AUSTRALIA'S NUMBER ONE ELECTRONICS MAGAZINE

ELECTRONICS AUSTRALIA

Registered by Australia Post — publication No. NBP0240.

JUNE 1983
AUST $2.10* NZ $2.60

COMMODORE COMPUTER REVIEWED

PERSONAL ROBOTS ARE HERE!

SWITCHMODE POWER SUPPLY

SOUND EFFECTS FOR MUSICIANS

◀ Heart pacemakers: Australian success story

SONY
THE ONE AND ONLY

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

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

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

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

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

Compact Discs Last Forever

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

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

CDP-101 Specifications

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

Contact Sony for the name of your nearest dealer.
Sydney (02) 2660655, Adelaide and N.T. (08) 212 2877, Brisbane (07) 44 6554, Perth (09) 323 8686,
Melbourne (03) 419 3133, Launceston (003) 44 3078, Wollongong (042) 715777.

AUD0378

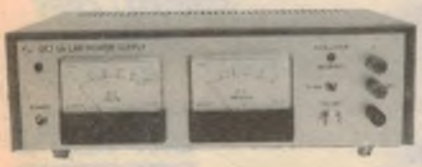
AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE

ELECTRONICS AUSTRALIA

Volume 45, No. 6
June, 1983

Sound Effects Unit

How about a versatile "Effects Unit" that can create phasing, flanging, echo, reverb and vibrato effects for around $75? This unit does all that and is easy to build. Details page 68.



Introduced last month, our new switchmode power supply has an adjustable output voltage from 3 to 50V and a maximum 5A output at voltages up to 35V. Construction starts on page 56.

On the cover

Robots may not be everyone's cup of tea, but they are the coming thing in industry. Find out more about them in our feature article on page 12, and read our review of the Mitsubishi Movemaster personal robot on page 20. Inset shows an Australian-made heart pacemaker from Telectronics (see story page 32).

FEATURES

SPECIAL OFFERS AND COMPETITION

HIFI, VIDEO AND REVIEWS

PROJECTS AND CIRCUITS

PERSONAL COMPUTERS

COLUMNS

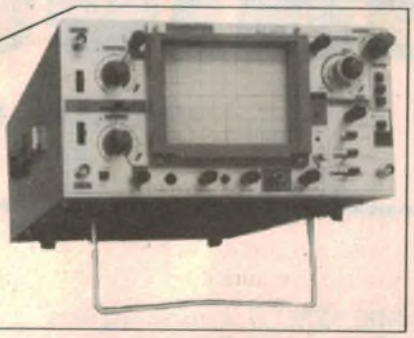
DEPARTMENTS

THINKING ABOUT BUYING A SCOPE?

FOR PERFORMANCE & VALUE AARON HAS TO BE YOUR FIRST SCOPE CHOICE

All these scopes are dual trace and incorporate the latest features such as high brightness rectangular CRTs.

SIGNAL AND TIMEBASE DELAY



- 7.7nS risetime
- Single sweep
- Trigger delay
- TV sync
- X-Y, dual, chop, add, subtract etc.

45MHz/1mV

BS625 $1095

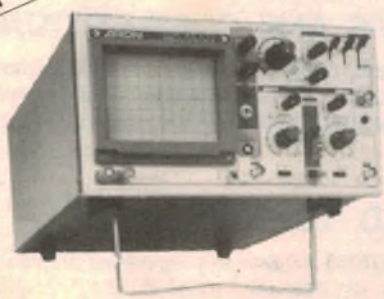
ALTERNATE AND DELAYED TIMEBASE

- 21 range timebase
- 100mS-1 μS trigger delay
- Front panel trace rotate
- X-Y, dual, chop, add, subtract etc

35MHz/1mV

BS635 $875

BUILT-IN COMPONENT TESTER



- Check components on screen
- 19 range timebase
- Triggerable to over 30MHz
- 17nS risetime

20MHz/5mV

BS601 $535

BATTERY PORTABLE

- 2 hour operation from built in NiCad battery
- Automatic recharging
- Auto trigger free run
- TV sync

15MHz/2mV

BS310 $795

COLINE SP100 PROBE

Professional 100MHz probe offering x1, ref, x10 positions. 1.5m lead with BNC connector and selection of tips. Complete in heavy duty plastic pouch. **$28**

QUICK SPEC CHECK

AARON

MODEL	B'WIDTH	SENS	SIG DEL	TRIG DEL	SCREEN	T'BASE
625	45MHz	1mV	Y	Y	150mm	0.2uS - 0.5S div
635	35MHz	1mV	N	Y	150mm	0.1uS - 0.5S div
601	20MHz	5mV	N	N	150mm	0.5uS - 0.5S div
310	15MHz	2mV	N	N	95mm	0.5uS - 0.5S div

All prices are plus sales tax if applicable and subject to change without notice

ELMEASCO Instruments Pty. Ltd.

MAIL COUPON FOR FREE GUIDE

Please send me a copy of your shortform oscilloscope guide.

NAME _____

ADDRESS _____

_____ P'CODE _____

TELEPHONE _____

P.O. Box 30, Concord
N.S.W. 2137
13-15 McDonald Street,
Mortlake, N.S.W.
Telephone (02) 736 2888
Telex 25887

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

Adelaide: (08) 271 1839
Brisbane: (07) 369 8688
Perth: (09) 398 3362

bankcard

N.S.W. Ames Agency 699 4524 • George Brown 519 5855 • Davred 29 6601 • DGE Systems (049) 69 1625 • Radio Despatch 211 0191 • Vimcom (042) 28 4400 ***VICTORIA*** Radio Parts 329 7888 • Browntronics 419 3986 • G.B. Telespares 328 4301 • Elanco 428 4345 • Ellistronics 602 3282 ***QUEENSLAND*** L.E. Boughen 36 1277 • Colourview Wholesale 275 3188 • Audiotronics 44 7566 • Electronic Shop (075) 32 3632 • Nortek (077) 79 8600 • W.G. Watson (079) 27 1099 ***S.A.*** Protronics 212 3111 • Trio Electrix 51 6718 ***W.A.*** Atkins Carlyle 321 0101 • Hinco Eng. 381 4477 • Brookeades 276 8888 • Protronics 362 1044 ***A.C.T.*** Actec (062) 90 6576 ***N.T.*** Thew & McCann (089) 84 4999 ***TAS.*** G.H.E. Electronics 31 6533 & 34 2233

Editorial Viewpoint

"Sunrise industries" don't need tax concessions

Perhaps some readers may be aware of the recent release of the Espie report on "Developing High Technology Enterprises for Australia", prepared by the High Technology Financing Committee of the Australian Academy of Technological Sciences. The main thrust of this report is a recommendation for the establishment of a formal structure to encourage venture capital for new, high-technology industries.

In this way, it is hoped that Australia will become a fertile breeding ground for the new "sunrise industries" as they are referred to by the Australian Government. While, at first sight, this is a worthwhile method of encouraging the development of new technology it could easily turn out to be just another way of fostering a cossetted and inefficient industry.

I am one of those who believe that Australia is better off without the grossly inefficient electronics industry that we had before the 1970's. Sure, that industry employed a lot of people but the products it turned out were very expensive. Consider for example, the cost of a black and white television set. The average 23-inch set in a basic console cabinet cost more than twice the weekly wages of an average worker.

Today, a small black and white TV can be bought for around $90 and the average colour TV set is very much cheaper (in real terms) than when they were first introduced eight years ago.

It is most unlikely that electronic goods would be as cheap as they are today if we still had the same high levels of protection. Our remaining electronics industry has to contend with strong import competition and is much more efficient than it was.

While the Espie report is not necessarily advocating a return to high tariff protection for "sunrise industries" it does suggest special tax concessions which would not be available for other new industries and which may be abused as a tax dodge. The Australian Government already has a range of incentives for new Australian industries (such as its export development grants) which, when fully analysed, are quite generous.

It is my opinion that if new "sunrise industries are well conceived at the start they will not need additional cossetting by the Government. Witness the success of Telectronics Pty Ltd and more recently, Applied Technology Pty Ltd with its Microbee computer. 10,000 have been produced and it is now being exported.

Leo Simpson

EDITOR-IN-CHIEF
Neville Williams
F.I.R.E.E. (Aust.) (VK2XV)

EDITOR
Leo Simpson
B. Bus. (NSWIT)

ASSISTANT EDITOR
Greg Swain, B.Sc. (Hons. Sydney)

TECHNICAL PROJECTS
John Clarke, B.E. (Elect. NSWIT)
Peter Vernon, B.A. L.L.B. (NSW)
Jeff Skeen
Colin Dawson

PRODUCTION
Danny Hooper

GRAPHICS
Robert Flynn

SECRETARIAL
Pam Hilliar

ADVERTISING MANAGER
Selwyn Sayers

CIRCULATION MANAGER
Alan Parker

Editorial and Advertising Office
57 Regent St, Chippendale 2008.
Phone (02) 699 3622 Telex 25027.
Postal Address: PO Box 163, Chippendale, 2008.
Advertising Sales Manager: Sel Sayers.

Melbourne — 392 Little Collins St, Melbourne 3000. Phone (03) 602 3033.
Representative: Mark Christian.

Adelaide — Charles F. Brown & Associates Ltd, 178 Fullarton Rd, Dulwich 5065
Representative: Sandy Shaw (08) 332 7711.

Perth — 454 Murray Street, Perth 6000.
Representative: Ashley Croft (09) 321 8217.

Circulation Office
Unit 3B, Sydneygate, Waterloo, 2018.
Phone (02) 699 2388.

Subscriptions
Subscription Dept, John Fairfax & Sons Ltd, GPO Box 506, Sydney 2001.
Enquiries: Phone (02) 699 2388.

Distribution
Distributed in NSW by Magazine Promotions, 57 Regent St, Chippendale; in Victoria by Magazine Promotions, 392 Little Collins Street, Melbourne; in South Australia by Magazine Promotions, 101-105 Waymouth St, Adelaide; in Western Australia by Magazine Promotions, 454 Murray Street, Perth; in Queensland by Gordon and Gotch (A'asia) Ltd; in Tasmania by Ingle Distributors, 93 Macquarie St, Hobart; in New Zealand by Gordon and Gotch (NZ) Ltd, Adelaide Rd, Wellington.

Registered by Australia Post — publication No. NBP0240.

Copyright. All rights reserved.

Information is furnished in this magazine without responsibility for its ultimate use or for any failure of equipment to operate as expected, or for any damage, loss or injury which may be sustained. Patents may apply to devices or arrangements depicted in this magazine.

Material intended for publication is submitted at the sender's risk and while care will be taken, responsibility for any possible loss will not be accepted by "Electronics Australia".

Printed by Magazine Printers Pty Ltd, of Regent Street, Chippendale and Masterprint Pty Ltd of Dubbo NSW for Magazine Promotions, of Regent St, Chippendale.

ISSN 0313-0150

* Recommended and maximum price only.

BIG SAVINGS ON CASIO CALCULATORS

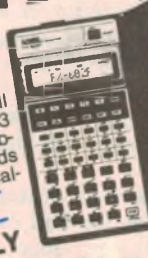
Casio FX-3600P Scientific/Programmable

Wow! Check out the Casio FX-3600P, programmable up to 38 steps - and it's an ideal calculator for engineers, uni, tech and advanced high school students, technicians etc. Ask about our tax free price for students.
Cat. Q-3105

SAVE $10

WAS $59.95 ONLY $49.50

Casio FX-602P Advanced Programmable



Advanced programmable: 88 memories . . . 512 steps . . . full memory retention. An amazing 33 parenthetical levels, up to 9 sub-routines and nestings . . . Sounds more like a computer than a calculator? You're right!
Cat. Q-3110

SAVE $30

WAS $199 ONLY $169

A Colour Computer for under $200!

DICK SMITH VZ-200

Here it is at last – the personal computer you've been waiting for! With all the right features: colour graphics, sound, standard Microsoft BASIC, both RF and video output, and lots more. Yet thanks to modern technology and Dick Smith's massive buying power, it will cost you only **$199** – far less than any comparable machine! Because of this dramatic breakthrough in terms of value for money, our new **VZ-200** provides you and your children with the ideal opportunity to learn about computers and programming.

Cat X-7200

SOME OF IT'S AMAZING FEATURES

- 8K bytes of RAM memory inbuilt
- Powerful Microsoft BASIC in ROM — so your VZ-200 understands easy-to-follow BASIC commands as soon as it's turned on.
- Full colour graphics capability: 8 colours
- 128 x 64 high resolution graphics mode or 64 x 32 — (mixed graphics & text mode)
- Built in sound/music facility: plays any note in a 2-1/2 octave range.
- Large 45-key keyboard, typewriter layout, Auto-repeating keys, too.
- RF output (channel 1) or direct Video output for colour TV monitor.
- Easily expandable using optional 16K memory expansion module, Centronics printer interface module (availability shortly).

AMAZING VALUE

$199

A PROFESSIONAL SOLDER STATION – HOBBYIST'S PRICE!

The Exclusive Dick Smith

SOLDERING STATION

Here's our brilliant temperature controlled solder station, offering you the very best quality at an unbelievably low price. Compare our Solder Station to others.

FEATURES INCLUDE:

- Variable temperature control from around 200 to over 500 degrees Celsius.
- Large temperature meter
- Fully approved by the Energy Authority
- Complete with lightweight iron, holder, cleaning sponge and users manual!!

ONLY $65

AMAZING!

SOLDERING SET AID

For the person working with PC boards this is an essential aid. Kit contains: guide fork tool, scriber, heatsink clip and stainless steel bristle brush. Can also be used for restringing dials! Cat. T-2610

AMAZING VALUE $5.50

BUY IN BULK AND SAVE!!

