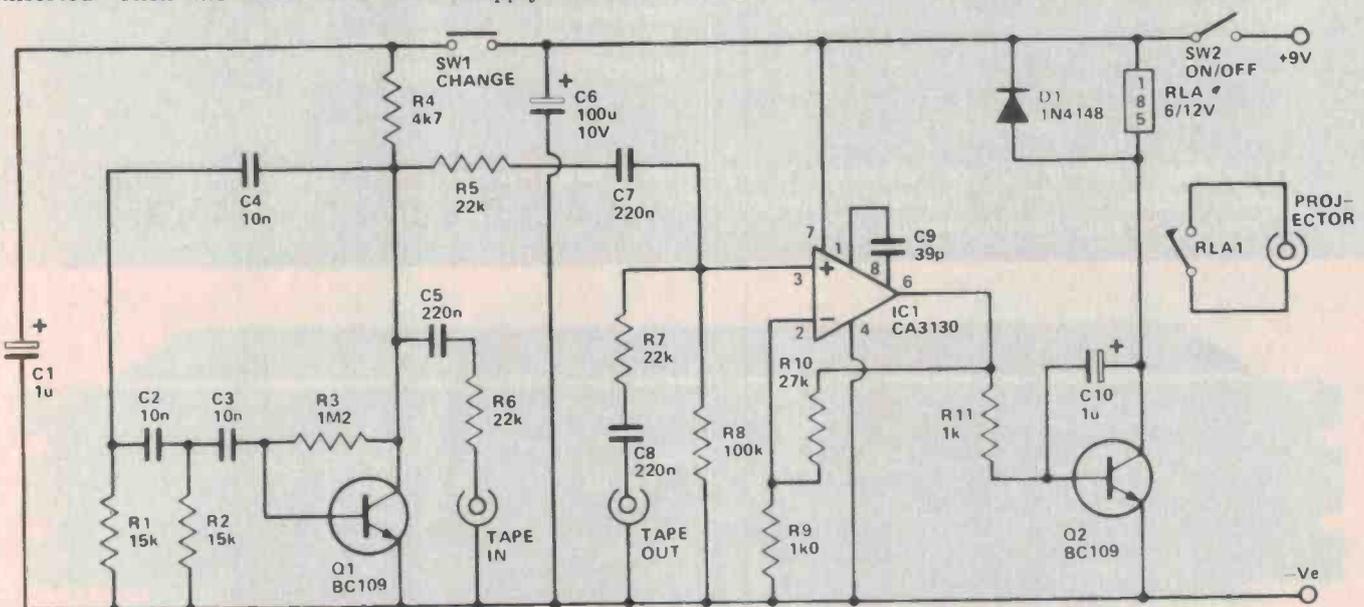
A similar technique is used when using the unit as a programmed slide timer, the only difference being that there is no soundtrack to bother with.

The tone generator uses Q1 in a straightforward phase shift oscillator operating at about 500 Hz, although the exact operating frequency is not of great importance. It is merely necessary to use one at which the recorder is capable of operating reasonably well. The output from the collector of Q1 is coupled to the tape recorder by dc blocking capacitor C5 and resistor R6. The latter attenuates the output. R6 also ensures that the oscillator cannot be so heavily loaded that it ceases functioning. SW1 is a non-locking, push-to-make switch. It is briefly pressed to connect the supply to the tone generator and

produce the tone bursts.

The tone generator is based on operational amplifier IC1, which is used in the non-inverting mode. Its voltage gain is set at about 28 by R9, R10, and R8 biases the non-inverting input to the negative supply rail. R5, R7 form a simple passive mixer at the input of IC1, so that it can be fed from either the tone generator or from the output of the tape recorder without the need for any changeover switching. The output of IC1 is used to drive common emitter amplifier Q2, which has the relay coil and protective diode D1 as its collector load. Normally IC1's output is low and Q2 is cut off, but in the presence of an input tone the output of IC1 goes strongly positive on positive-going half cycles. C10 integrates these pulses so that Q2 is continuously switched on in the presence of an input tone and the relay is energised. The relay contacts then close and operate the slide change mechanism of the projector.

The current consumption of the unit is only about 500 μ A, but rises to around 40 mA during the brief periods when the relay is activated. The relay can be any type having a 6/12 V coil with a resistance of about 185 ohms or more, provided it has at least one set of normally open contacts of adequate rating.



High-Com II

NOISE REDUCTION SYSTEM



Nakamichi

Obviously a noise reduction system that carries the Nakamichi logo has to offer some *real* benefits over existing systems.

Features like:—

- Professional two-band design affords 20 dB noise reduction throughout the *entire* audio band — necessary if side effects such as breathing, pumping and sonic coloration are to be eliminated.
- Ultra-fast attack and release times in each band assures accurate transient reproduction and minimal distortion — necessary for *faithful* reproduction of music.
- Optimum compander ratio for each band provides an additional 5 dB headroom affording a dynamic range improvement of 25 dB!
- 50 dB range peak responding meters assure correct record level monitoring.
- Subsonic and MPX filters eliminate externally induced errors.
- Suitable for any cassette or reel-to-reel recorder.

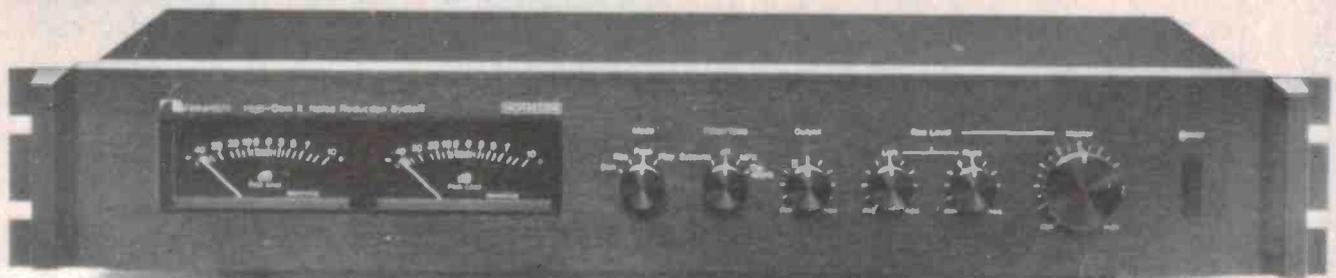
High-Com II follows Nakamichi's commitment to excellence in the fine art of recording.

SPECIFICATIONS:

Noise reduction system	2 bands, level encoding and decoding
Compression ratio	Encoding 1:2, Decoding 2:1
Noise reduction	20 to 25 dB
Frequency response	20 to 20 kHz \pm 1 dB
Distortion	less than 0.1%
Dimensions	482(w) x 82(h) x 270(d)mm (fitted for 19" rack mount)

High-Com is the trademark of AEG-TELEFUNKEN

For complete information on Nakamichi's High-Com II, see your nearest dealer or write to Convoy International Pty Ltd, 4 Dowling Street, Woolloomooloo 2011.



The moving coil replacement from Stanton Magnetics... the revolutionary 980LZS!



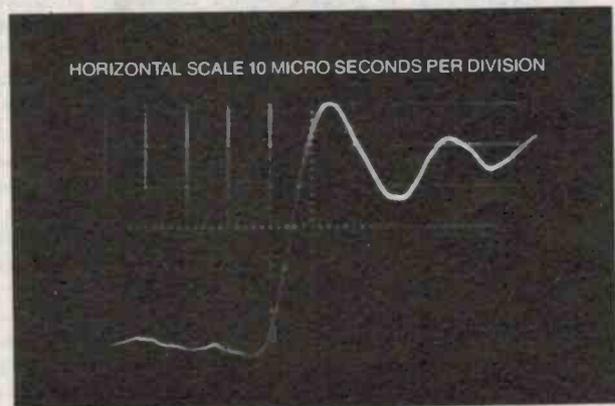
Now from the company to whom the professionals look for setting standards in audio equipment comes a spectacular new cartridge concept. A low impedance pickup that offers all the advantages of a moving magnet cartridge without the disadvantages of the moving coil pickup. At the same time it offers exceedingly fast rise time—less than 10 micro seconds—resulting in dramatic new crispness in sound reproduction—a new “openness” surpassing that of even the best of moving coil designs. The 980LZS incorporates very low dynamic tip mass (0.2 mg.) with extremely high compliance for superb tracking. It tracks the most demanding of the new so called “test” digitally mastered and direct cut recordings with ease and smoothness at 1 gram $\pm \frac{1}{2}$ $\frac{1}{4}$.

The 980LZS features the famous Stereohedron™ stylus and a lightweight samarium cobalt super magnet. The output can be connected either into the moving coil input of a modern receiver's preamps or can be used with a prepreamp, whose output is fed into the conventional phono input.

For “moving coil” audiophiles the 980LZS offers a new standard of consistency and reliability while maintaining all the sound characteristics even the most critical moving coil advocates demand. For moving magnet advocates the 980LZS provides one more level of sound experience while maintaining all

the great sound characteristics of cleanliness and frequency response long associated with fine moving magnet assemblies.

From Stanton... The Choice of The Professionals.



Actual unretouched oscilloscope photograph showing rise time of 980LZS using CBS STR112 record.



STANTON
THE CHOICE OF THE PROFESSIONALS™

IMPORTERS AND EXPORTERS OF AUDIO EQUIPMENT



SOUNDEX PTY LTD

WA Head Office: 156 Railway Parade, Leaderville, 6007. Phone (09) 381-2930.
NSW Office: 7 Jordan Road, Wahroonga, 2076. Phone (02) 487-2543.

Nakamichi 480Z cassette deck

Containing the new Dolby C noise reduction system, the Nakamichi 480Z cassette deck provides good results on both pre-recorded and home-recorded tapes.



Louis Challis

was not simply and arbitrarily 'more noise reduction'. A number of devices, such as dBX wide-band companders, have long been available, and provide more noise reduction than Dolby B under some signal conditions, most notably in the absence of signals altogether. However, these devices also introduce such side effects as noise modulation and overshoot distortion under other signal conditions.

Thus an important objective for Dolby noise reduction was minimising the side effects, and there were a number of other related goals. The first of these was the quantity and quality of noise reduction. With a companding noise reduction system, the greater the noise reduction desired, the more the signal must be manipulated by the encode/decode process, and thus the more likely that side effects will be audible.

Dolby Laboratories decided that Dolby C would not trade more noise reduction for more audible side effects than had Dolby B. This decision was not only reflected in the design of the system, but also in the choice of the amount of noise reduction the new system provides. To minimise the signal processing required, it was necessary to establish the minimum amount of noise reduction required to meet the likely demands of the market. It was concluded that for cassette recording 20 dB of noise reduction would provide a noise level below that of any current or likely future program source, and would indeed result in tape noise below the ambient noise level of most home listening environments.

For a noise-reduction system to be practical, it must be reasonably tolerant of errors introduced by the recorder at both high and low frequencies between encoding and decoding. Dolby B-type

WHILST TAPE recorders have proved to be one of the most efficient means of recording music and other forms of programme content, they have from the very outset exhibited a limitation which disturbs the purist. That limitation is associated with the internal noise figure or lowest level of hiss that is capable of being achieved. Many solutions have been offered to this problem, the most recent of which has been the introduction of digital tape recorders whose dynamic ranges may be as great as 100 decibels or more. Not everybody however wants a digital cassette recorder, and particularly not at the current market price.

The average purist or amateur is seeking a reel-to-reel or cassette recorder which is capable of providing a dynamic range somewhere in the range 60-70 dB(A) on recording and with the compatibility to cope with any pre-recorded cassettes purchased.

Noise reduction

In ETI Feb. '72 we examined the performance of the Dolby B Noise Reduction System, which has become the most common system used on cassette recorders and quite a few reel-to-reel recorders as well. Ray Dolby, in developing that system, certainly produced a financial winner, and the licensing agreements and associated fees which have accrued over the period of the last ten years have been a god-

send, not only for Dolby, but equally for the various tape recorder manufacturers who have achieved a degree of compatibility between their individual machines and pre-recorded cassettes which has accelerated the sales of these machines.

The trouble is that like any other encoding system, the Dolby B system has limitations, and this has been realised right from the very outset. The increases in distortion and the somewhat limited improvement in signal-to-noise ratio that the Dolby B system provides have worried Dolby Laboratories, who have spent a fortune in researching a new and improved system. At best this has been only 11 dB at the high frequency end of the spectrum and on some machines considerably less than this, i.e. 7-8 dB under adverse conditions.

More recently Dolby Laboratories have released an improved version of the Dolby Noise Reduction System, known as Dolby C, which is a two-stage encoding and two-stage decoding system that has, in theory, the capability of providing a significant improvement in terms of signal-to-noise ratio. The most important aspect, however, is its ability to provide effective noise reduction at frequencies as low as 150 Hz, whilst the Dolby B system does not become effective until frequencies of 500 Hz and above.

The goal for the new Dolby C system

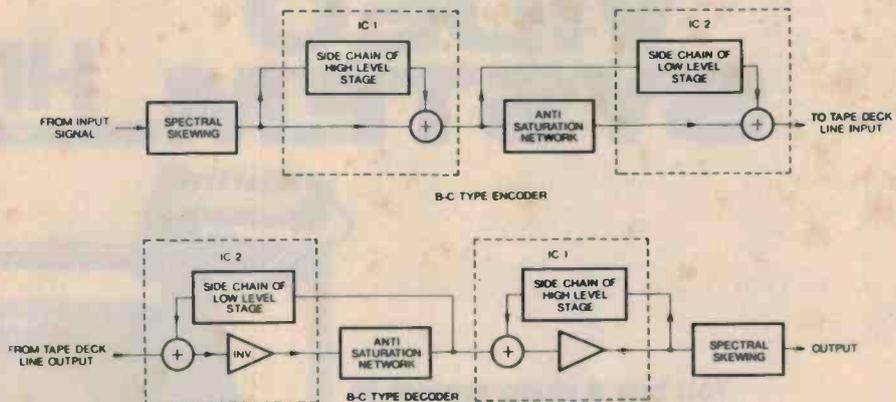
noise reduction has proved to be reasonably tolerant enough of such errors to be practical, so a similar tolerance was an objective for Dolby C.

The Dolby C system

By using a two-stage encoding system, the overall improvement of the Dolby C System may be as high as 13 dB over the low frequency end of the spectrum and as much as 20 dB over the frequency region 500 Hz to 20 kHz. This is achieved by utilising two processing integrated circuit stages in series, each supplying approximately 10 dB of compression during the recording and 10 dB of expansion during playback.

The two circuits operate at independent levels. One is nominated and specified as the high-level stage and is sensitive to signals at about the same levels as those in the Dolby B-type noise reducing circuit, whilst the other, the low-level stage, operates on signals at somewhat lower levels.

Not surprisingly, the two conventional Dolby IC chips are used in a modified manner to achieve the C-type noise reduction, and by this means it is possible to use one chip by itself as a Dolby type B encoder. The tape recorders incorporating the C-type noise reduction system are therefore capable



Block diagram of the Dolby B-C type noise reduction system.

of providing both a B-type characteristic and a C-type characteristic at will.

In the C-type mode two additional special circuits are incorporated to make the system function. The first is a *spectral skewing circuit*, known and designated schematically as the SN circuit, as well as an anti-saturation network (ASN), which adjusts the system response to avoid high frequency demodulation and thus effectively increase the headroom.

The spectral skewing circuit suppresses certain signal levels over 8 kHz during encoding or recording, and compensates this totally in decoding (during playback). Its purpose is twofold. Firstly, to prevent the deterioration of the tape's high frequency response as a result of the emphasis action, and secondly to prevent intermodulation of low frequency content caused by high frequency saturation during the emphasis phase of the action.

The anti-saturation network operates to raise the tape saturation level and thereby maintain the overall system alignment and performance.

The 480Z

The Nakamichi 480Z Cassette Recorder is the first machine that we have seen incorporating both Dolby B and Dolby C

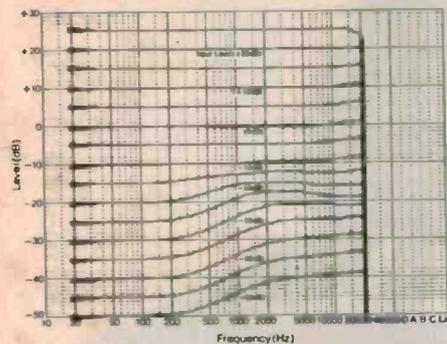
noise reducing systems. The 480Z is in fact the simplest and least expensive of the 480, 481, and 482Z Series Recorders just released by Nakamichi. The basic difference between the 480Z and the other two units is that it incorporates a two-head system whilst the others are three-head machines.

Whilst one would expect that the 480Z would suffer considerably in terms of performance as a result of this compromise combination of two heads versus the three-head system, nothing could be further from the truth. In fact, as our investigation showed, the performance of the 480Z is better than many other top-line three-head machines and quite a few of the earlier three-head machines produced by Nakamichi.

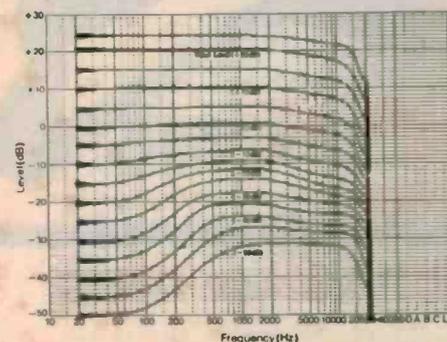
The appearance of the 480Z is not unlike the previous 480, 481 and 482 Series machines, which we have previously evaluated and reviewed in this magazine.