SOLDER

Top quality corrosion free multicore solder. 1.25mm (18g) 200 grams
Cat. N-1619 ONLY $4.95

0.71mm (22g) 200 grams
Cat. N-1623 ONLY $4.95

NOW IN STOCK

The Dick Smith

AUSTRALIAN SEMICONDUCTOR HANDBOOK

Application data for the nine to five engineer . . . and the weekend professional.
The book you've always needed, a 'one source' reference for the common devices often used. It contains data on hundreds of semiconductor devices - descrete, linear, TTL, CMOS, etc the types of components used extensively in Australia, particularly by the Australian Electronics magazines.
Cat. B-4200

$7.95

EVERY OHM NEEDS ONE!

High Impedance Multimeter

10 MEG FET INPUT

For the professional who wants the lowest circuit loading . . . you want the highest input impedance. The FET input multimeter gives you a huge 10M input impedance on DC voltage, and a highly respectable 1M on AC voltage.
Batteries, test leads & instructions supplied. Cat. Q-1200

LIMITED STORE STOCK

SAVE $13

WAS $72.00 ONLY $59

FAMOUS ADCOLA 12 Watt Soldering Iron S30

SAVE 25%

Reliable iron for general service or production area and ideal for the hobbyist. High impact plastic handle, complete with Triclad 3mm long life tip. Cat. T-1820
Tips to suit: Cat. T-1854 $2.60

WAS $21 NOW ONLY $15.95

FAMOUS SHURE CARTRIDGES

WOOPS! We forgot to put them in our Catalogue (slap wrists) but we DEFINITELY still stock Shure Cartridges.

M70B (Spherical) Cat. C-5511 $22.50ea
M91ED (Elliptical) Cat. C-5515 $49ea

Styli to suit

N70B (Spherical) C-5032 $17.60
N70EJ (Elliptical) Cat. C-5034 $19.95
N91ED (Elliptical) Cat. C-5036 $21.95

HUGE SAVINGS!

Cat. T-2000

RECALL NOTICE

Cat. T-1300 240V Soldering Iron
PURCHASED SINCE DECEMBER 1ST, 1982

A possible manufacturing fault in some of the last batch of T-1300 Soldering Irons could cause faulty operation and, in some rare circumstances, make them potentially dangerous.

For maximum safety we are recalling the iron and offering a refund or exchange with different model.

If you have purchased one of these irons please return it to any Dick Smith Store or re-seller for your exchange or refund.

This recall applies ONLY to irons purchased since December 1st, 1982.

DICK SMITH ELECTRONICS

DICK SMITH

NEW 'PHONY PATCH'

Landline Interface

As seen in the May issue of Electronics Today. Get ready for Phone Patching when it's made legal – this great little kit is ideal for connecting a four wire (eg transmitter/receiver) system to a two wire (eg phone lines or intercoms, etc). You could even set your transmitter up for complete remote operation using VOX.

UNIQUE IN AUSTRALIA!

Cat. K-3054 **$59.50**

Bargain Grab Bag

Wow! Up to $30 worth – and more. Mainly components from end of runs in our kit department, also includes things like 40 channel CB switches, various pcb's, rubber feet, etc etc. Fantastic bits'n'pieces for the hobbyist's junk box.

LIMITED STOCK Cat. R-7101 **$4.95**

SAVE $20

~~WAS $29.50~~ Cat. Y-1607

Storage Cassette Unit

Suit Y-1600 WIZZARD. Comes complete with fantastic demo-cassette. **$69.50**

HORN SPEAKER

A miniature rugged weatherproof horn with an impedance of 8ohms and a power rating of 5 watts. Ideal for PA work, burglar alarms etc. It has a mounting bracket for easy installation and comes complete with lead. Cat. C-2705

~~WAS $10.25~~ NOW ONLY **$8.25**

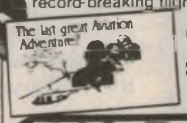
SAVE $2.00

HURRY! ATARI CARTRIDGES AT LOW PRICES – YOUR LAST CHANCE

STORE STOCK ONLY

The last Great Aviation Adventure

A special souvenir edition of Dick Smith's solo round-the-world helicopter flight, with pictures, maps, flight details etc. of this historic & record-breaking flight. Cat. B-9100

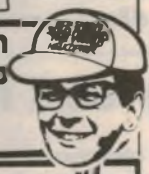


ONLY **$1.50**

Dick Smith Flight Cap

$3.50

Cat. Y-1000



Transmitting Valves

Replacements for when yours stop working.

6146B.... Cat. D-7202 **$19.95**

6SJ6C..... Cat. D-7204 **$14.95**

EXPERIMENTERS TRANSCEIVER

Here's one for all the amateurs, servicemen, technicians etc. Famous National brand 9 channel 27MHz CB, ideal for conversion to 10 meters, use as spare parts, experiment with etc. We over-bought on this model and we MUST reduce stocks – our loss is your gain. Take advantage of our mistake and save a fortune! Cat. D-2500

HURRY! STRICTLY LIMITED STOCK

Now sacrificed at only **$49.95** ~~WAS $169~~

JOYSTICK INTERFACE KIT

Calling all System 80 owners: isn't it a pain in the neck using the arrow keys to play games? Wouldn't you rather use a Joystick control? Cat. K-3455

Here's your chance! This kit allows you to add a joystick to your System 80 via the printer port – and here's the good news: This month only we're GIVING A FREE 'QUICKSHOT' JOYSTICK with each Interface kit! That's right, save an amazing ***$24.95*** – this month only!

OVER $62.00 WORTH FOR JUST **$37.50**

QUICK SHOT JOYSTICK

It must be the ultimate joystick . . .

Features:

Contour grip, rubber suction cups to hold it down during those tight movements. It's just like the real one in a helicopter. Suit VIC and Atari, or System 80 (see above).

Cat. Y-1495

Normally $24.95 or FREE with the above Interface Kit

AMAZING VALUE

Quality Stainless Steel Tools

Dick Smith Prices!

Resists rust, spring load return, insulated, easy grasp hand grips.

Transistor Nipper
Ideal for PCB work, long life, cutting edge. Cat. T-3205

Mini Flat Nose Plier
Great for those small nuts. Cat. T-3325

Mini Needle Nose Plier
Ideal for small components, and confined spaces. Cat. T-3570

Mini Long Nose Plier
Long reach in a small plier. Cat. T-3565

DIRECT IMPORT YOU REAP THE BENEFIT!

ALL ONE PRICE

TOP QUALITY

$7.75 ea

NOISE PROBLEM? BEAT IT WITH THESE SUPPRESSORS

Inline Distributor Suppressor
Connect anywhere in lead to eliminate or reduce distributor noise. Cat. A-7904 **55¢**

Spark Plug Noise Suppressor
A spark plug cap with inbuilt 50K resistor. Cat. A-7908 **$1.00**

Generator Noise Suppressor
Heavy duty 0.5uF-100 volt capacitor. Cat. A-7902 **80¢**

Alternator Noise Suppressor
A capacitor type suppressor with three leads. Reduces or eliminates the whine. Cat. A-7924 **$2.80**

Delux Alternator Suppressor
A coil type filter wound on a high density ferrite core. Cat. A-7926 **$11.95**

Coax Alternator Suppressor
Heavy duty 0.5uF 50 volt coaxial capacitor for extreme cases of alternator whine. Will handle 60 amps. Cat. A-7928 **$5.50**

ELECTRONICS

See page 98 for full address details

News Highlights

Doubts cast on space-based laser weapons

President Reagan's Star Wars vision of space-based defence against nuclear missiles has been dismissed as fantasy by many United States scientists.

At a White House press conference in March, Reagan described his "vision of the future" in which orbiting space battle stations equipped with lasers or particle beam weapons would destroy nuclear ballistic missiles as they left the atmosphere on the way to their targets.

Reagan himself acknowledged that "this is a formidable technical task, one that may not be accomplished before the end of this century", but most US scientists put the date of a practical system far beyond that – and even then many of them doubt its feasibility.

"Absurd" was how Jeremy Stone, head of the 5000-strong Federation of American Scientists, characterised the plan. Apart from the expense and technical difficulty of constructing and orbiting high-powered lasers, there are the immense problems of aiming and controlling the weapons, he says.

Without tracking and focusing optics which surpass the precision of most ground-based astronomical telescopes, a space-based laser would have difficulty even hitting one target, let alone stopping 1000 or so missiles in the few minutes that their flight takes them outside the atmosphere.

Even if these problems could be solved, the effectiveness of the laser weapon could be reduced by simple and inexpensive counter-measures such as making the surface of the missile highly reflective so that it absorbs little energy, or covering it with an ablative layer which would burn off. A layer of gas secreted from the missile would have the same effect. And simply causing the missile to spin in flight would spread the energy of the laser beam over a larger area, reducing the chance of a successful "kill".

The laser battle-station itself could also come under attack, and the least damage to its 10-metre focusing mirror, tracking optics or highly reactive fuel supply would put it out of action.

"Lasers have little or no chance of succeeding as practical cost-effective defensive weapons" says Kosta Tsipis, director of the Massachusetts Institute of Technology's Program in Science and Technology for International Security. "It is difficult to see how the development and deployment of such fragile, complex and expensive weapons would improve the military capability of a nation", he says.

Silicon compilers automate chip design

The hottest topic in semiconductor technology today is the "silicon compiler" – a way of designing very complicated semiconductor chips automatically.

The lead in this new technique comes, not unexpectedly, from "Silicon Valley" in the US, but is shared with Edinburgh University where a small group led by Dr Peter Denyer has developed a silicon compiler which is as good as anything to come out of Silicon Valley.

The principle of silicon compiling turns on the fact that it now costs hundreds of thousands of dollars to design a new VLSI (very large scale integrated silicon chip) and that, if the chip does not work when actually fabricated, much of that investment is lost.

Peter Denyer points out: "Soon we will be able to cram one million components on a single chip. Designing circuits of that degree of complexity is difficult and getting it right first time even more so. The techniques and tools we have been using for the past 10 years cannot cope. They are simply inadequate."

In fact, the high costs, long development timescales and first time failures offset the advantages of custom LSI design. In particular, it is frequently beyond the means of the small or medium-sized company to fund the development of a custom VLSI chip.

In silicon compiling whole chunks of microelectronic circuitry already designed and tested are held in a software library. This makes it possible for the designer simply to specify in a very high level (English-like) language what the chip is supposed to do.

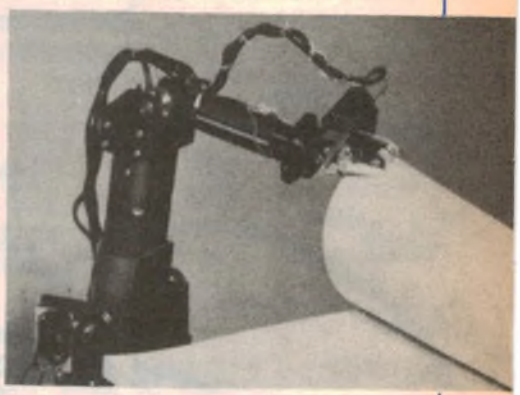
At the press of a button, the computer sets about designing the new chip automatically, using the tried and tested features from the library in its memory to build a chip that will do the job intended and work first time.

Computer programs which design circuits automatically are not all that new. What makes the silicon compiler special is its ability to handle simple high-level commands and the way it can alter the size and proportions of the circuit elements in its library to suit the chip under design. It will automatically take care, for example, of the number of binary digits the circuit is handling at any point.

Page-turning robot from NTT

While this month we report on the coming wave of personal robots, the Japanese are already looking at ways to put them to practical use. One company, Nippon Telegraph and Telephone Public Corporation (NTT), has developed a page-turning robot that turns the pages of a book leaf by leaf.

Designed primarily as an aid for the disabled, the new robot uses a rubberised pressure-sensing contact that automatically senses the height of the page. To turn the page, the arm of the robot lightly presses on the edge of the book and lifts the page with the pad of the "thumb" as if hooking the edge of the paper leaf.



According to NTT, the robot's action is quite gentle and approximates that performed by the human hand.

Electronic access tag for security control

A security access control tag currently under development in Britain will, according to the company's managing director Mr Malcolm Barker, become one of the most acceptable and crime-proof systems available.

The tag, about the size of a book of matches, contains a sealed, custom-made integrated circuit, associated miniaturised radio circuits and a lithium battery with an operational life of seven to 10 years. It weighs only 17g.

Kept in the pocket or handbag, the tag lies dormant until within range of a door equipped with suitable transmitter. This activates the tag and causes it to radiate a very low power signal in the 100kHz region carrying a specific digital code. If the code is right the door's receiver unlocks the door. Those with no tag, or an unsuitable one, would be denied access.

The attraction of the system is that the user has to do nothing except carry his tag. In difficult locations such as oil platforms, staff movement could be accurately monitored without the use of either plastic cards or keyboards. The system has already been used to tag cows and monitor individual animal's food consumption and milk yield.

Malcolm Barker believes that within a year the company will be able to impress voice prints and signature data on the tag. Then, the user would simply approach a door, utter a few words and, if the door system is able to match what it "hears" with the signal delivered by the tag, the door will be opened.

Alternatively, the user might sign his name on a pad which would be electronically read by the door system and compared with signature data in the tag.

DO-IT-YOURSELF ROBOT – Recently released by the Heath Company (USA) is this build-it-yourself robot. Called HERO I, the robot is completely self-contained and carries electronic sensors to detect light, sound, motion and obstructions in its path. It is controlled by its own on-board computer, features a voice synthesiser, and comes complete with comprehensive instruction manuals that detail assembly, theory and operation. For further details contact Warburton Franki Ltd, 372 Eastern Valley Way, Chatswood 2067.

Low-cost satellite TV ground station

Broadcast distribution of TV programs via satellites, particularly on a non-subscription basis, is being investigated and tried in many parts of the world. It undoubtedly has a bright future, provided receiving system prices can be brought down to consumer level.

In an effort to meet this market Toshiba has developed a Super High Frequency (SHF) home TV satellite system. Although not the first prototype system, this is claimed to be the first with the prospect of mass production in Japan. It is scheduled to be on the market in time for the first regular commercial satellite broadcast in Japan, expected in late 1983. Price of the package is expected to be between 100,000 and 150,000 yen ($A480 and $A720).

The package consists of a 1m diameter dish antenna, an outdoor unit containing an RF and an IF amplifier, and an indoor unit for connection to the TV receiver. It is also capable of processing the digital audio signals which will be used for these broadcasts.

British Telecom switches to fibre optics

The fibre optic cable, for a long time "just around the corner" as an improved communication link, has at last come into its own. British Telecom is now bringing into service the first section of its high capacity communications trunk network using optical fibres.

From next year, the UK will order no more coaxial cables for its trunk lines but switch completely to advanced-technology fibre optic cables.

The first 47km section of 140 megabit per second optical fibre cable came into service in mid-March linking the Faraday telephone exchange in the City of London with the new town of Basildon just outside the capital. This will form part of a new trunk link between London and Colchester in eastern England.

Fibre optic cables are a fraction of the size of normal coaxial cables but offer many advantages such as high capacity, greater reliability, and less maintenance. They eliminate interference and cross-talk on telephone lines and need far less repeaters to boost the signals.

In the London-Basildon trunk line, for example, the normal repeater intervals of 2km have been extended to every 8km. Spacing of repeaters at intervals as wide as 30km has already been successfully demonstrated.

British Telecom expects to order some 20,000km of fibre a year from next year onwards for use in its inter-city trunk network. If the cost of fibre continues to decline there could be an additional market for 30-50,000km a year for use in network junctions interconnecting nearby telephone exchanges. The amount of fibre required in local networks is still being studied but it could amount to 100,000km a year.

UK companies such as Plessey, STC and GEC have already invested more than $225 million in the new fibre optic technology while the UK government is providing $68 million support with another $25.5 million for collaborative research by British industry and universities.

Applied Technology expands Microbee production

Applied Technology has opened a new factory in West Gosford to meet the demand for their Microbee personal computer. At the opening in April, Applied Technology's managing director Owen Hill announced that the Microbee will be distributed in Sweden, Norway, Israel, the UK, Canada, United States, South Africa, Malaysia, the Philippines and West Germany. In Malaysia the computer is being considered for use in government schools as an educational computer.

Over 8000 Microbees are already in use in Australian homes and schools, with over 2500 computers used in primary and secondary education in NSW. The computer is recommended for use in schools in NSW along with the Apple, while negotiations are continuing with the Education Departments of Western Australia and Queensland.

In addition to the basic Microbee, new colour and disk-based CP/M systems are in production and the new Microbee "IC" has been introduced. This new machine includes integrated Basic, word processing, machine language monitor and terminal communications software "built-in" in ROM.

The new factory is already producing just on 1000 Microbees a month, with production set to move to 2000 a month. Future plans call for the production of 100,000 units each year from the Gosford factory and the establishment of an Australia-wide network of retailers and dealers for Microbee computers, software and peripherals.

Largely under the impetus of the Microbee, Applied Technology has grown from just two employees two years ago to over 80 full-time and part-time employees, providing a significant boost to employment in Gosford.

Mr Owen Hill, Managing Director of Applied Technology, looks on as the new Gosford factory is officially opened by the NSW Minister for Education Mr J. J. Mulock.

For further information on the Microbee contact Applied Technology, PO Box 311, Hornsby, NSW 2077.

Computers tune "Australia II" for America's Cup challenge

Computers have entered one of mankind's oldest endeavours — sailing. *Australia II*, one of Australia's three challengers for the coveted America's Cup, made use of a Data General computer system during recent tuning-up trials.

Two computers were used by the crew of *Australia II* to test equipment and hone their tactical and sailing skills to a fine pitch in preparation for the America's Cup Challenge later this year. Three years ago, Australia missed out on winning several races by only a small margin so the new computer system may make all the difference in wresting the cup from the Americans.

One of the computers, a Data General microNOVA MP100, was on board the tender vessel *Black Swan* which travelled closely behind *Australia II* during trials on Port Philip Bay. The computer received vital information from various instruments on the yacht via a radio link, and stored this data on magnetic tape for later transfer to another Data General computer on shore.

The larger, shore-based computer analysed the information and produced print-outs and plots showing the effectiveness of equipment on the yacht, the efficiency of various racing tactics and a host of other vital information. The complete computer installation, donated by Data General, is valued at over $150,000.

Information such as boat speed, apparent wind angle (the actual wind angle plus the effect of the yacht's motion), apparent wind speed, heel angle, heading and rudder position were all read by instruments on board *Australia II* and transmitted to the tender for storage on the microNOVA. Other information, including the state of the tides, the yacht's starting position and the positions of marker buoys was also recorded, allowing the crew to plan tactics in advance for a wide range of sailing conditions.

Because the computer system can store up to one million pieces of statistical data each day, the crew were able to look back over previous trials and races to work out the best timing for different manoeuvres. They could also check the performance of the yacht under different weather conditions and the effectiveness of various designs of sails, masts and other equipment.

It is the first time that an Australian challenger for the 132-year-old America's Cup has had access to a fully computerised system, although the last three defenders of the Cup have all had the advantages of computer analysis and training systems supplied, ironically enough, by Data General in the US.

Australia II during recent trials on Port Philip Bay.

Buy from a good sound company

The Rogers LS1
See David Praekel – review
January 1983, Practical Hi-Fi

The Rogers LS5
See David Praekel – review
January 1983, Practical Hi-Fi

The LS5/LS7
See James Hughes – review
January 1983, Hi-Fi Answers

When Rogers set out to design a new series of loudspeakers especially for use in the home they were determined to keep to their own self-imposed high standards. The result was that the superb crystal crisp clarity of the LS3/5A BBC monitor, the Studio 1 and the rest of the professional range is now captured in the LS1, LS5 and LS7.

Rogers

BRITISH HIGH-FIDELITY

Please send me further information on Rogers speakers.

NAME

ADDRESS

POSTCODE

Ref. SW2

DISTRIBUTED BY:

AUDIO 2000

P.O. Box 107, Brookvale NSW 2100. Tel: (02) 939-2159.

LOW COST EQUIPMENT

low cost hi fi

3—WAY SYSTEM
$24.95 a set
2 SETS (6 SPKR)
FOR STEREO
ONLY $39.95

That's right a 3 — WAY HI FI speaker kit from only $19.98!!
Each kit contains a massive 10" (250mm) woofer, cone midrange and DOME tweeter!! You also get, at no extra charge, the special cross-over capacitors!
The system is rated at approximately 20 watts RMS so it is ideal as an economical but reasonably powerful main Hi Fi unit or as a second system for another room or outdoors.
Each 3-way kit comes with a recommended enclosure design which you can build yourself easily!
You would normally pay well over $60 for the equivalent from major kit speaker suppliers so this is an outstanding bargain. Sensitivity of system 93dB/1m/1 watt. Cat. AK3700
HURRY LIMITED STOCKS and they are made in JAPAN!!

Woofer not to same scale as other components

FROM ONLY
$19.98

28 PIN IC SOCKETS SAVE A FORTUNE

FROM ONLY 15 CENTS!!

YOU MUST BUY THESE FROM US!!
WE DARE YOU TO FIND THEM FOR LESS!!
Buy in bulk and save!! NORMALLY 60c & 55c 10+
NOW 30cents each 10 up
20cents each 100 quantities!!
15cents each 1000 up
Quality US-made Robinson-Nugent Cat. PI6507
All prices include sales tax!!

1N914 DIODES — INCREDIBLE SAVINGS

The 1N914 (or 1N4148 if you like) is probably the most popular diode in the history of electronics. We probably use over 1,000,000 a year ourselves!!
We have made a bulk scoop purchase and for JUNE ONLY we can pass them on at great savings!
Because they are so low in price anyway, we must sell in minimum lots of 500.

Cat. No.	Description*	500	1,000	10,000
ZR1100	1N914/1N4148	0.035	0.028	0.02

Prices INCLUDE sales tax!!
* The glass envelope is really too small to have markings, however some are branded. We reserve the right to supply units that are the same size as the 1N914/1N4148 but are electrically superior.

Fully Guaranteed

$12.50

$38.50

INTRIGUING

For years and years 240V mains powered strobes have been selling for between $30 and $40. Even kits are around $36. So why is it that Jaycar can sell a 240V strobe — guaranteed — for $12.50?
We can tell you for a start that we're not selling them below cost. Even at $12.50 we're doing OK.
Why so cheap?
Well they were made for a well known electronics chain. Their Q.C. (Quality Control) Department rejected them on the grounds that around 5% of them were faulty. That was an unacceptable figure considering the very good name that the chain has in this country. All goods were rejected (even the 95% good ones) and sent back to the importer.
The importer came to us with his problem. We said that we would sell them PROVIDED we could offer a 90 day guarantee on the item.
Whilst all stock has been checked and the duds weeded out we STILL feel that even at $12.50 you deserve a comeback if we sell you faulty goods.
So that's it. You get a 240V strobe that is perfectly OK for $12.50
Compare THAT with the $36.50 that you will pay elsewhere.
It's almost too good to be true except for one thing. It's true.
FULL 90 DAY WARRANTY — Cat. XM7005

NEW CODEMASTER*

$9.95 ONLY ~~$12.50~~

Many of you know the clever parlour game that uses coloured tokens to stretch the brain to work out a hidden code in a minimum number of moves.
The people that came up with the game used a descriptive name which no one else can use. It is a popular game and is well known under this name. Our game is similar to this game but — naturally — its electronic!! And, what's more, you can play against the machine — alone. Each XM7015 Codemaster measures 140(l)x85(w)x25(d) looks similar to a pocket calculator and runs off a standard 9V cell. Provision is made for a mains adaptor as well.
The Codemaster once sold for $29.50 but Jaycar has made a huge scoop purchase. You save a fortune!
Grab one now for only $9.95!!
* (For a further clue to the origin of this game read this page carefully)

ONLY $3.95

THE catalogue of Motorola Semiconductor's products.
Over 330 pages of specifications, drawings, data and other information on:
- MOS devices, including CMOS, Memory and CPU.
- Bipolar, including Linear, Memory, Logic (SSI) etc.
- Power, including Rectifiers, SCR's, Triacs & power transistors.
- RF, small signal & Opto.
- Solar power systems.

This valuable reference book also contains a comprehensive index at the back! At $9.95 this book would be great value. But no! It's yours for only $3.95!!
Book measures 210x280x15 (336 pages)
Cat. BM4250

JAYCAR FOR VALUE!

MICRO CHARTS

NEW!

Instant Data on the Most Popular Computer and Microprocessor Parts

- Fully decoded data — no need to unscramble numbers
- Instant Access
- Compact 8½" x 11" size
- Durable credit card plastic — lasts a lifetime
- Perfect for programmers and engineers — two-sided and totally comprehensive
- Clear and concise tables for: full instruction set, disassembly, ASCII, base conversion, effect of flags, compare vs. jump, interrupt structure, pin-out, cycle times, diagrams, bug notes, and much more

Cat. BM8500	Z80 CPU
Cat. BM8501	8080A/8085A
Cat. BM8502	6502(65XX)

NOW ONLY $9.95 SAVE $3.00!!

BRILLIANT

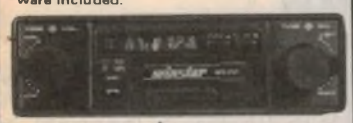
New range of Super-Bright LEDs! Due to the incredible demand for our 200mCd super-bright LED, we have increased the range available. Now you can get super-bright in green & yellow as well as a new massively powerful 500mCd red! This new red LED will give you 500mCd @ 20mA or -wait for it - ONE CANDELA of light at 40mA! Remember, a typical 15 cent 5mm red LED gives only 1.8mCd at 20mA, the difference is staggering!

Cat No.	Description	1-9	10+
ZD1790	200mCd SB Red LED	$ .69	$ .62
ZD1792	500mCd SB Red LED	$2.95	$2.50
ZD1794	80mCd SB Green LED	$ .95	$ .85
ZD1795	160mCd SB Yellow LED	$ .95	$ .85

AM/FM STEREO CAR CASSETTE

Unbelievably low price! (Pre Budget tax) That's right! An AM/FM Stereo Radio and Cassette! Features:

• 2 x 7 watts • One lever operation (fast forward and eject) • Tape run indicator • FM Stereo indicator • Auto stop • Adjustable pitch controls • Mounting hardware included.



STAGGERING VALUE ONLY **$69.50**

LOW COST SILICON PHOTO CELLS

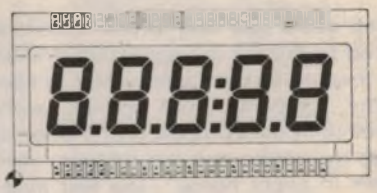
We now stock a COMPLETE range ofhigh efficiency Silicon Solar Cells. All cells give 0.45V under rated load and they can be stacked in series or in parallel for higher current.