The front panel of the 480Z machine features, on the left hand side of the deck, a power switch at the top front and a bias control for fine tuning the bias current so that the characteristics of a particular brand of tape may be optimised over those automatically set by the selection of the type 1, 2 or 4 tapes. (EX, SX or ZX tapes).

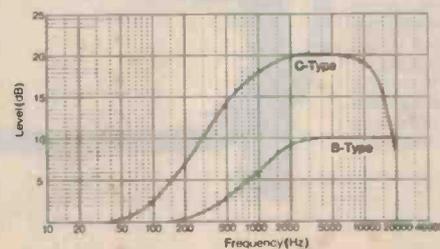
Below the fine bias tuning is a headphone socket, which provides two fixed output levels for monitoring the headphones. To the right of these three controls is the cassette well, which is pneumatically controlled by an eject button located to its right. Whilst the system is described as the silent mechanism drive, the double capstan drive is not silent per se and is readily audible when one is close to the deck during playing. ▶



B-type encode characteristics



C-type encode characteristics



Low level Dolby encoding frequency response.

HITACHI VIDEO SYSTEM

HITACHI VERS

You buy a video system to put more fun in your life. To expand your viewing possibilities. To turn your TV into a multi-use entertainment center. For optimum enjoyment, you need two things: versatility and creativity. The Hitachi VT-7000 Portable Video System gives you an abundance of versatility. The creativity, you've already got.



- VT-7000 Portable Video Recorder**
- Still picture & frame advance
 - Full remote control
- VT-TU70 Video Tuner/Timer**
- Soft-touch tuning
 - 10 day/1 program preset with daily repeat recording
- VK-C770 Portable Color Video Camera**
- 6X zoom lens
 - Electronic viewfinder

VHS

UTILITY & YOUR CREATIVITY

FORMULA FOR FUN:

You'll be able to enjoy a wide variety of prerecorded tapes: old and new movies, cultural events, educational materials, and a fast-growing list of rock concerts.

The VT 7000 Recorder and A-V70 Adaptor are all you

need for full playback convenience. And thanks to Hitachi's advanced technology, the picture (and sound!) quality are excellent.



Have you ever had the feeling you could put together a better show than some of the ones on TV? With the VT-7000 Recorder and VK-C770 Camera, you can indulge your fantasy. You'll also appreciate their light weight and small size when taping family outings, sports events, and so on.



The VT 7000 Portable Video System is a totally versatile, total

enjoyment system. Not only are the units lightweight and compact for take-along convenience, but their elegant, matching design makes them look great in any home. And their performance and reliability are outstanding, thanks to Hitachi's world leading integrated technology. No matter what type of application appeals to you, you'll find that the VT-7000 System makes it easier and more enjoyable.



With the addition of the VT-TU70 Tuner/Timer, you're assured of never missing another must-see show. If an appointment or a trip takes you away from home, just set the VT-TU70 to record it,

then watch it later at your leisure. You can preset to record a program up to 10 days ahead, or for daily repeat recording. In addition, you can tape one show while watching another.



What's missing from this great video system? Just one thing: you. Your creativity is all that's needed to let it reach its full potential. And the more creative you are, the more fun you'll have with it.

The VT-7000 Portable Video System. Let your nearest Hitachi dealer show you the fun.

 **HITACHI**

Across the top of the cassette escutcheon is an illuminated clear plastic bezel behind which is a three-digit tape counter, which is reset to zero by a button immediately below. To the right of this are peak-reading level meters covering the range -40 dB to +10 dB. This uses LEDs based on a 16-segment array, with 10 LEDs covering the range -40 VU to 0 VU and a further six covering the range +3 to +0 VU.

In a line below the LED display are two parallel slide attenuator controls whose functional usage I have previously criticised and must do so once again. These are not a good ergonomic design feature and really should be paralleled for easiest usage.

In the bottom centre of the front escutcheon are the six controls to record, rewind, stop, play, fast-forward and pause, which are electromechanical but function extremely well. The five other controls at the bottom right hand corner of the deck are the memory on/off switch, a Dolby C or Dolby B encoding control switch, a noise reduction on/off switch controlling the C and B functions, two tape buttons — one for SX and EX (namely gamma ferric oxide or chromium type derivative) tapes and the other for metal tapes.

The last control is the 70 microsecond/120 microsecond equalisation switch. On the rear of the deck are two switches for selecting Multiplex Filter on/off and high level/low level headphone outputs. A remote control socket for inserting the optional Nakamichi RM-100 Remote Control Unit is provided, whilst the voltage selector for 120/240 V had been disabled in the unit reviewed. Inputs and outputs are provided by two pairs of co-axial sockets for connecting the cassette deck to the associated amplifier.

The inside of the unit incorporates a

large motherboard with the main control functions located on it, whilst a satellite board, providing the special functions of the new 480 class recorders, is located immediately above. The wiring harness, leading to the plug-in sockets and wire wrapped connections on this board, is not typical of Nakamichi neatness, and it is possible that these may be different in the production models that will follow. In particular the number of add-on components on the rear of the main printed circuit board are atypical of Nakamichi construction and must also be presumed to be a feature of this early production unit.

The designers have taken obvious pains to angle the position of the main supply transformer and to provide what appears to be a mu-metal screen to minimise stray hum field leakage. As we found in our subsequent objective testing, this has not provided a complete solution. The control board for the LED record level indicator is located behind the front panel and is apparently automatic in its functional control. This display is a positive plus for users when compared with the two VU meters that it replaces.

The tape drive is based on the well-proved diffused resonance drive system that we have previously reviewed and, if anything, appears to be even slightly better in this particular machine.

The main chassis, lid and cover for the unit are fabricated from galvanised steel, with the lid and back panel being painted black to match the satin anodised finish of the front panel.

On test

The objective testing of the unit provided some outstanding results.

The first and foremost feature is that the replay frequency response of this machine is within ± 2 dB from 10 Hz to 20 kHz with gamma ferric oxide tapes,

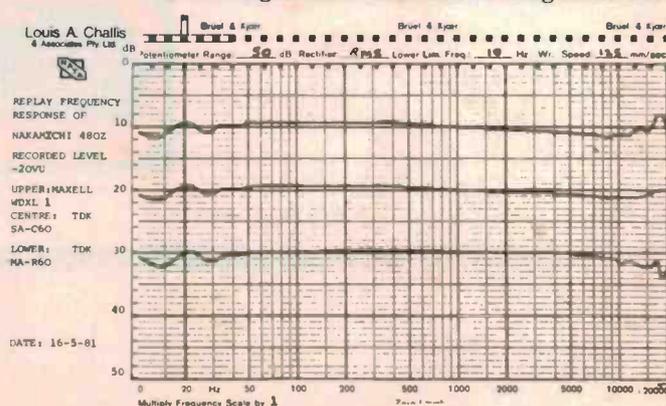
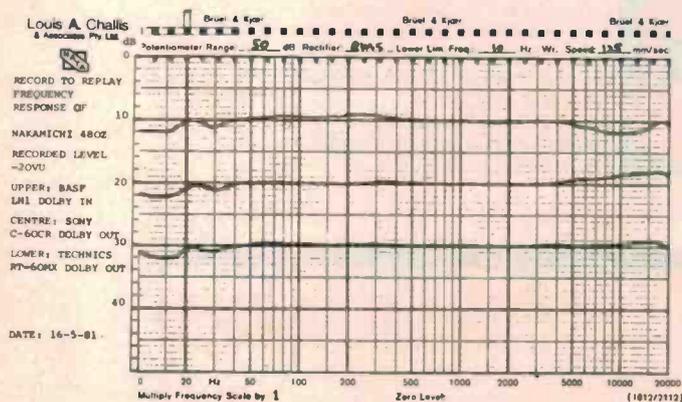
within +1, -1.5 dB from 10 Hz to 20 kHz with chrome equivalent tape and within +0, -2 dB from 10 Hz to 18 kHz with metal tape. This is an *outstanding performance*, a credit to the manufacturer, and would be equalled with any pre-recorded tapes with correct azimuth alignment.

The record-to-replay frequency response is to all intents and purposes just as good, being +1, -2 dB from 10 Hz to 20 kHz with gamma ferric-oxide tapes, -2 dB from 10 Hz to 20 kHz with chromium tape and +1, -2 dB with metal tape. With BASF LH1 tape used in the third series of evaluations the frequency response is better than most professional reel-to-reel recorders, being -20 dB within 0.5 dB from 35 Hz to 20 kHz and ± 2 dB from 10 Hz to 40 Hz.

In evaluating the signal-to-noise performance of this machine one very quickly starts to appreciate the differences between straight recording, Dolby B encoding and Dolby C encoding. The improvements in signal-to-noise ratio in the critical 150 Hz to 1000 Hz region show up remarkably well in the level recordings which we produced, and with these you can readily see how this machine is able to achieve such high signal-to-noise ratios. Surprisingly, the overall A-weighted signal-to-noise improvement in the C mode is less than would be expected because of the extent to which hum at 50 Hz is able to pass through the encoding circuits.

Even allowing for this hum leakage, this machine still achieves a commendable 66.5 dB(A) signal-to-noise ratio in the Dolby C mode. If the hum level had been lower this noise figure would undoubtedly have exceeded 70 dB, and as such justifies the whole concept of the Dolby C encoding system.

The channel separation of this machine is remarkably good, the only significant intrusion coming as a result



MEASURED PERFORMANCE OF NAKAMICHI 480Z

S.N. 1711

HARMONIC DISTORTION:

RECORD TO REPLAY FREQUENCY RESPONSE AT -20VU:

Tape	Dolby	Lower - 3dB Point	Max. Point and Frequency	Upper - 3dB Point	SIGNAL TO NOISE RATIO (Re OVU) (Slightly degraded by residual hum in unid)
BASF LHI	in	10Hz	+1.0dB -25Hz	20kHz	Dolby out -50.0dB(A)
BASF LHI	out	10Hz	-	20kHz	Dolby "B" in -59.0dB(A)
SONY C-60CR	out	10Hz	+2dB - 18kHz	20kHz	Dolby "C" in -62.5dB(A)
TECHNICS RT -60mx	out	10Hz	+1dB - 17kHz	20kHz	

SPEED ACCURACY: -0.7%

MAXIMUM INPUT LEVEL:

(for 3% third harmonic distortion at 1kHz)

Taper: BASF LHI +4.0VU

DYNAMIC RANGE:

Taper: BASF LHI

Dolby Out	-48.5dB(Lin)	-54.0dB(A)
Dolby "B" In	-50.5dB(Lin)	-63.0dB(A)
Dolby "C" In	-52.0dB(Lin)	-66.5dB(A)

WOW AND FLUTTER:

WOW:	Average	0.2% P-P
FLUTTER:	Unweighted	0.1% RMS
	Weighted	0.05% RMS

ERASURE RATIO:

(for 1kHz signal recorded at OVU)

Taper: BASF LHI	90dB
Taper: TECHNICS RT - 60MX	90dB

Date: 16.5.81

Taper: BASF LHI

OVU:	2nd	100Hz	1kHz	6.3kHz	
2nd	-33.2	-56.8	-57.4	dB	
3rd	-37.1	-46.4	-41.0	dB	
4th	-39.5	-	-58.7	dB	
5th	-56.4	-67.9	-	dB	
T.H.D	1.44	0.5	0.91	dB	
-6VU:	2nd	-54.7	-63.6	-56.0	dB
3rd	-62.2	-61.8	-47.6	dB	
4th	-	-68.7	-60.1	dB	
5th	-62.0	-72.7	-	dB	
T.H.D	0.2	0.11	0.45	%	

NAKAMICHI 480Z

Dimensions: 450 mm wide, 135 mm high, 280 mm deep.

Weight: 6.4 kg
Price: \$599 rrp.

Manufactured: In Tokyo by Nakamichi Corporation

Distributed by: Convoy International, 4 Dowling St, Woolloomooloo, NSW.

of the 150 Hz third harmonic of mains frequency. (This is not really a channel separation problem so much as a common component evident in both channels of the machine). The actual level of channel separation is better than 75 dB at 500 Hz and is still better than 45 dB at 20 kHz. These are good figures and indicate the extent to which better performance may well be achieved in the three-head versions of the same 480 class systems.

The distortion levels are also good. At 0 VU they are typically 1.5% at 100 Hz and less than 1% at the other frequencies. At -6 VU the distortion levels are particularly low, being less than 0.25% at 100 Hz and 1 kHz and still less than 0.5% at 6.3 kHz.

The erasure ratio is very good, being

better than -90 dB on both standard gamma ferric oxide and metal tape.

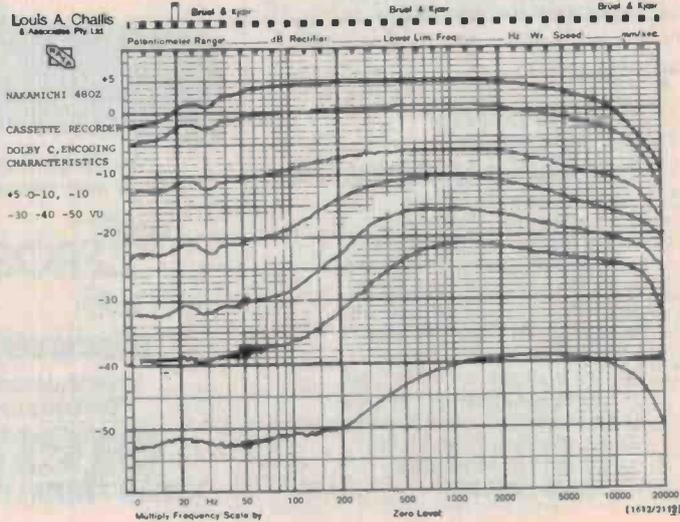
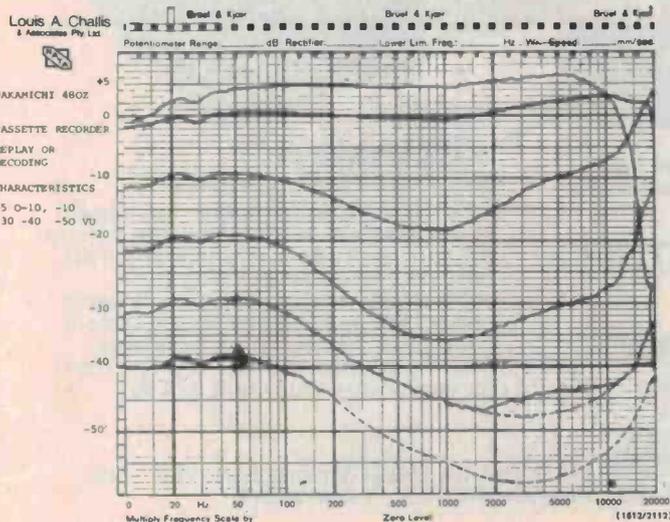
The wow and flutter figures are low at 0.2% wow peak-to-peak, whilst the weighted flutter is 0.05% RMS.

To the ear

The subjective evaluation of this machine was truly a delight in that the performance achieved on playback of pre-recorded tapes was outstanding. The performance achieved in recording material with Dolby C is also extremely good. The hum level is the only characteristic which is not typically Nakamichi. Without Dolby encoding this is -48 dB and as such was readily audible with my reference monitoring system. With Dolby C encoding this hum is -56 dB and is only just detectable.

Absolute copyright in this review and accompanying measurements is owned by Electronics Today International. Under no circumstances may any review or part thereof be reprinted or incorporated in any reprint or used in any advertising or promotion without the express written agreement of the Managing Editor.

The Nakamichi 480Z offers unusually good performance and facilities, especially with the new Dolby C noise reduction system, though one might well be tempted to pay the extra money for slightly better performance in one of the more advanced machines. At \$599 recommended retail this is not a cheap recorder, but its attributes more than justify the price tag.



'The quality remains after the price is forgotten?'

Henry Royce, founder of Rolls-Royce, 1906.



ZEROSTAT ANTI-STATIC PISTOL

The new red Zerostat Pistol is the latest version of a leader in it's field. The simplest way to remove static and it's associated symptoms. Needs no refills, batteries or power supply and neutralises static charges in seconds. Lasts for at least 50,000 operations. \$24.95.

New discwasher[®] DISCKIT

Combines the Zerostat Anti-static pistol, Discwasher D-4 Record Cleaning System and Discwasher SC-2 stylus cleaner in a handsome walnut storage tray with smoked perspex dust cover at a significant cost saving over the individual components. \$69. Save 22%. Discorganiser, the walnut tray and the perspex lid are available separately for just \$25.

New discwasher[®] D4 RECORD CLEANING SYSTEM

New formula D-4 fluid removes dust, dirt, even fingermarks, whilst protecting the vinyl record surface. Walnut mounted D-4 fabric pad has extra soft directional fibres to absorb fluid and contamination, leaving record surface entirely free of contamination or residue of any kind. DC-1 pad cleaner keeps the fabric in good condition for maximum efficiency. \$24.95.

New discwasher[®] SC-2 STYLUS CLEANER

SC-2 Stylus Cleaner fluid is formulated to disperse not only harmful grit, but also the very vinyl additives which D-4 fluid protects and which can clog stylii. SC-2 brush, with bristles of a calculated density and texture, removes dirt without damage to delicate stylus cantilevers. Reverse of brush is a magnifying mirror for easy stylus inspection. \$13.95.