Cat. No	Description	1-9	10+
ZM9002	Rect. 10x20mm 45mA	$2.95	$2.45
ZM9003	3" diameter 1 amp	$29.50	$26.50
ZM9004	3" diameter x 30° segment 78mA	$3.50	$3.25
ZM9005	4" diameter x ¼ segment 450mA	$12.95	$12.45

LIQUID CRYSTAL DISPLAY

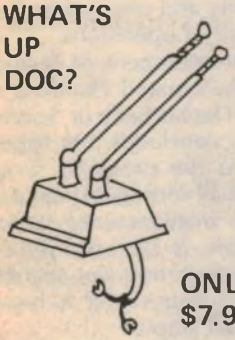
AMAZING LOW PRICE!

ONLY $2.95 each
$2.50 each 10+



We have done it again! Once again Jaycar has secured a quantity of valuable LCD displays. Once again we are passing them on to you at prices that will make our competition green with envy!
Basically we have a 5 digit x 18mm high (that's BIG) LCD display. But there is a snag, and here is where you save. Normally this display would sell for around $20 — if it had the connecting pins bonded to the glass substrate. But this display just has the metallization on the glass substrate. Too hard to connect you say? No, not at all!!!
We have discovered that a humble Molex pin is JUST PERFECT as a connector! You slip the Molex pin on to the edge and superglue it in place. You then have a permament connection, a great LCD display and have saved a fortune to boot! (Instructions for fitting the Molex pins as well as FULL DATA and connection diagrams on the LCD are supplied).
And what do you pay for this LCD display? **ONLY $2.95 each or $2.50 each 10 up.**
Staggering value. Cat. ZM9015
Pack of 50 Molex pins (only 42 required) Cat. PI6540 Only $1.00

WHAT'S UP DOC?

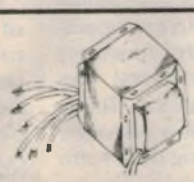


ONLY $7.95

Are the "rabbit ear" antennas on the back of your portable TV broken? You know those ones that are telescopic and have ball-swivel joints.
We have genuine 'HMV' factory spares that will fit other TV's Apparently they are almost industry-standard components.
Each unit comes with a short length of lug-terminated 300 ohm ribbon.
We have a small job lot available at only $7.95 each.
ONLY 220 SETS AVAILABLE.
Cat. AA2005 $7.95

COMPUTER TRANSFORMER

ONLY $24.50
SAVE $5.00
WAS $29.50



We have secured a quantity of a power transformer at a never-to-be repeated price. This transformer is ideal as the basis of an S-100 power supply, but can be used for many other computer or general power supplies.
SPECS: Primary 240VAC — Secondary 1: 15VAC 2 amp — Secondary 2: 15VAC 2 amp — Secondary 3: 8VAC 8 amp.
A typical DC supply could be ±15VDC @ 1.5A & 5VDC @ 8A or ±12VDC @ 2A & 5VDC @ 8A.
This transformer would normally sell for around $50
Brand new stock.

Clue

M-S T-RM-N-D

TRANSISTOR BARGAIN

3 AMP HIGH SPEED TO-5 POWER TRANSISTOR
TYPE 2SC799
NORMALLY $1.95 each
NOW 75 cents each OR $5 for 10!

Has exclusive slide-on flange to convert to chassis mount for greater power dissipation!
SPECS: NPN Silicon — Vce 40V — Vcb 80V — Veb 5V — Ic 3A — hFE 50-90 — Ft 150MHz. Cat. ZT2600

Jaycar NUMBER 1 FOR KITS

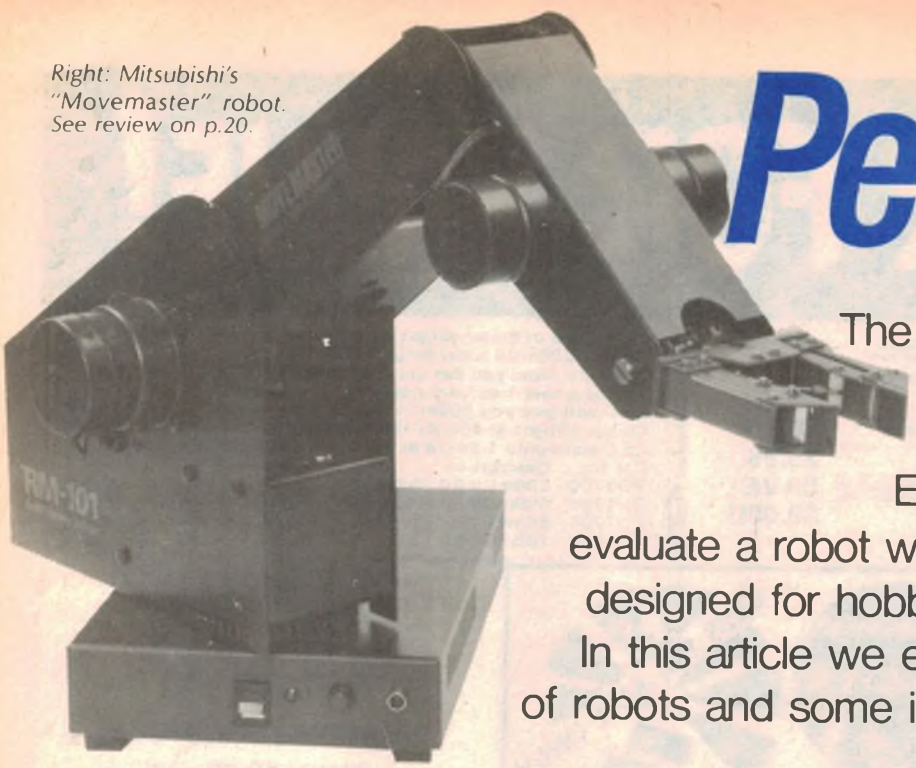
SYDNEY SHOWROOM
125 YORK STREET PHONE: (02) 264 6688
TELEX: 72293

CARLINGFORD SHOWROOM
Cnr CARLINGFORD & PENNANT HILLS ROAD
PHONE: (02) 872 4444

MAIL ORDERS & CORRESPONDENCE
BOX K 39 HAYMARKET, SYDNEY 2000
POST AND PACKING CHARGES
$5 — $9.99 ($1.50) $10 — $24.99 ($3.20)
$25 — $49.99 ($4.50) $50 — $99.99 ($6.50)
$100 or more ($8.00)

SHOP HOURS CARLINGFORD
Mon — Fri 9am — 5.30pm Sat — 9am — 12pm Thurs night 8.30pm
SHOP HOURS SYDNEY
Mon — Fri 8.30am — 5.30pm Sat — 8.30am — 12pm Thurs night 8.30pm

Mail Order By BANKCARD Via Your Phone



Right: Mitsubishi's "Movemaster" robot. See review on p.20.

Personal

The age of the home robot, if it has not already arrived, is definitely in sight. Elsewhere in this issue we evaluate a robot which has been specifically designed for hobbyist and educational use. In this article we examine the current status of robots and some important robot concepts.

by PETER VERNON

Ten years ago only a few visionaries dared to predict the day when it would be feasible to put "a computer in every home". Now with the growing acceptance of home computers and booming sales we can go one step further – to "a robot in every home". The first indications of a progression from microcomputer to robot helper are already evident.

To many the concept of a "robot" remains only vaguely defined however. Countless re-runs of "Lost in Space" and "Forbidden Planet" and more recently the movie "Star Wars", have created an image of a robot as a walking, talking humanoid figure, even making the occasional mechanical joke.

Today's industrial robots by comparison are not nearly so glamorous. The true image is not so much that of a super-intelligent humanoid but that of an "electronic crane". Today's industrial robots are more like machine tools with electronic control than entities created in the image of human beings. R2D2 has a lot to answer for!

What is a robot?

On January 25, 1921, the first performance of Karel Capek's play "R.U.R." (Rossum's Universal Robots) gave the world a new word, and a new phobia. Named for the Czech word for "worker", Capek's robots eventually became dissatisfied with their servile status and rose up and destroyed their creators, providing the theme for the majority of robots in fiction up to the present day.

The image began to change with Isaac Asimov's science fiction. His robots were inherently benevolent and obedient and seen in many ways as superior to human beings. "Star Wars" continued this trend, preparing the way for popular acceptance of robots as essential help-mates. Today "robot" has come to mean many things to many people with many corresponding definitions of the term.

The Robotics Institute of the United Kingdom defines a robot as "a reprogrammable, multifunction manipulator, designed to move material, parts, tools, or specialised devices through variable programmed motions for the performance of a variety of tasks". This definition emphasises the versatility of robots, as opposed to machine tools which are designed exclusively for a particular function.

Other keywords in this definition are "reprogrammable", and "manipulator". A reprogrammable machine is one which can be made to perform different operations by changing the control functions which determine its movements. The manipulative component of the definition emphasises that a robot is intended for handling objects, changing their form and relationship.

Thus a computer is not a robot, even though it is reprogrammable, because it manipulates information, not physical objects. Nor is a drilling machine if it can only be set up for drilling. An arm connected to a computer and capable of gripping a drill, a spray gun or a screwdriver and moving it according to a variable program, more closely fulfils the current definition of a robot.

The use of robots in industry is no longer just a possibility or an experiment. Depending on the definition which is applied there are between 17,000 and 20,000 industrial robots at work in the world – a market which is expected to exceed $US600 million by the end of the decade. According to at least one report before the Australian government the use of "flexibile automation" is essential if local manufacturing concerns are to increase productivity and competitiveness over a wide range of operations.

The report, "Development of Robotic Technology in Automated Handling of Parts" from the Department of Science and Technology, concludes that robots are a solution to the problems facing both large and small Australian manufacturers. Australian manufacturing, according to the report, is characterised by small production runs, frequent changes in tools and techniques and a heavy reliance on manual labour.

The key is the general purpose nature of a robot. The ability to program the robot for a number of different operations at short notice makes the robot more cost-effective than a collection of dedicated machines. As manufacturing conditions change or a new product is required the robot can be reprogrammed for the new operation. Again according to the report, "robots offer the versatility of production facilities needed for effective competition against high-volume overseas manufacturers."

In Australia the robot population is as yet tiny and applications are limited. According to Dr Michael Kassler, the convenor of the Australian Robots Association, there are less than 200 robot installations in Australia. They include some 120 sophisticated "playback" robots, priced at over $50,000, and

Robots Are Here!

around 60 less advanced "limited sequence" robots, which go through a sequence of motions under the control of a magnetic tape loop.

The main application of industrial robots is in the metals and motor industries, where they are used as spot welders and spray painters. In Australia, Nissan and Ford are the main customers, using robots imported from the United States and Japan. There are also an increasing number of West European countries selling robots.

Techniques in robotics

Is a robot a computer with an arm, or a mechanical device with an electronic controller? At first sight the distinction may seem unimportant, yet it raises a significant point, says Associate Professor Jack Phillips of the Department of Mechanical Engineering at the University of NSW, and indicates the shortcomings of the present practice of training electrical and mechanical engineers in isolation.

According to Professor Phillips it is vital that computer scientists who write programs that control robots have an understanding of the problems of mechanical design involved in their construction. "There is an intimate relationship between the kinematics, statics and dynamics of machines, many aspects of which are not fully understood . . . there is a whole set of mechanical principles surrounding the 'dextrous workspace' of a robot. The relatively primitive robots of today have to use enormous amounts of energy just to lift their arms. You can see how far there is to go in this field if you compare this with the lack of concern with which we humans move our limbs."

The main criterion of the usefulness of a robot is the size and shape of the "dextrous workspace", the volume in which the robot can perform useful work.

The workspace of a robot arm is determined by the number and configuration of the arm's joints which define the axes of movement which are available. The number of axes is often referred to as the "degrees of freedom" of the arm. A robot with four axes of movement for example, is said to have four degrees of freedom defining the dexterity and reach of the arm. In theory, three degrees of freedom are sufficient to position the end of an arm anywhere within a given workspace. There are other considerations however.

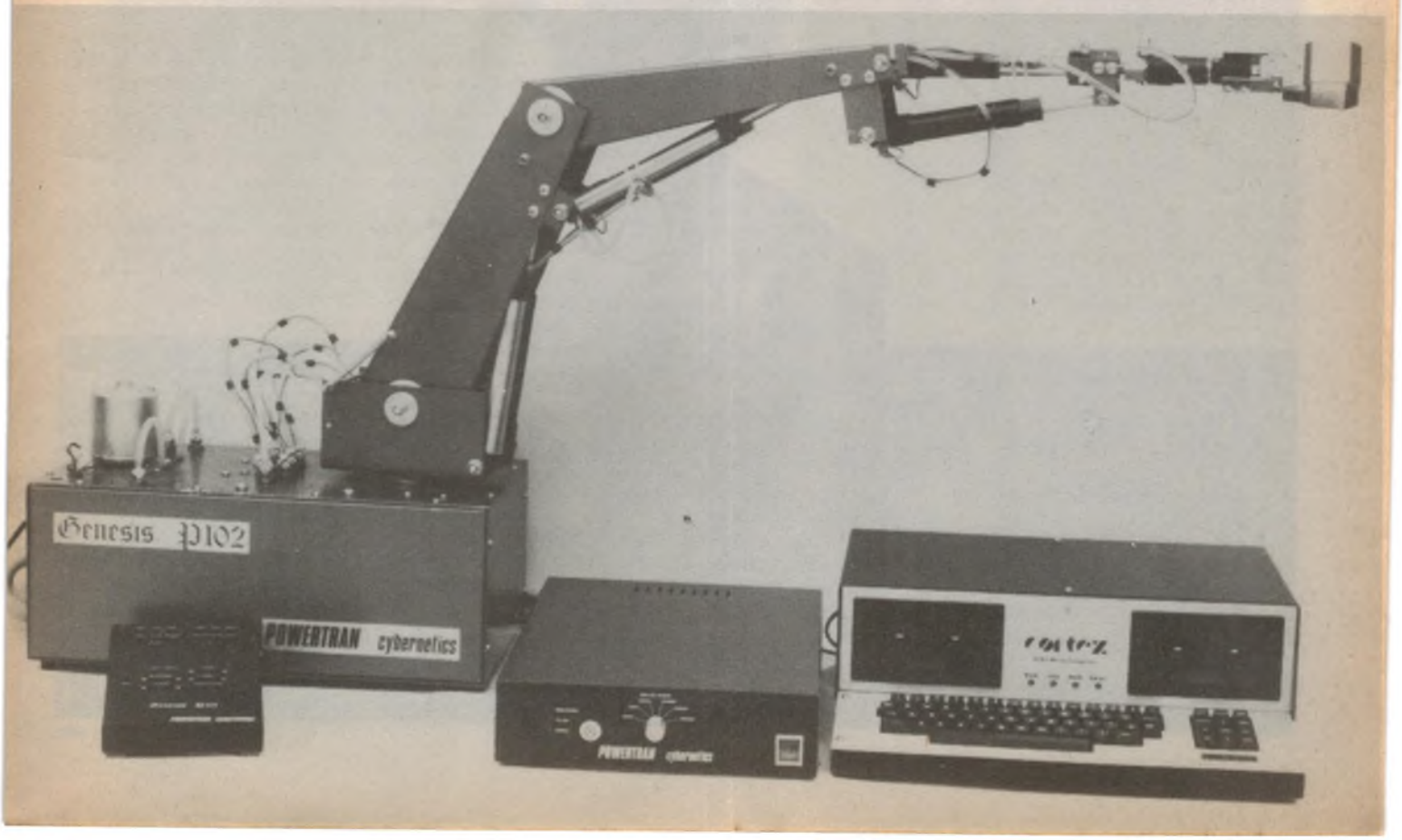
Just as important as the number of degrees of freedom is the configuration of the joints.

There are four major configurations of the joints of a robot arm, usually named for the coordinate system which most naturally describes the motion of the tip of the arm. Each coordinate system imposes certain limits on the dexterity of the arm and each raises certain problems and opportunities in programming the robot for a given operation.

The simplest arrangement from a conceptual point of view (although not from the programmer's viewpoint) is described in terms of three dimensional rectangular (Cartesian) coordinates, as shown in Fig.1 (a).

Consider a post mounted on a slide which is free to move horizontally. The X-axis is assigned to movement along the slide and the Y-axis is considered to be vertical movement up and down the post. The Z-axis, or the "reach" of the robot is movement in the horizontal

The Genesis P102 is an hydraulically powered robot made by Powertran of the UK and distributed in Australia by Jaycar.



Meet Junior...

...he'll give you more than just a taste of what his big brothers can do.

Mitsubishi's Move Master RM-101 is the low-cost answer to your robotics training and research needs.

For little more than $2000, it offers five degrees of freedom and completely independent rotation around six independent axes.

Any personal computer can provide the power to put the Move Master through its paces. Alternatively, there's Mitsubishi's specially designed MX-6000 microcomputer system, complete with a built-in CRT display, a floppy disk drive and line printer, which can control one or two robots.

Quick to obey and easy to program, its applications are limited only by your imagination.

From the sophisticated Move Master to his powerful industrial brothers – talk to Mitsubishi for all your robotics needs.

MITSUBISHI ELECTRIC AUSTRALIA PTY LTD

73-75 Epping Road, North Ryde, New South Wales 2113, Australia. Telephone 8885777.

MB2

Personal Robots are here!

plane in a direction perpendicular to both X and Y-axes.

With this arrangement the end of the arm can be positioned at any point within a cube defined by the maximum possible movement along each of the X, Y and Z-axes.

Consider now the sequence of movements necessary to take an object from a belt in front of the robot and place it in a box at one side; assuming that the robot has a multi-purpose gripper or end effector.

First the arm must move along the X-axis until the gripper is in line with the object to be lifted. Next it must move up or down to align the gripper vertically with the object, and finally reach out and grasp the object. These movements can be performed in any order, or indeed performed simultaneously, but the inescapable fact is that movement along all three axes is required; leading to waste motion and excessive use of energy.

To place the object to one side it must first be lifted (the Y-axis), then transferred horizontally towards the box in both the X and Z-axes. A problem is immediately evident if we want the object placed to one side. What if the arm cannot retract far enough to bring the object over the box? The workspace of the robot which moves in a rectangular coordinate system is limited to a cubical volume directly in front of the horizontal slide.

The problem can be solved if the post on which the arm is raised and lowered is free to rotate as shown in Fig. 1(b). Now the end of the arm can be moved in a circular path in the horizontal plane. The arm can lift an object, swing it to one side and then lower it into a waiting receptacle. The total movement is more economical, with less wasted motion. Because the overall workspace of the robot resembles a cylinder with its vertical axis on the upright post and a radius defined by the length of the horizontal arm, this configuration of axes is described by "cylindrical" coordinates.

Actually, though we still have the same problem of waste movement and limited dexterity, transferred to a different plane. Suppose instead of placing the object in a box we want to put it on a shelf above the belt? The arm must reach out, grasp, retract, lift, reach out and release the object, with consequent wasted motion. It would be much simpler if the horizontal arm, too was free to rotate around a horizontal axis, and this in fact is the next refinement, producing a system which moves in a hemispherical workspace defined by "polar" coordinates. See Fig. 1(c).

The problem of ultimate dexterity is still not solved however! To see why, consider a spray-painting operation. At the end of the arm is a spray-gun which is moved evenly over the front of the surface to be painted. Now we want to paint the rear of the object. (We will assume that the object is not mounted on a revolving platform, as this would involve another piece of equipment and our theoretical robot-user is a penny-pincher.)

To reach the rear of the object, the gripper swings upward, then moves outwards and comes down again. Unfortunately the gripper is attached to a heavy arm, which comes down on the object to be painted. While positioning the spray-gun we have crushed the object flat. Such are the perils of robotics!

In fact, linear motion will always limit the range of movements which can be performed by a robot arm. While theoretically the end of an arm can be positioned anywhere within the workspace by linear motion alone in practice the components of the arm themselves occupy space, and robots are not immune from attempting to place two objects simultaneously in the same space.

Perhaps the ultimate in dexterity requires a different approach. The "revolute" coordinate system shown in Fig. 1(d) is so-called because all movements of the arm are performed by rotations alone. Not coincidentally this is the configuration that most closely approximates the structure of the human arm and the components of the robot can be conveniently described in anthropomorphic terms, as "upper arm", "shoulder", "upper arm", "elbow" and "forearm".

The spray-painting problem can be solved then by holding the forearm up out of the way while the upper arm swings up to place the end of the arm above the object. The forearm then swings downwards and out to bring the spray-gun behind the object. In practice of course careful attention must be given to the position of each part of the arm to avoid contact with the object to be painted, but at least the solution is feasible.

Needless to say, any or all of these coordinate systems may be combined within one robot. Some industrial robots in fact have as many as ten axes of movement, resembling a revolute arm mounted on a horizontal slide and free to raise and lower the shoulder joint. Such a robot is even more dextrous than the human arm.

Muscle power

Equally as important as the range of movement of a robot arm is the power

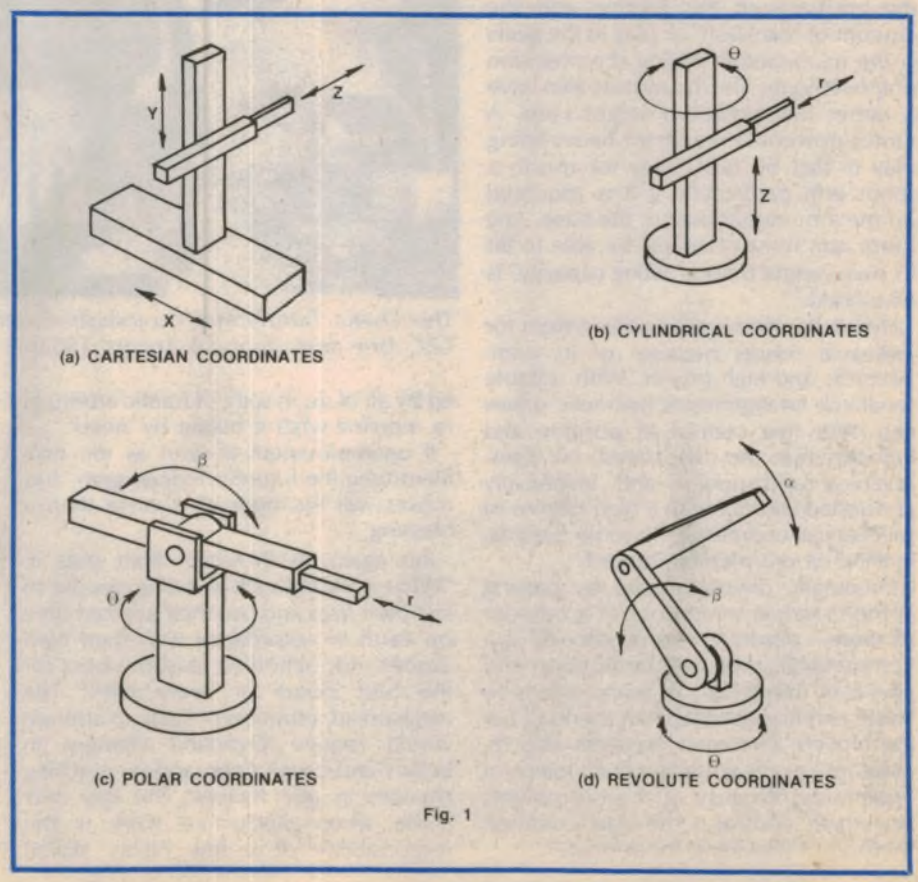


Fig. 1

Personal Robots are here!

source, which determines the speed and strength of the robot. Three methods are available; electric motors, hydraulic cylinders and pneumatic drive, and each has certain advantages and disadvantages.

In general electric drive is more cost-effective in small robots which require a high degree of accuracy. Precise positioning is more easily achieved with electric motors than with either of the other two systems and the rotary motion can be readily converted to linear motion with a lead screw or similiar arrangement.

Electrically driven systems can use servo-controlled DC motors or stepping motors, which advance by a fixed increment for each pulse delivered.

Servo control demands some form of feedback of the position that the joint has reached at any time in order that the possible errors can be corrected. Stepping motors may be used without feedback, in an "open loop" control system, although in fact since the load being lifted may alter the response of the motors industrial robots almost always incorporate position-sensing when stepping motors are used.

Many other considerations apply to the design of an electric drive system. Some form of gearing or power transmission arrangement is required, and frequently the accuracy of the gearing and the amount of "backlash" or play in the gears is the main factor limiting the precision of movements. Electric motors also have a rather low power-to-weight ratio. A motor powerful enough for heavy lifting may in fact be too heavy for use in a robot arm particularly if it is mounted on the arm, rather than in the base. Any robot arm must of course be able to lift its own weight before "lifting capacity" is calculated.

Hydraulic drive is a popular system for industrial robots because of its compactness and high power. With suitable feedback arrangements hydraulic drives can offer fine control of position and velocity but the associated oil lines, reservoir and pumps and electrically controlled valves mean a high degree of mechanical complexity. In some designs, leaking oil is a possible hazard.

Pneumatic drives operate by passing compressed air in and out of a cylinder to drive a piston. However since air is a compressible medium the position and speed of movement of the piston is to some extent dependent on the load being moved. Pneumatic systems also require an air compressor, a bulky piece of equipment. Because of these problems pneumatic control is the least common method of providing robot power.

Robots and society

The application of robots will not guarantee economic success, but they will serve as amplifiers of effort. The application of robots in manufacturing can make a product which is already successful both cheaper and more reliable. Their flexibility can allow manufacturers to consider short production runs and the mass production of goods which were previously uneconomic.

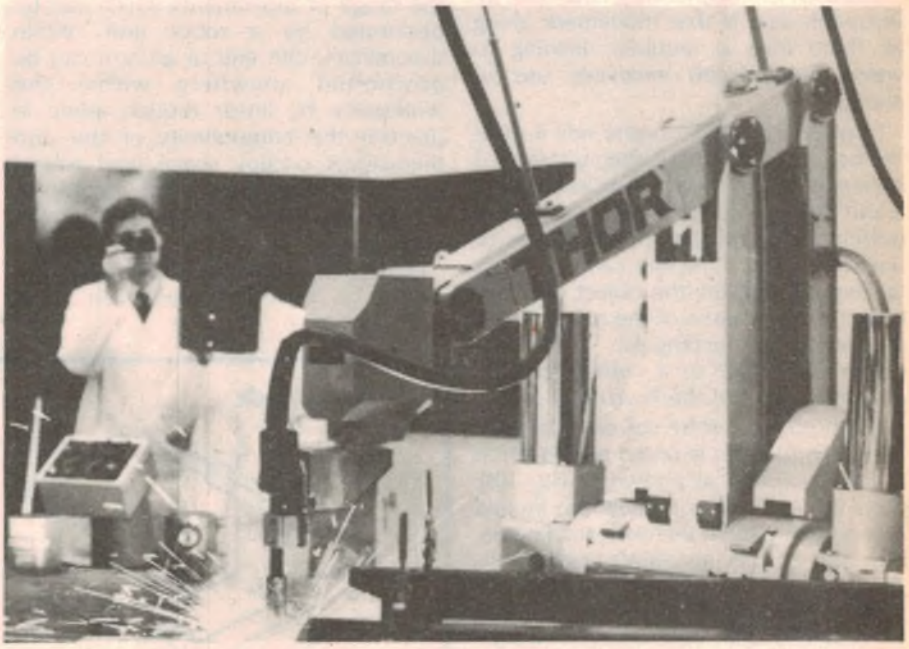
Robots will take jobs. "Lower production costs" after all, is usually a euphemism for "less labour". Their effect is to enable fewer, more skilled people to produce more and more goods. As Professor John Blatt puts it, "We have become so enormously productive, as a society, that considerably fewer than all of us suffice to produce everything needed by all of us, in spite of frantic attempts to redefine what is meant by 'need'."