Available now from hi-fi and record stores.

from
ZEROSTAT

and
discwasher[®]

Sole Australian
Distributors

arena
DISTRIBUTORS

642 Albany Highway, Victoria Park, W.A. 6100.
Ph: (09) 361 5422 Telex: 93299

Sansui puts you in charge of your music.

Does listening to your stereo system make you feel like you're at a live performance? Of course it doesn't. And if you don't agree, either you've got a tin ear or you've never been to a live performance. The best a stereo system can hope for is to approach the rich dynamism of the real thing. And at Sansui, that's our goal.

One way we do this is to put you in charge of the way your system sounds. Nobody we know of has a listening room with the fine acoustics of a music hall. And none of the standard reproduction methods — discs, tapes, FM — can accommodate the full dynamic range of a symphony. That's why you need versatile take-charge stereo equipment like the SE-8, a full 10-band stereo graphic equalizer with a built-in real-time spectrum analyzer. In a nutshell, it lets you recreate an approximation of the original performance.

Even if you don't opt for the

remarkable versatility of the SE-8, you get *four* tone controls — Superbass, Bass, Presence and Treble — with the AU-D7 "Linear-A" DD/DC integrated amplifier. Plus, you get MC-cartridge capability and the pure-sounding Linear-A design that has eliminated switching and cross-over distortion completely.

And when you're ready for the vast treasure-trove of musical enjoyment available over the airwaves, we've got the matching TU-S7 Quartz Synthesizer Tuner. It offers 3 tuning modes including preset pushbutton tuning of 6 FM and 6 AM stations.

If you want your music to sound like a live performance, let Sansui put you in charge

AU-D7



TU-S7

(Also available in black finish.)



SE-8

Sansui

SANSUI ELECTRIC CO., LTD. 14-1 Izumi 2-chome, Suginami-ku, Tokyo 168 Japan
VANFI (AUST.) PTY. LTD. 297 City Road, South Melbourne, Victoria 3205, Australia Tel: 690-6200
283 Alfred Street, North Sydney, N.S.W. 2060, Australia Tel: 929-0293

B&W DM 16

THE DOMESTIC MONITOR



New concepts of design philosophy and new materials developed to optimise driver performance allow the DM 16 to take over where the DM 6 left off. Many of these innovations have been carried forward from the intense research for model 801 now widely acclaimed as one of the best reference monitor loudspeakers in the world.

The DM 16 employs a sloping custom tooled front panel to ensure accurate time delay correction complete with an integrated stand. The DM 16 offers an attractive visual appearance with minimal loss of acoustic perfection.

Dimensions

950 mm high x 335 mm wide x 415 mm deep.

Monitor Standard

Frequency linearity ± 2 dB 65 Hz to 20 kHz.

APOC-Protected

B&W's exclusive audio-powered overload circuit protects against accidental damage or overload.

B&W

LOUDSPEAKERS

For further information see your B&W dealer or contact
Convoy International Pty Ltd
4 Dowling Street Woolloomooloo NSW 2011
Telephone (02) 358 2088

Available from: N.S.W.—Leisure Sound City • Artarmon • Parramatta. 29 1364 • Russin Electronics, Ashfield. 799 2421 • Duty Free Travellers Supplies, Sydney. 290 1644 • Dave Ryall Electronics, Dee Why. 982 7500 • Singleton Hi Fi, Singleton. (065) 72 2793 • Springwood Hi Fi, Springwood. (047) 51 3091 • Pitmans, Wagga Wagga. (069) 25 2155 • Wollongong Hi Fi, Wollongong. (042) 28 3773. ACT—Duratone Hi Fi, Phillip. (062) 82 1388. VIC.—Tivoli Hi Fi, Hawthorn. (03) 818 2872 • Steve Bennett Audio, Geelong. (052) 21 6011 • Boon Sound, Wodonga. (060) 24 3388. QLD.—John Gipps Stereo, Brisbane. (07) 36 0080 • Mackay Audio Centre, Mackay. (079) 575 035 • Premier Sound, Rockhampton. (079) 27 4004. S.A.—Soundcraftsman, Hawthorn. (08) 272 0341. W.A.—Audio Distributors, Mosman Park. (09) 384 5455 • Audio Centre, Perth. (09) 322 5177. TAS—Bel Canto, Hobart. (002) 342 008.

The audio experts are raving about Sonic Holography



C-4000 Control Console

"When the lights were turned out we could almost have sworn that we were in the presence of a real live orchestra."

Hal Rodger, Popular Electronics

"Had I not experienced it, I probably would not believe it . . . the 'miracle' is that it uses only the two normal front speakers."

Julian Hirsch, Hirsch-Houck Labs

Sonic Holography is only the most spectacular achievement of the C-4000. The others are merely extraordinary.

Consider what you actually have in the C-4000

- A full function stereo preamplifier
- A time-delay system with controllable reverberation mix
- A built-in 40 watt (total) power amplifier for time delay speakers
- The Autocorrelator system that reduces noise up to 8 dB with any source material
- A peak unlimiter-downward expander that nearly doubles dynamic range
- And the Sonic Hologram system that aroused the quotes above.

To hear for yourself why all the audio experts have flipped over Carver, ask us for a demonstration and descriptive literature. It will be a totally new experience for you.

CARVER

CORPORATION

DISTRIBUTED BY CONVOY SYDNEY (02) 358 2088

Available from:

N.S.W.: LEISURE SOUND City • Parramatta • Artarmon 29 1364
VIC: TIVOLI HI-FI Hawthorn-818 2872
QLD: STEREO SUPPLIES Brisbane 221 3623
S.A.: SOUNDCRAFTSMEN Hawthorn 272 0341
W.A.: THE SOUNDCRAFTSMAN Subiaco 381 5114

The new-dimension excitement of National's lifesize, lifelike... **Big Entertainer.**



These new dimensions in home entertainment can be seen and heard only at selected National Video Specialists.

Try it for size...

NATIONAL CINEMA VISION TC-4500's 115 cm picture projects with unvarying clarity to virtually every corner of your room.

Try it for sound...

Cinemavision's FM sound comes alive through a hi-fidelity 2 way, 4 speaker system. And you have total armchair control through the Big Entertainer's 26-function cordless remote control.

Try it for systems...

Couple your video recorder, link your stereo gear,

tune in your FM radio, plug in your video games, or watch your favourite programmes, all in life-size colour – a new era of sight & sound enjoyment.

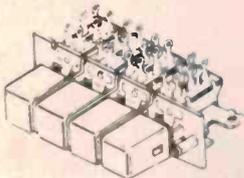
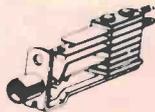
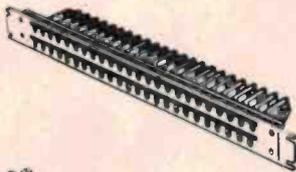
CINEMA VISION
National
just slightly ahead of our time.

T519



CONNECTORS & ELECTRONIC COMPONENTS

Superb quality and reliability from one of the oldest and most experienced manufacturers in the U.S.A.



AUSTRALIAN DISTRIBUTORS
AUDIO TELEX COMMUNICATIONS
PTY. LTD.

SYDNEY
1 Little Street,
Parramatta, 2150
Tel: 633 4344

MELBOURNE
7 Essex Road,
Mt. Waverley, 3149
Tel: 277 5311

BRISBANE
394 Montague Road,
West End, 4101
Tel: 44 6328

SHEAFFER *Pen Portraits*



Matte Black 1002 Black and silver have always been a classic colour combination. Take the modern Targa look, make the black matte, add the stylish writing of a Rolling Ball, and you have a brand-new classic for the '80s - a Sheaffer classic. The Matte Black 1002 also comes in a Ballpoint \$16.95, Propelling Pencil \$16.95* and Fountain Pen with stainless steel inlaid nib \$27.50*. Another classic combination.*