If unemployment is seen as *the* problem then the future is indeed grim, and robots will be more of a curse than a blessing.

But again, as Professor Blatt puts it, "What is wrong with allowing people to live their lives and use their allotted time on earth in accordance with their own desires, not beholden to some boss for the best hours of every day?" The widespread adoption of such an attitude would require profound changes in beliefs and cause deep and far-reaching changes in our society. The day may come when productive work is the responsibility of a few highly skilled engineers aided by innumerable robots. We can either prepare for that day and welcome it as a source of new opportunities and challenges or have change forced upon us, with all the consequent dislocation and social turmoil that such a change would entail. There are steps which individuals and institutions can take however, to offset the social dislocations which robots may bring in their wake.

One preparation which we can make is the expansion of our knowledge of robots. For better or worse we are living in an age of rapidly increasing automation. Whether changes are imposed from outside or come as a result of individuals willing and able to enter a new field will depend on the willingness of those individuals and our educational institutions to come to grips with the new technology.

There is a long way to go but there is no doubt that today's robots are an increasingly significant part of industrial life and an important first step in a new field. Prepare yourself – here come the robots!



This Osaka Transformer Co industrial welding robot is distributed in Australia by GEC. (See news item, EA August, 1982).

For further reading

Jones, Barry. "Sleepers Wake! Technology and the Future of Work." Oxford University Press, 1982.

Blatt. J. M. "Will Robots take your job?" *Electronics Australia*, December 1980.

"Development of Robotic Technology in Automated Handling of Parts," report published by the Department of Science and Technology.

Marsh, Peter. "The Robot Age," Sphere Books Ltd, London, 1982. See EA February 1983 for review.

TRIO — Still the Best Scopes for Value and Performance

100MHz, 4 Channels, 8 Traces. 1mV Sensitivity!

CS 2100A

$2,495*

For applications requiring the highest degree of measurement sophistication, TRIO offers the new 100MHz CS-2100A. A second generation design with a new level of performance and reliability. It brings ultra-high performance standards and a vast array of features into one efficient package. This new scope represents the state-of-the-art and features a rugged industrial construction. As a result, the CS-2100A is efficient, light-weight and highly reliable.

- 100MHz response and 3.5ns rise time
- 120MHz response at −6dB
- 500μV/Division cascade sensitivity
- 2ns/division sweep rate with 10x magnifier
- Four-input operation provides trigger views or four separate inputs
- Selectable 1MΩ or 50Ω inputs
- Alternate timebase operation
- 20MHz bandwidth limiter for best view of low frequency signals
- Lighted function pushbuttons
- Voltage and current probe calibrators
- 8 x 10cm internal graticule CRT
- Video sync separator standard
- Dual intensity controls

CS 2070

70MHz 4 Channel, 8 Trace, 1mV Sensitivity Scope at a 60MHz Price!

$1,795*

The new TRIO Model CS-2070 is a cost-effective full-feature portable lab scope. Having many of the important capabilities of the CS-2100A, the CS-2070 comes more feature-packed than most other scopes in its bandwidth class — and it offers higher performance.

- 1mV/division sensitivity to 70MHz
- 500μV/division cascade sensitivity
- Four-input operation provides trigger view on four separate inputs
- Alternate time base operation
- 20MHz bandwidth limiter
- Lighted function pushbuttons

A Favourite of Leading Computer Companies! 35MHz, 2mV Sensitivity

CS 1577A

$995*

The CS-1577A should be your choice for microprocessor system development and troubleshooting. . . Broadcast studio applications . . . Monitoring RF waveforms. . . Monitoring digital data transmission . . . Logic and digital design work . . . Measuring propagation delays and phase shifts . . . Troubleshooting and maintaining video systems . . . Comparing amplifier input-output waveforms and displaying algebraic difference as a distortion curve.

- 35MHz response; usable beyond 50MHz
- Triggers on signals beyond 50MHz
- 2mV/cm vertical sensitivity
- Signal delay line
- Alternate trigger capability
- Automatic or manual CHOP/ALT selection
- Variable hold-off for pulse train display
- UNCAL "reminder" LEDS
- Single sweep feature for photography or observation of non-repetitive waveforms
- Video sync separators standard
- Built-in triggering filters
- Differential input capability

Our Most Popular Model — and Still the Best Value Available!

CS 1560AII

$545*

Over 2,000 Sold

Used extensively by educational institutions, hobbyists and by industry, the TRIO CS-1560AII has gained an enviable record for dependability. A record unsurpassed by any other scope in its class.
Truly your first choice for a workhorse oscilloscope. A reliable scope that will stand by you in even the toughest conditions.

- Sensitivity 10mV/Div. (Triggers at 0.5 Div. Typ.)
- CH1, CH2, DUAL, ADD, and SUB
- Risetime 23nS
- XY Mode
- Triggered Sweep and Auto
- Sweep time 0.5μS/Div -0.5S/Div and XY

For Those Who Require the Extra Capability of a 20MHz Scope at a Reasonable Price

CS 1022

$649*

The CS-1022 has that extra punch needed for engineering design work. Its 20MHz bandwidth and 1mV/div. sensitivity make it ideal for microprocessor, digital data, broadcast, RF and IF system design work.
All performance features are geared for maximum flexibility and convenience.

- Illuminated inner-face graticule 150 mm rectangular CRT (6kV)
- Maximum sensitivity 1mV/div (DC-10MHz)
- Maximum sweep speed 20ns/div (X10MAG)
- Maximum accuracy ±3% (voltage and time axis, 0-40°C) guaranteed
- New video sync circuit requires no troublesome trigger setup
- 8-division dynamic range
- Vertical signal output (CH1 output)

MS 1650B

$3,195*

"DIGITAL STORAGE"

Capture Those Unpredictable One-Time Events!

The MS-1650B captures one-time or otherwise unpredictable events, stores them in a digital memory, and instantaneously reproduces them as analog waveforms on a CRT display screen. It, in combination with the MU-1651 memory unit, represents a powerful and versatile waveform recording and analysis tool.

- Simple storage and display of transients
- 1024 byte memory
- 1μs write time
- Conventional 10MHz oscilloscope mode
- Immediate display of stored waveform
- Can capture waveform prior to trigger signal
- Digital data output capability

PARAMETERS PTY LTD

PERFECTION IN MEASUREMENT

Sydney: (02) 439 3288. Melbourne: (03) 580 7444
Adelaide: PROTRONICS (08) 212 3111. TRIO ELECTRIX (08) 51 6718. K. D. FISHER (08) 277 3288. Brisbane: ST. LUCIA ELECTRONICS (07) 52 3547. L. E. BOUGHEN (07) 369 1277. Cairns: THOMPSON INSTRUMENT SERVICES (070) 51 2404. Canberra: GEORGE BROWN (062) 80 4355. ORTEX (062) 80 5283. Hobart: IMBROS (002) 34 9899. GEORGE HARVEY (002) 34 2233. Launceston: GEORGE HARVEY (003) 31 6533. Melbourne: RADIO PARTS (03) 329 7888. GEORGE BROWN (03) 419 3355. ELLISTRONICS (03) 602 3282. Newcastle: D.G.E. SYSTEMS (049) 69 1625. GEORGE BROWN (049) 69 6399. Perth: W. J. MONCREIFF (09) 325 5277. PROTRONICS (09) 362 1044. Rockhampton: PURELY ELECTRONICS (079) 21 058. Sydney: GEORGE BROWN & CO (02) 519 5855. DAVID REID ELECTRONICS (02) 29 6601. Townsville: NORTEK (077) 79 8600. Wollongong: MACELEC (042) 29 1455.

XYCORPar 199

* All prices plus sales tax if applicable. Prices do not include probes. Inc. in Victoria

Public Apology

The response to our February catalogue has been **staggering!!** Thousands and Thousands of orders have come in from everywhere **(even Pakistan!)**. Unfortunately though — our normal same day order despatch started to drift out to 2 days and longer. Not that we've had many complaints as it seems that, even so, this is still faster than a good number of other Australian suppliers. **But frankly we felt it was not a good enough service to provide our valued customers.** So we've spent a small fortune and increased the size of our Mail Order Department 400% and installed a computer to control back order / out of stock items. So as of right now we're back to same day despatch — once again my apologies for any delays experienced. — Regards,

Jack O'Donnell

SUPER BUY ON TOP SELLING DATA BOOKS

MOTOROLA MASTER SELECTION GUIDE

B 1104. ..... $7.95

The most useful book ever printed. Covers MOS IC'S listed by function. LINEAR IC'S listed by function. INTERFACE IC'S listed by function. LSI, memory, TTL ECL power products, SCR'S, diodes, transistors listed by application and ratings. RF small signal and opto devices listed by application and ratings. Essential Data given for all devices. **TERRIFIC VALUE**

MOTOROLA LINEAR IC'S

B 1114. ..... $9.95

Popular data manual. At last readily available. Approx. 800 pages, full Data Design proceedures and equivalent listings for 1000's of devices under headings OP AMPS, VOLTAGE REGULATORS, CONSUMER CIRCUITS (eg. TV, AUTOMOTIVE, POWER), HIGH FREQUENCY CIRCUITS and SPECIAL PURPOSE CIRCUITS.

MOTOROLA LINEAR INTERFACE IC'S

B 1115. ..... $11.50

Complements the Linear IC Manual. Gives data, design proceedures and equivalent listings for: MEMORY, MICROPROCESSOR SUPPORT, LINE DRIVERS/RECEIVERS, TELEPHONY, COMPARATORS, VOLTAGE REFERENCE AND DATA CONVERSION DEVICES. **Includes comprehensive selector guide.**

MOTOROLA MICROPROCESSOR DATA

B 1120. ..... $14.95

Over 1200 pages covering all aspects of motorola's microprocessor, microcomputer and peripheral components. A clearly written Manual providing all the data necessary to design and build a working computer system from scratch. **100's of circuit examples, flow charts, truth tables and programme routines.**

MOTOROLA MEMORY DATA

B 1113. ..... $8.95

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

SCHOTTIKY TTL DATA

B 1109. ..... $9.95

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

MOTOROLA CMOS DATA

B 1105. ..... $11.50

A comprehensive reference covering 40XX, 45XX CMOS family's along with specialty devices such as LCD drivers, telephone and general communication functions and industrial control. **862 pages essential in all spheres of electronics.**

MOTOROLA MECL DATA

B 1100. ..... $9.95

Emmiter Coupled Logic (ECL) is today's fastest form of digital logic providing the most direct way of improving system performance. **This previously hard to get manual** provides data on the 10KH, 10K and III families. **MECL** memory and **PLL CHIPS.**

MOTOROLA OPTO DATA

B 1118. ..... $8.95

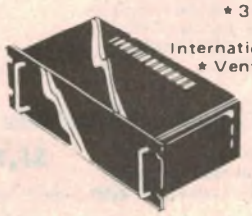
Handy reference provides data and application notes on opto couplers, infra red LEDS, Photo transistors and a complete chapter on fibre Optics, a communications system which is fast gaining usage worldwide. **VERY EDUCATIONAL.**

MOTOROLA POWER DATA

B 1101. ..... $12.95

Motorola are the undisputed world leader in Power Transistors. Renowned for their low cost and reliability. Book includes a 9 page selection guide, application notes and Data Sheets for over 700 Devices. 989 pages. **Previously over $20.00.**

ECONOMY RACK CABINET



* Solid steel construction
* Black anodised front panel
* 3 unit (132mm)
* Conforms to International Standards
* Ventilated top and side panels

H 0400 ONLY **$45.00**

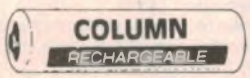
10 up **$40.00**

DE-SOLDER BRAID

NEAR ½ PRICE

T 1230. ..... **$1.00**

NICAD RECHARGEABLE

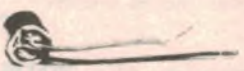


AA Size 1·2V Genuine Sintered Plate Nicad Construction by Furakawa — arguably the top Nicad designer/manufacturer in the world today. Amazing low price.

S 5020. ..... **$1.95 ea**

10 up. **$1.80**

MIC INSERT ELECTRET



Great little replacement for tape recorders, etc. Handy for hobby projects. Includes data sheet and application circuit. 50 HZ - 15 KHZ

C 0170. ..... **$1.95 ea**

VELOSTAT

Non-static sheeting for storing CMOS IC's, LSI's etc. 1000 times better than aluminium foil. Will store up to 150 IC's on one 225 x 150mm sheet.

H 0500. ..... **$3.50 per sheet**

DIL SWITCHES

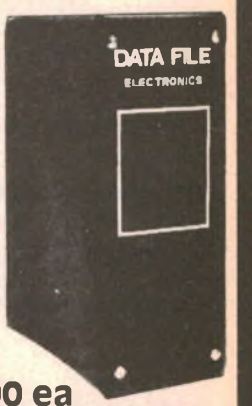
GOLD PLATE SELF WIPING CONTACTS

	EA	10Up
S 3050 4 Way	**$1.50**	**$1.35**
S 3060 8 Way	**$2.00**	**$1.75**

VINYL BINDER

Holds 12 magazines, each on a spring out wire rod. Just the shot for each year's set of Electronics Australia, ETI or any of your favourite magazine.