\$19.95*

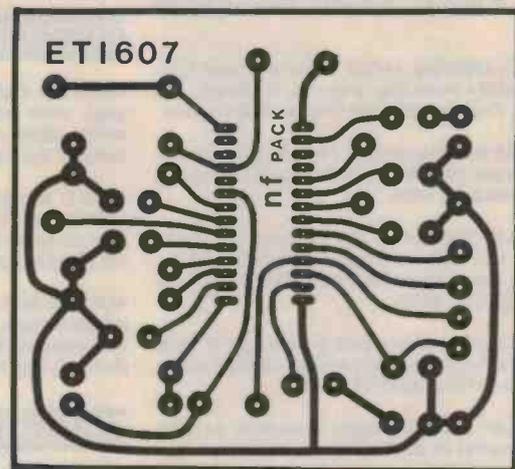
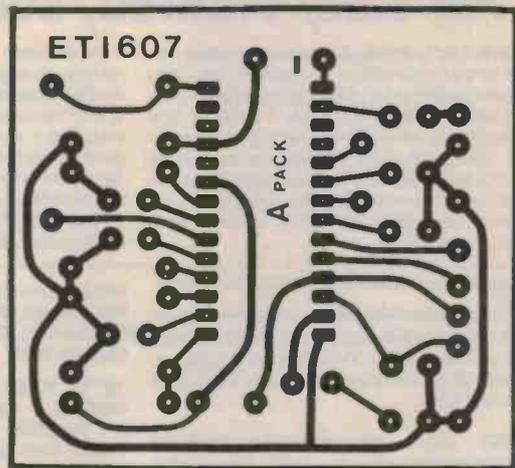
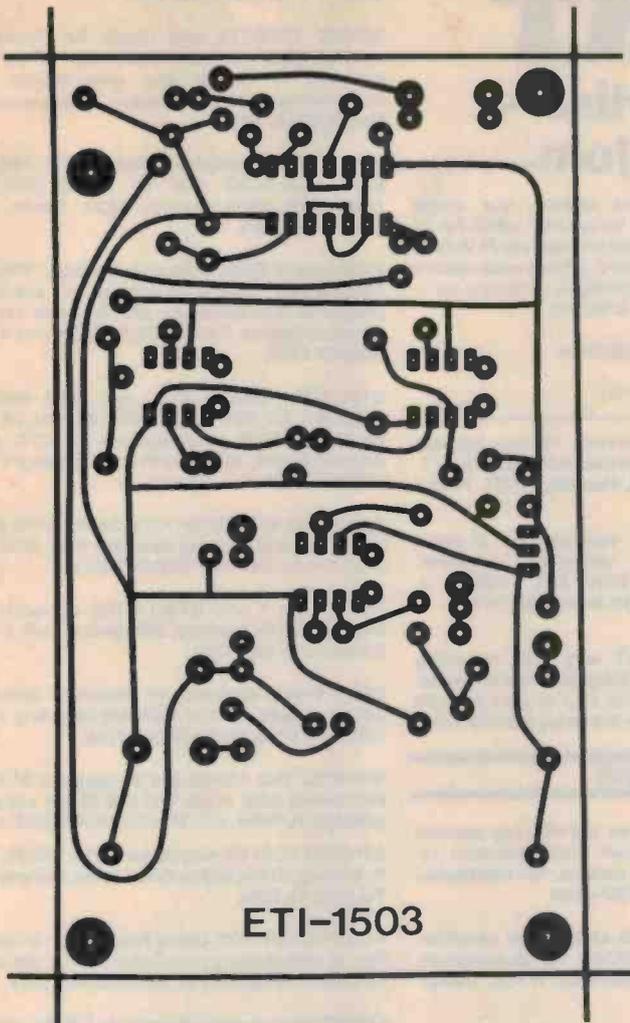
Kaleidoscope 'Silver Rings' Just one of the six highly individual Kaleidoscope cap designs. In a basic, easy-to-hold easy-writing Rolling Ball pen. Big, sturdy clip and strong ABS barrel and cap make Kaleidoscope a pen for everyone, everyday. This model comes in a ballpoint too, \$2.98. Why write anonymously? Choose the design that suits your personality and sign with a flourish.*

\$2.98*

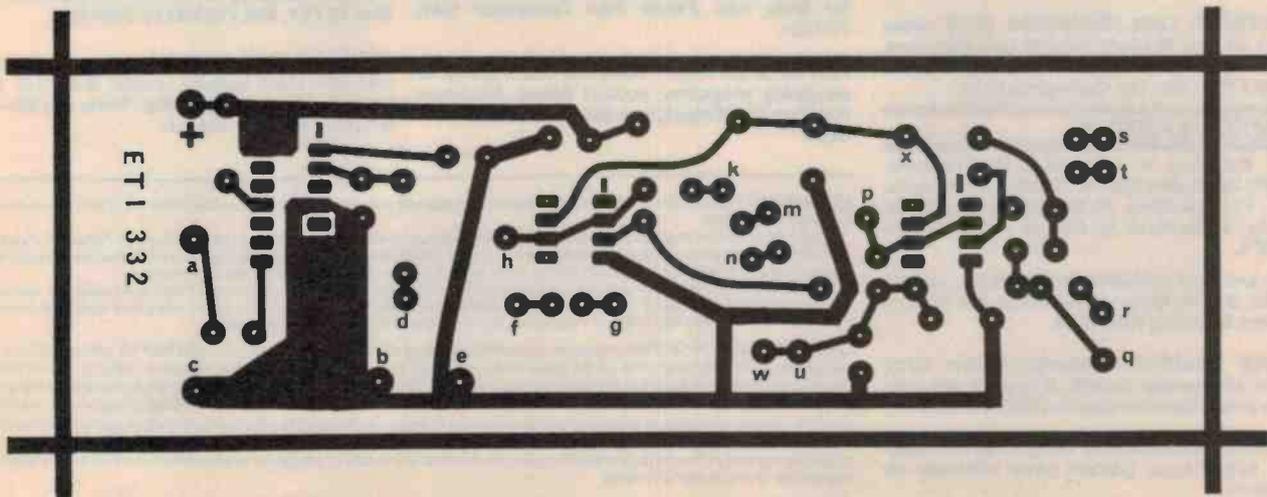
*Recommended Retail Prices

SHEAFFER PEN **TEXTRON**

Sheaffer Eaton Division of Textron Pacific Ltd.



Instructions on how to make your own pc boards using the Scotchcal method and exposing through this page may be found on page 159 of the June '81 issue.



MINI-MART

Where readers can advertise —
For Sale/Wanted/Swap/Join.

• We'll publish up to 24 words (maximum) totally 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 adverts clearly, otherwise it may not turn out as you intended! Every effort will be made to publish all adverts received however, no responsibility for so doing is accepted or implied. Private adverts only will be accepted. We reserve the right to refuse adverts considered unsuitable.

• Conditions: Name and address plus phone number (if required) must be included within the 24 words. Reasonable abbreviations, such as 25 W RMS or 240 Vac, count as one word. Adverts must relate to electronics, audio, communications, computing etc — general adverts cannot be accepted. Send your advert to:
ETI Mini-Mart, Modern Magazines
15 Boundary St,
Rushcutters Bay NSW 2011

AUDIO

SELL: 300+300 W RMS amplifier. Built and tested, including power meters. VI limiting and speaker protection built in. Dual power supplies, \$650. Rod Smart (053)52-2487.

DAHLQUIST DQ10 Professionally modified mirror-imaged loudspeakers, \$950. Quad 22/II valve system including tuners, \$395. Quad AM3 tuner wanted. Brisbane (07)262-5168.

WANTED: Instruction manual and circuit diagram for Teac A-3300. Photostat copy acceptable. Will pay \$10. R. Eldridge, 33 Rosella Crescent, Wulagi 5793.

WANTED: Goldring Lenco variable speed turntable. Details including price to D. Rintel, 133 North St, Toowoomba 4350. Phone (076) 32-4958.

TECHNICS SU-V6 amplifier, 70 watts per channel, 6 months old, \$400. Write: Alan Ung, 40 Boronia St, Kensington NSW 2033.

FOR SALE: Thorens TD 166 turntable with TP 11 tonearm and ADC cartridge. Excellent condition, \$180. Ian Cruickshank, 56 Forest Road, Launceston Tas. (003)31-4859.

FOR SALE: JVC add-on rear amp, 4 x 25 W RMS, inbuilt graphic equal. plus remote control. As new, \$100. Phone Pat ah (02)759-5080.

FOR SALE: Kenwood audio de-noiser, as new, \$40. Phone Pat ah (02)759-5080.

FOR SALE: Remote control for Teac RTR A4300, never used, \$40. Phone Pat ah (02) 759-5080.

BOOMERANG TAPE RECORDING CLUB. Make friends all over Australia through tape recording. Lots of services offered. For information about the club, B.T.R.C., Box 155, Carlingford 2118.

MISCELLANEOUS

SELL: Resistors ¼, ½, 1, 5 & 10 W, approx. 100 000. Capacitors approx. 10 000, mixed values. 240 V 10 A, sockets, flush mount, 80c each. M. Sully, 61 Newman St, Niddrie Vic. 3042. (03) 379-2879.

RACK and card system/s (front panel ≈ 1 x 2m) wanted, second hand. John Jacobs, 959 Princes Highway, Engadine NSW 2233.

WANTED URGENTLY: Motorola diodes, thirty 1N4934 and twenty 1N4935. If anyone can help please phone Mark Buckley on (062)45-4283 b.h.

FOR SALE: Approximately 120 ETI and EA magazines, \$20.00 o.n.o. Contact David Wilkinson on (03)469-3171.

SENSATIONAL ZX80 software. Send SSAE for list, \$1.50 each or for 10+, \$1.00 each. A.F.T. 15 Mitchell Ave, Tatura, Vic 3616.

SOUND EFFECTS and music for System 80 system tape with demonstration tunes, plus program to create your own effects, fully documented, \$7.50. D. Johnson, 50 Bayswater Rd, Moonah Tas 7009.

FOR SALE: SOL-20 plus software, \$900; 64K RAM, \$550; Discus-2D plus 50 discs, \$950; SM Electronics S100 chassis, \$230. Phone: Mark (049)51-3880 a.h.

ZX80 new 8K ROM, instruction manual, "The ZX80 Companion", magazine copies of associated programs and materials, etc. Includes cassette player and leads. Value \$350. Sell \$300 ono. Phone (02)663-4830.

S100 CPU: Bought \$330, sell \$250, excellent condition. SD-SBC-100, 2.5 MHz, 2K Mon, 1K RAM, up to 8K PROM, parallel/series I/O, CTC, more! Andrew Heard, 18 Elsworth Dv, Banksia Pk 5091. (08)264-1055.

SYM-1 with 8K RAM/8K ROM BASIC, \$200. KTM-2 (keyboard and video) in case with PSU, \$250. Both \$420. David Johnson (08)293-5605 a.h.

FOR SALE: 1 only SYM.1/KTM2 computer with BASIC and 16K memory, \$400 ono. R. Hall, c/- P.O. Southbrook Qld. 4352.

SELL: Dream 6800 with 4K expansion board and power supply. Lots of software including dream invaders. \$100. Phone (08)44-1765.

WANTED: Dec '80 and Jan '81 copies of 80-Micro-computing (U.S. mag). Will pay \$5 per copy incl. postage. R. Rider, P.O. Box 26, Weston ACT. 2611.

STRINGY FLOPPY with 25 wafers for TRS80, \$300. R. Worley, 9 Henderson Court, Glen Waverley Vic. Tel (03)233-1986.

AUSTRALIAN ZX80 Users Association is for you. For an introductory newsletter send a 30c stamp to: AZUA, 19 Godfrey St, Cambell ACT 2601.

ACTIVE filter design program for OSI C4, actually draws the circuit and calculated values on the VDU. \$20 on 5" disk, \$10 for listing only. P.O. Box 73, Lyneham ACT 2602.

CHIP8 — Programs and routines to share and swap. Offer of help to other beginners. Frank Rees, 27 King St, Boort Vic 3537.

HEATH H8 microcomputer, 16K RAM, serial I/O, BASIC, Assembler, Text Editor, \$495. Heath H9 video display/keyboard, RS232 interface, \$300. Mod 15 TTY, \$50. VK3BSX (03)598-1034.

SELL: Watanabe X-Y/X-T recorder, full A3 size with roll chart adaptor, model WX-411R. Used once, \$1800 ono. Phone Reg, Yowie Bay 524-5918 a.h., 525-2811, ext. 281 b.h.

SELL: Quantity of transformers, 120 Vac. Primary 24V 500 mA centre-tapped secondary 30c each. T. Pearson, 31 St. Pauls St, Randwick 2031. Phone (02)398-1861.

19"×8" RACK FRAMES, seconds, incl 8 cards holders, removable mounting brackets, 5¼"(3U), \$25, Exorcisor/S100, \$50, +PSTGE. J. Wicks, 1040 Heatheron Rd, Noble Park 3174.

LARGE STEEL CABINET with rack mounting suitable for modems, switchgear, small computer or test equipment. Size: 2 m x 0.7 m x 0.7 m. Front and rear doors. \$200. Glen Waverley (03)560-6708.

COMMUNICATIONS

ICOM 551 Delta, 10 weeks old with log periodic yagi. Also digital readout communication receiver. Both as new, in cartons. HF transceiver wanted. Springwood (047)51-4050.

LUNAR Model HF3 solid state linear amplifier, 100 W, 3-30 MHz, SSB/CW/AM, 12 Vdc operation. New cond. Best reasonable offer. W.H.R. Treloar. Ph. (02)239-5267 b.h.

AUSTRALIAN RADIO DX CLUB: For shortwave, medium wave, utility and amateur listeners. Big monthly bulletin sent to all members. Details from: Box 227, Box Hill Vic 3128, for the cost of a stamp.

COMPUTERS

SELL: DG640 VDU, DG680 CPU, TCT 64K board with 16K, SECI, 6-slot motherboard, software (BASIC, Assembler, games). Cost \$900 as kits, sell for \$800 ono. Phone Paul Colquhoun (049) 77-1231.

FOR INFO ON TI-99/4 computer users group, or swapping programs, contact Shane Andersen, P.O. Box 101, Kings Cross 2011 or phone (02)358-6662.

COPYRIGHT: The contents of Electronics Today International and associated publications is fully protected by the Commonwealth Copyright Act (1968).

Copyright extends to all written material, photographs, drawings, circuit diagrams and printed circuit boards. Although any form of reproduction is a breach of copyright, we are not concerned about individuals constructing projects for their own private use, nor by pop groups (for example) constructing one or more items for use in connection with their performances.

Commercial organisations should note that no project or part project described in Electronics Today International or associated publications may be offered for sale, or sold, in substantially or fully assembled form, unless a licence has been specifically obtained so to do from the publishers, Modern Magazines (Holdings) Ltd or from the copyright holders.

LIABILITY: Comments and test results on equipment reviewed refer to the particular item submitted for review and may not necessarily pertain to other units of the same make or model number. Whilst every effort has been made to ensure that all constructional projects referred to in this edition will operate as indicated efficiently and properly and that all necessary components to manufacture the same will be available no responsibility whatsoever is accepted in respect of the failure for any reason at all of the project to operate effectively or at all whether due to any fault in design or otherwise and no responsibility is accepted for the failure to obtain any components parts in respect of any such project. Further, no responsibility is accepted in respect of any injury or damage caused by any fault in the design of any such project as aforesaid. The Publisher accepts no responsibility for unsolicited manuscripts, illustrations or photographic material.



Electronics Today International is published by Modern Magazines (Holdings) Ltd, 15 Boundary St, Rushcutters Bay NSW 2011. It is printed (in 1981) by Offset Alpine, cnr. Wetherill and Derby Sts, Silverwater NSW, and distributed by Gordon and Gotch.

Editor
Roger Harrison VK2ZTB
 Technical Editor
David Tilbrook VK2YMI
 Production Editor
Jane Clarke B.A. (Hons)
 Editorial Staff
William Fisher B.Sc. (Hons)
J.B. Scott B.Sc./B.E. (Hons)
VK2YBN
Jan Vernon B.A.
Phil Wait VK2DKN
 Layout
Bill Crump
 Typesetting
Lin Booth
 Reader Services
Jan Collins
 Managing Editor
Collyn Rivers
 Acoustical Consultants
Louis Challis & Associates

Mail enquiries: There is no charge for replies, but a foolscap-sized, stamped, addressed envelope must be enclosed. Queries relating to projects can only be answered if related to the item as published. We cannot advise on modifications to projects, other than errata or addenda, nor if a project has been modified or if components are other than specified. We try to answer letters as soon as possible. Difficult questions may take time to answer.

Phone enquiries: We can only answer readers' technical enquiries by telephone after 4.30 pm. In enquiring by telephone about back issues or photostats, please ask for the Subscriptions Department.

(02)33-4282

Editorial and Sales Office:
4th Floor, 15 Boundary St, Rushcutters Bay NSW 2011. Ph. 33-4282; Tlx: 27243
 Sales Manager: **Bob Taylor**
 Sales Admin: **Jan Collins**
 (address as above)

Melbourne: Virginia Salmon, 150 Lonsdale St, Melbourne Vic 3000. Ph: 662-1222; Tlx AA34543.

New Zealand: Frank Hargreaves, Circulation Marketing Manager, c/- ACP, 4th Floor, Sun Alliance House, 42-44 Shortland St, Auckland. Ph: (9)30311.

Adelaide: Admedia Group, 24 Kensington Rd, Rose Park SA 5067. Ph: 332-8144; Tlx AA82182.

United Kingdom: Australian Consolidated Press, Ludgate House, 107 Fleet St, London EC4A 2AL. Ph: 353-1040; Tlx: 267163.

Brisbane: Geoff Horne Agencies, 16 Bellbowrie Centre, Bellbowrie Qld 4070. Ph: 202-6813.

Japan: Genzo Uchida, Bancho Media Services, 15 Sanyocho, Shinjuku-Ku, Tokyo 160. Ph: 359-8866; Cable: Elbanchorito; Tlx: BMSINC J25472 Tokyo.