Suits all A4 size publications (275 x 210). Very smart Royal Blue colour with beautiful gold embossing.



B 9999. **$5.95**

4 or more **$5.00 ea**

TECHNICIAN'S UTILITY PARTS CASE

H 0449 Now **$6.50**

Lightweight and durable this Parts Case is a **MUST!**

Featuring:— Clear lid (tell contents at a glance); Positive action snap lock; 30 partition combinations.

WEATHERPROOF RE-ENTRANT HORN SPEAKER

5 WATT 8 OHM

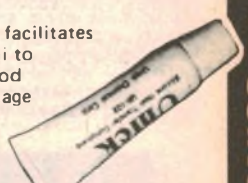
Fully weatherproof. New unique voice coil construction ensures high dependability on full drive. **Suitable for PA Intercom and security systems etc.**

C 2010. **$8.95**

10 Up.. **$7.50**

HEATSINK COMPOUND

Heat conducting paste facilitates heat transfer from semi to Heatsink. One tube good for up to 30 TO3 package semiconductors.



H 1600...7.5g Pack. **$1.20**
New trade pack

H 1610...150g Pack. **$7.50**
SAVE UP TO 33%

MINI TOGGLE SWITCHES

OEM QUALITY 250V 2 AMP RATED

6mm mounting hole
12mm x 12.7mm x 20mm (D)

	ea.	10+
S 1010 SPDT	$1.25	$1.10
S 1025 SPDT Centre off	$1.50	$1.25
S 1020 DPDT	$1.50	$1.25
S 1030 DPDT Centre off	$1.95	$1.75

DAINICHI WIDE RANGE 25 Watt

200 mm (8 in.). This superbly smooth high power speaker comes from **Dainichi**, one of Japan's finest speaker manufacturers **(they produce OEM Speakers for Pioneer)**. Max. input power 25W 8 OHM Z. Resonant fo 60 HZ. Huge 10 OZ Magnet frequency response 40 HZ-18 KHZ.

C 2001..... **$22.50**
4 or more... **$19.95**

DUAL CONE WIDE RANGE

200 mm (8 in.). 10 Watts Max. power input. Public Address, Background Music, Ideal Hi Fi extension speaker. Includes transformer holes at 51 mm.

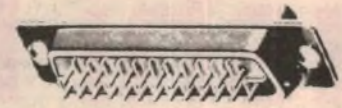
Over 30,000 sold in Australia!

Mounting holes
140 x 140 mm

C 2000..... **$9.50**
10 Up..... **$8.70**

NEW D RANGE CONNECTORS

SUPERB AB UK QUALITY



AMAZING VALUE

				ea.	10 +
P 0880	DB9	Male	9 Pin	2.50	2.20
P 0881	DB9	Female	9 Pin	2.95	2.70
P 0890	DB15	Male	15 Pin	2.95	2.50
P 0891	DB15	Female	15 Pin	3.50	3.00
P 0900	DB25	Male	25 Pin	4.50	3.95
P 0901	DB25	Female	25 Pin	4.95	4.50

VERO TYPE STRIP BOARD

Alpha numeric grid
Pre drilled .9 mm, 2.5 mm spacing, 95 mm wide

H 0712 95 x 152..... **$2.50**

RESISTOR PACK

INCREDIBLE
$3 pack

All computer selected values, i.e. you get more of the most used values and less of the least common. All 1st quality factory fresh.

R 3501 .25W RESISTOR PACK
Average contents: 300 $12.00 Value

MICROPHONE TRANSFORMER

MU-METAL SHIELD CAN

Primary: 200 OHM

Secondary: 50 K OHM

A high quality item eminently suited to mixers, PA amplifiers and where an ultra low "hum" pickup level is desired.

M 0701..... **$17.50**
10 or more... **$16.40**

BRIDGING / ISOLATING TRANSFORMER

MU-METAL SHEILD CAN

Use for coupling audio modules — prevents earth loops, hum etc. Essential coupling device where DC isolation is required.

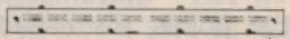
Nominal Impedance Radio
19K/10K (1:1)

M 0702.... **$17.50**
10 or more **$16.40**

PROTO TYPE BREADBOARDS

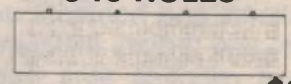
* You just plug-in vertically your components without soldering.
* Proto Boards will accept all LSI's, semis, transistors, diodes, leds, resistors, capacitors etc.
* 22-30 gauge solid hook up wire for inter-connection.
* Boards are "keyed" enabling simple "add on" facility.

MINI STRIP 100 HOLES



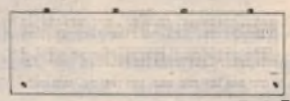
P 1000..... **$1.95**

640 HOLES



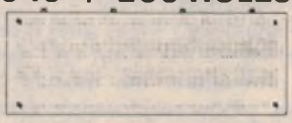
P 1005..... **$8.50**

640 + 100 HOLES



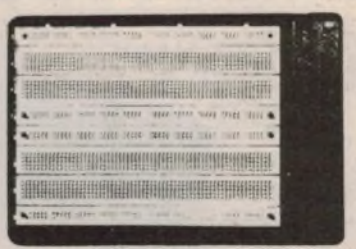
P 1007..... **$10.00**

640 + 200 HOLES



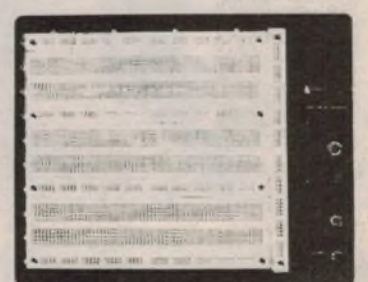
P 1009..... **$12.00**

400 + 1280 HOLES



P 1012..... **$26.00**

500 + 1920 HOLES

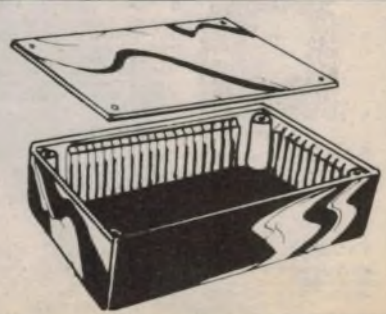


P 1015..... **$38.00**

ALTRONICS JIFFY BOXES — Incredible offer!

Black plastic body with 22 g. aluminium lid and 4 st. screws supplied. Unique horizontal PC "Snap In" mounts as well as vertical card guides. Order your PC Boards presized and dispense with costly stand offs, screws etc. These utility boxes are used in dozens of E.T.I. and E.A. projects.

Box	Dimensions	Board Width Vertical	Board Width Horizontal	Price this month
H 0101	150 x 90 x 50	90	87	**$1.90**
H 0102	195 x 113 x 60	106	103	**$2.90**
H 0103	130 x 68 x 41	62	60	**$1.80**
H 0105	83 x 54 x 28	50	47	**$1.20**



ALTRONICS • BANKCARD JETSERVICE DELIVERY NEXT DAY • ALTRONICS

Electronics Australia reviews the . . .

Mitsubishi RM-101

The RM-101 "Movemaster" robot arm illustrates many of the technical points discussed in the preceding article. It can be connected to any personal computer which has a standard Centronics-type interface and is specifically designed for educational and hobbyist use. The Movemaster allows individuals, schools and tertiary institutions to gain practical experience in many areas of robotics at a fraction of the cost of using a full-scale industrial robot.

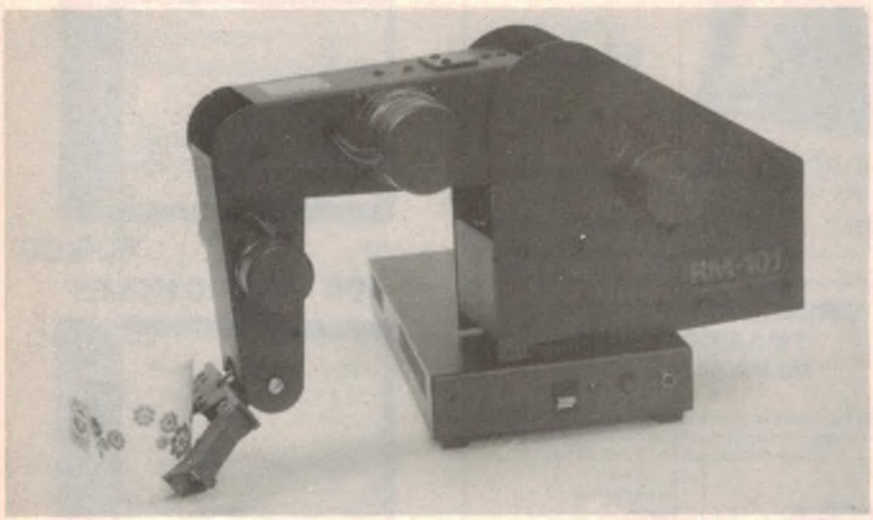
The Movemaster robot has five degrees of freedom and uses the revolute coordinate system. Motive power is provided by six stepping motors and dimensions and configurations are as shown in Fig. 1.

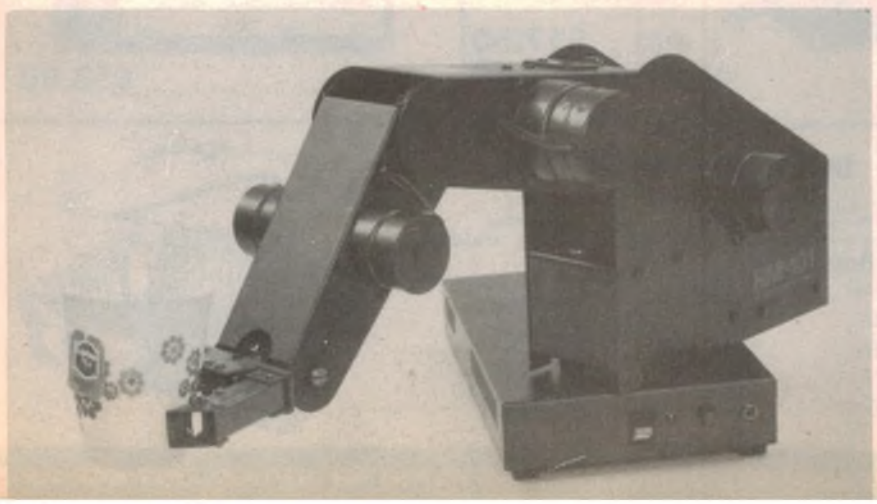
Black enamelled sheet steel is used for the housing of the robot and the cylindrical protrusions for motors at the shoulder, elbow and forearm. Except for necessary openings for clearance when the arm is in motion, all gearing and electronics are enclosed – an essential safety precaution for a robot used in teaching situations.

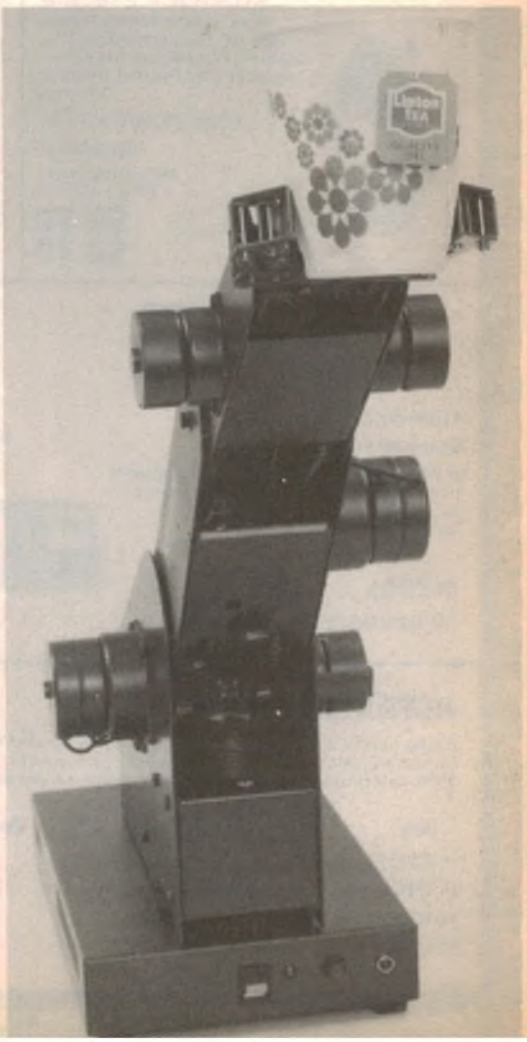
The arm itself rotates on a heavy base plate and has joints corresponding to the human shoulder, elbow and wrist. At the end of the arm is a gripper which can be moved up and down, rotated and opened and closed. Three interchangeable sets of jaws are provided which can be bolted to the hand for particular applications. (See photos.)

The body, shoulder, elbow and gripper are controlled by stepping motors, with two further motors for movement of the wrist (a total of five axes of movement and six motors). Limit switches prevent movements beyond the range of each joint. There is no feedback of position information but precise movements can be made reliably thanks to the accuracy of the stepping motors. Mitsubishi do warn however that accuracy could be affected by loads beyond the 500g maximum lifting capacity of the robot.

The body, shoulder and elbow joints are driven by large ratio gears coupled to the shaft of each respective motor and large springs tension the arm and hold it in position when the motors are not driven. Two separate motors drive the wrist. When both are rotated in the same direction the wrist bends up or down and when the motors are rotated in opposite directions the wrist rotates. By mixing these movements in various ratios these two actions can be combined in any proportion.