Perth: Aubrey Barker, 133 St Georges Terrace, Perth WA 6000. Ph: 322-3184; Tlx: AA93810

USA: Peter Samuel, Australian Consolidated Press, 444 Madison Avenue, New York NY 10022. Ph: 751-3383; Tlx: 620892.

The publisher accepts no responsibility for unsolicited manuscripts, illustrations or photographic material.

ORDER FORM

I enclose \$ for (tick appropriate box/es). All prices include postage.
 Send orders to: ETI, 4th Floor, 15 Boundary St, Rushcutters Bay NSW 2011. Phone: (02)33-4282.

<input type="checkbox"/>	Subscriptions	\$23.30 per year within Australia \$28.80 overseas (surface mail) Airmail rates on application	\$	NAME (Please print)
<input type="checkbox"/>	Back Issues	\$2.50 from April 1977 on (October 1978 unavailable)		ADDRESS
<input type="checkbox"/>	or photocopies	\$2.50 per article per issue	
	Project No.	Month	Year	\$
	Project No.	Month	Year	\$
	Project No.	Month	Year	\$
	Project No.	Month	Year	\$
	Please attach a list if more than four required.		
<input type="checkbox"/>	Binders	No. @ \$6.10 in NSW No. @ \$7.50 in other states	\$	POSTCODE

DREGS



LIFE WASN'T MEANT to be easy — a cliché variously attributed to M*lc*Im Fr*s*r, George Bernard Shaw and Pliny the Elder (* — fill in the spaces to suit yourself) — is readily recognised as a corollary of Murphy's law. Those of you who've been involved in computer programming could undoubtedly relate at least one memorable occasion when the adage applied. The learned gentlemen of the London Science Museum certainly could.

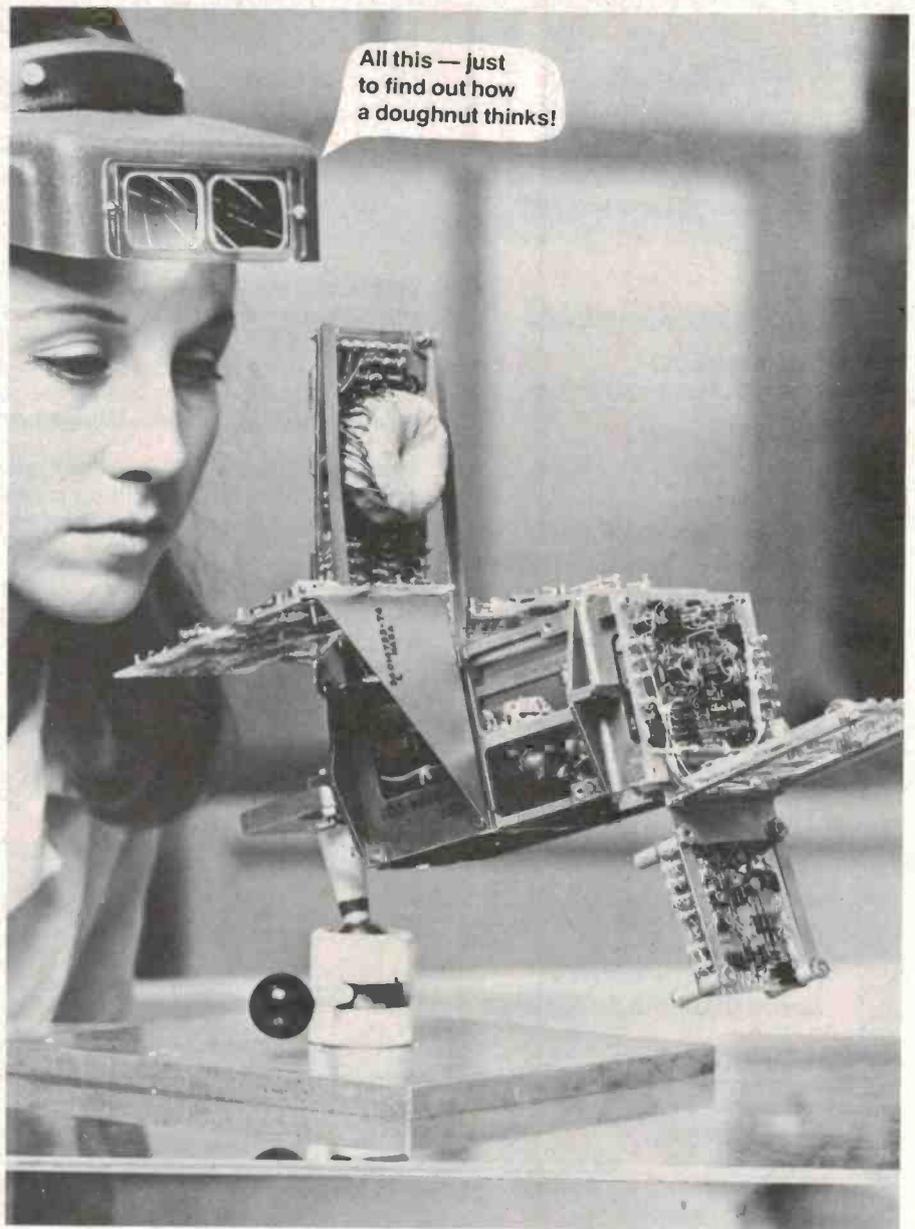
Back when 'personal' computers first began to trickle through to the public's imagination (1975-76), the London Science Museum set up a new gallery devoted to the history of computing science. Part of the display consisted of a computer terminal and video display for visitors to experiment with.

The Science Museum staff, realising that the odd visitor might fill the display with various graffiti, loaded the computer's memory with a vocabulary of unsuitable words and phrases.

If any such words were entered via the terminal the computer discreetly prevented them being displayed.

At least, that was the intention.

Apparently, the system worked quite well for a time until one day a teacher with a large class of genteel girls was faced with a display totally filled with obscenities — the computer had somehow contrived to display its vocabulary of bad words!



King Kong meets Godzilla — Quotes comp.

in your lounge room?
A three-dimensional television set able to produce life-size images is to be jointly developed by two US companies, Design West Inc. and Biofuel Inc. If they get the product off the ground (pardon the pun) it will no doubt do wonders for the video recorder and software market. We have a few misgivings though; hence the heading. Imagine — King Kong in your lounge room, and life-size? We note that 'life-size' was not defined, however. That misgiving notwithstanding, just think what such a television would do for the 'skinflink' video companies!

You didn't **really** think we meant two years' sub. to E.A. (see last issue) was worth less than one?! This contest is more cunning than first glance reveals. To win second prize (twice the value of first prize) you have to have just sufficient incorrect answers to be one behind the person who happens to get one more right than yourself. If you're convinced you have all the correct answers, you have to deliberately put in some wrong ones. But how many? It's going to be interesting.

Incidentally, the contest closes with the last post of 30 September, 1981.



THE IDEA BEHIND OUR RADIO CASSETTE RECORDERS.

The stereo headphone represents perfect stereo reproduction.

As well as receiving sound through your ears, you appear to receive sound from above your head.

This added dimension in sound is stereo.

Of course, anyone can get this sound from any good stereo radio cassette recorder if they listen through stereo headphones.

But, at JVC, we realised it was impractical to wear stereo headphones all the time.

So we invented a new kind of sound system just for our stereo radio cassette recorders.

The Biphonic System.

This exclusive system offers 3-dimensional sound effects, so you enjoy true stereo reproduction without headphones.

If you'd like to know more about the many innovations JVC has brought to the stereo radio cassette recorder, write to us for a brochure, or call in to any JVC dealer.

Then you'll see why JVC equipment is recognised as **The State of the Art.**





TELETEXT

The Information Computer
you access on your own Television



- **STOCK BROKERS—SHARE MARKET ENTHUSIASTS**—Get the latest Stock Exchange and Futures market reports.
- **PUNTERS**—Get the latest odds on a race and the earliest actual results and dividends.
- Who won the cricket, football, league, tennis—get all the important results.
- What were the lotto, lottery, pool numbers—how much did it pay?
DID YOU WIN? The results are on Teletext.
- **MUM**—How much should you be paying for fruit and veggies, meat and poultry.
- **DAD**—Read the news at your leisure.
- **KIDS**—Enjoy mastermind, jokes, graphics and puzzles.
- What will the weather be like tomorrow in Brisbane, Sydney, Perth, New York, Athens, London—**IT'S ALL ON TELETEXT.**

GET ALL THIS INFORMATION and much more from the **FREE** electronic newspaper of the 80's—**YOUR OWN** television set with an **ADAM 180 TELETEXT ADAPTOR** by **RADOFIN ELECTRONICS (AUST).**

THE ADAM 180 TELETEXT ADAPTOR

by
RADOFIN ELECTRONICS (AUST)

5 Curlewis Street, Borindi, NSW 2026, AUSTRALIA

Telephones: (02) 309 1957 or (02) 309 1904