Movemaster Robot

The "hand" is controlled by a sixth motor mounted low on the shoulder of the robot arm. A steel cable wrapped around a drum pulls the jaws of the gripper together against the tension of leaf springs. As will all joints the stepping of this motor can be controlled precisely – there are 2000 steps between a closed and a fully open grip. With the standard jaws attached the gripper can grasp objects up to about 80mm in diameter.

All movements of the arm are specified as a number of steps in either a clockwise or counter-clockwise direction. Body rotation for example is in the range of ±3000 steps. The plus direction is clockwise and each step corresponds to a radial movement of .04°. The total rotation angle of the body is thus 240°.

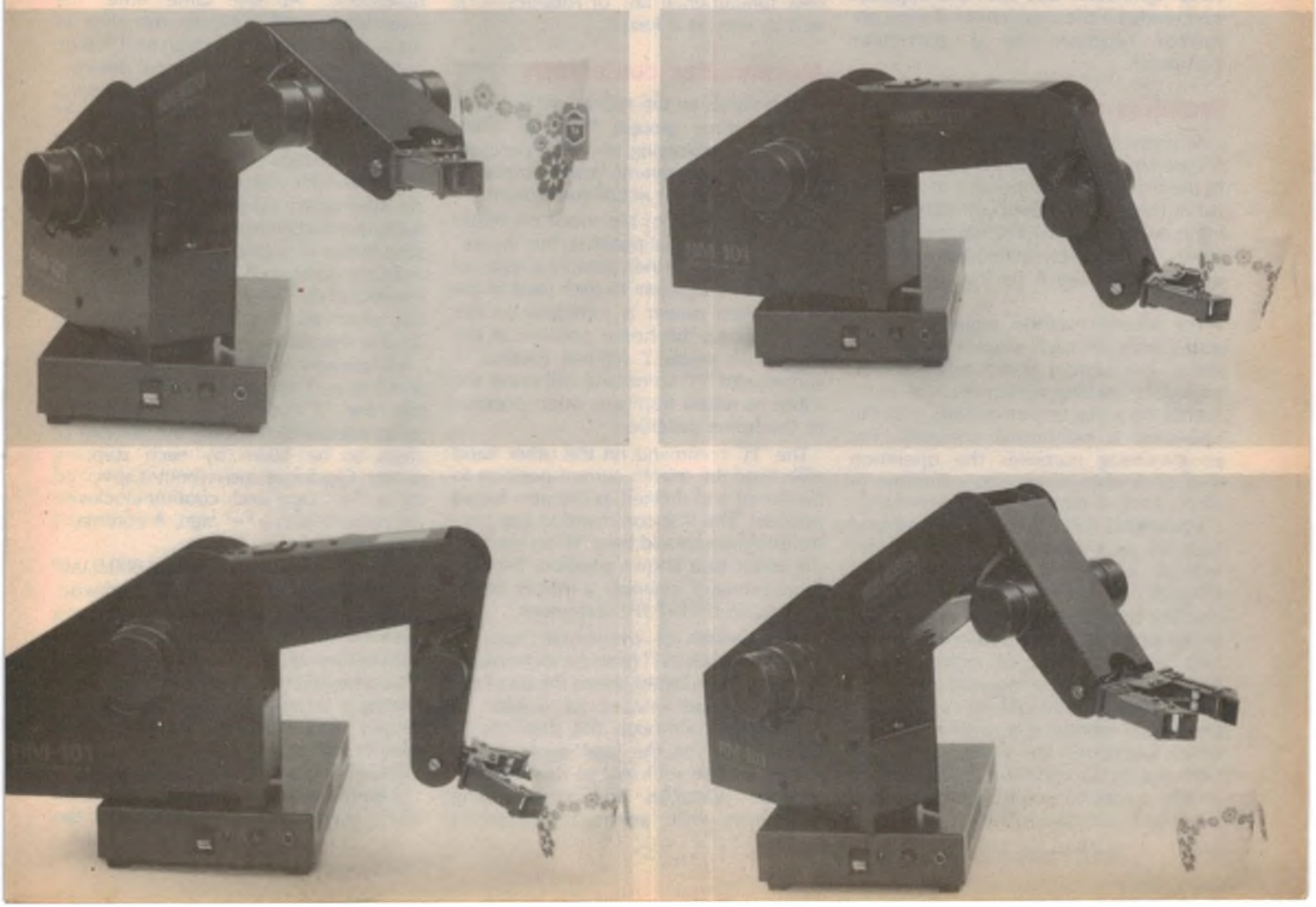
Movement of the "shoulder" is in the range of 1875 steps upwards and 1875 steps downwards. Each step again corresponds to .04°, for a total range of 150° for this joint. Elbow movement is more restricted, in the range 562 steps upward and 937 steps downwards and each step corresponds to an angular movement of .08°, a total range of 120°. The robot has a positioning accuracy quoted as ±0.3mm.

The base of the robot measures 180mm × 290mm and contains a dedicated microprocessor, command memory and interface connector. On the front plate of the base is a rocker type power switch, green power-on indicator and a red "error" LED which lights to indicate a command error. A pushbutton marked "test" initiates one of two self-test routines which exercise each axis of movement and enable the user to step the robot to any position by running each motor in sequence. Both routines are contained in an internal ROM (Read Only Memory).

The rear of the base is open and provides access to a connector for the cable from the host computer and a second connector which brings out the lines from separate 4-bit and 8-bit parallel ports. These ports can be written to by the host computer and are intended for communication with ancilliary equipment such as a video camera, pressure sensors or specialised tools.

Connection to a host computer

Any microcomputer which has a standard Centronics-type parallel port can be used to control the Movemaster robot. Data specifying the movement to be performed is latched into the robot's onboard processor by a STROBE signal. A BUSY output goes high to indicate that a movement is being carried out and returns to "0" at the completion of the action. There is also an ACK (acknowledge) signal which goes to "0" when the robot is ready to accept another command.



Mitsubishi RM-101 Movemaster Robot

The Centronics type interface is a considerable advantage as it means that no specialised hardware is needed to interface the robot to a computer. Commands are sent to the robot as a combination of ASCII characters and numeric parameters using the Basic LRPRINT statement.

With a standard connection computer processing is suspended while the robot is moving. An alternative would be to use the ACK signal to interrupt the computer, allowing the host to continue operation while sending new commands to the robot on request.

A 2K RAM buffer is installed in the standard Movemaster robot to store position information or commands for later execution. Up to 100 separate positions of the arm can be stored in the standard buffer, and up to three additional 6116 2K RAM chips can be installed by the user to allow storage of up to 600 separate positions.

The actual connector to the robot is an unusual type available only from Mitsubishi Australia. Assembled cables can be supplied to connect the robot to the Apple II and NEC PC-8001 computers, or a cable can be purchased fitted with the robot connector and with the opposite end ready for the attachment of any connector required by a particular computer.

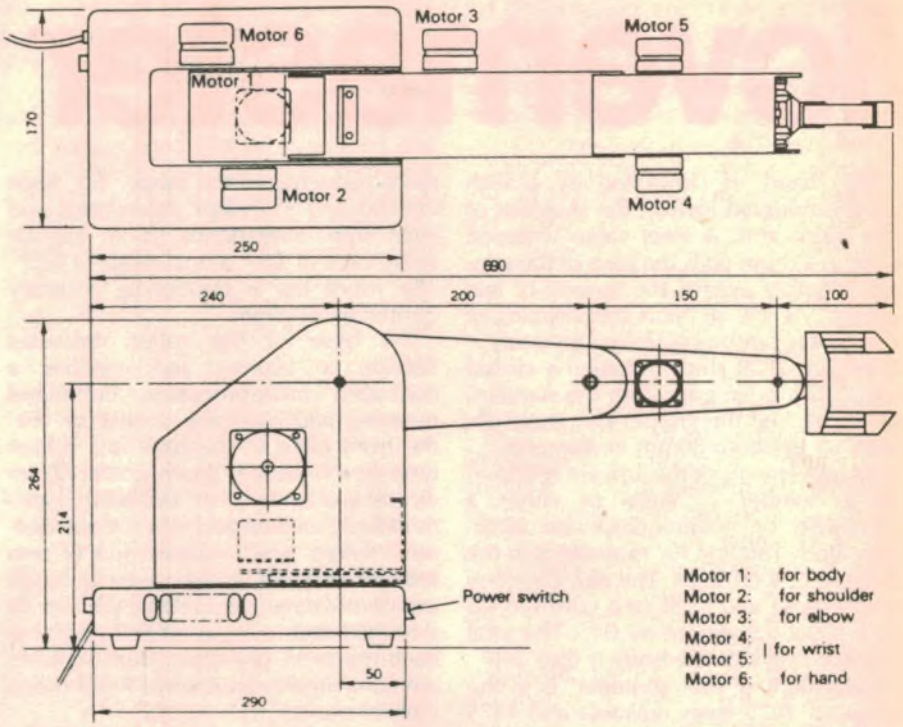


Fig.1: Taken from the Mitsubishi users manual, this diagram shows the dimensions and configuration of the stepping motors of the RM-101 robot arm.

Robotics programming

At present there are two methods of programming the movements of a robot. In the first a human operator moves the robot through a sequence of motions using manual controls. The control system stores the parameters that define this sequence and plays it back at the speed required.

The second method requires explicit instructions for each step of the movement. The motion of the robot is controlled by issuing a sequence of commands on a trial and error basis until the operation is performed correctly. For programming purposes the operation may be broken down into a number of steps, each determined experimentally.

Mitsubishi's robot arm uses the second method as there is no provision for manual control to lead the robot through its paces. Basic commands operate on individual joints and it is up to the programmer to determine the extent and sequence of movement of joints to produce the required operation.

An intriguing exercise for anyone interested in robotics is to write a program which calculates the sequence of motions required to position the end of the arm at a specific point. Attempts to do so quickly introduce the student to a new fundamental law of robotics – "It ain't as easy as it looks".

Movemaster commands

Commands to the robot can be divided into three groups; "homing" commands for specifying an initial position, speed and movement limit commands and command for actual movement.

All movements of the robot are made relative to an initial position, the "home" position, which is indicated by a series of red markers adjacent to each joint of the arm. When power is switched on the arm assumes the home position at the end of its mode 2 self-test routine. A subsequent "N" command will cause the robot to return from any other position to the home position.

The "H" command on the other hand will cause the robot's current position to be stored and defined as the new home position. The first command in any control program should be a "H" to initialise the robot to a known position. Sending the command is simply a matter of executing an LPRINT "H" statement.

Five speeds of movement can be specified, from "S1" (slowest movement) to "S5". At the fastest speed the tip of the robot's gripper moves at a rate of 7cm/second, although this depends to some extent on the load applied. This speed is quite sufficient to demonstrate robotics principles and programming techniques while posing no danger to bystanders. At the same time, the operating speed is clearly too slow to make the robot a production tool. It is intended only as an instructional device.

The "L" command allows the programmer to set a limit to movement. "L1" followed by a parameter specifying the number of steps will replace the preset hardware limit with a new software limit. An attempt to exceed this new limit in subsequent commands will result in the suspension of movement and the error indicator lamp will light. Only the "N" command will be effective once an error has occurred. An "L0" command will disable the software limit setting.

Movements can be specified in one of three ways. The most direct method is to use the "I" command, followed by parameters which specify the number of steps to be taken by each stepping motor. Clockwise movement is specified by a "+" sign and counter-clockwise movement with a "–" sign. A command such as:

LPRINT "I +2000,–1000, +800,0,0,0"

will rotate the arm 2000 steps clockwise, lower the upper arm by 1000 steps and raise the forearm by 800 steps, leaving the position of the gripper unchanged.

A command to bend the wrist up while turning it through 90° and opening the gripper without moving the arm would take the form:

LPRINT "I 0,0,0, –2800,–800,–2000"

Since the wrist can rotate through a full 360° there are no limits on the

Mitsubishi RM-101 Movemaster Robot

parameters which can be specified for this movement.

Movement can also be specified early in a program and carried out at a later point in one of two ways. The "P" command takes the same parameters as "I", but does not move the arm immediately. Instead the specified position(s) are stored as P1, P2 and so on, and carried out when an "M" command is sent. As already mentioned a total of 100 positions can be stored in the standard memory buffer, expandable to 600 when extra RAM chips are fitted on the robot's processor board.

The "E" command causes the robot's current position to be stored. When a subsequent "M" is sent the robot will return to the specified position. Again up to 100 positions can be stored and called up by a number. However since the "E" and "P" commands use the same area of memory if two identical position numbers are entered the last one entered has priority.

In addition to the gripper movement specified by the "I" and "P" commands two other commands allow the gripper to be opened or closed. LPRINT "C" closes the jaws, and LPRINT "F" opens them. Unlike the "I" and "P" commands it is not possible to specify a number of steps with these two commands. They act to close the gripper or to open it to its fullest extent.

One other command introduces a pause between movements. "Tx" will halt the movement of the robot for a duration specified by the parameter x (in seconds).

Programming the Movemaster for simple tests and experiments is easy but becomes complex for extended sequences of movements. Each step of the movement must be carefully planned and accurate initialisation of the "home position" is essential. Objects to be moved must also be precisely positioned initially to ensure that the action is repeatable.

A second lesson of even elementary robotics programming is the relative helplessness of a "blind" robot. A mistake in positioning an object initially results in it being brushed aside while the robot blithely continues on its pre-programmed course. Mitsubishi apparently recognise the problem as the auxilliary parallel ports provided on the Movemaster control board can be adapted to control a video camera. Additional equipment would be needed to digitise and process the video signal before sight could be added to the robot arm, however.

In conclusion

With the increasing use of robots in industries of all types will come a demand for engineers with a knowledge of robotics. Until recently such training was hard to come by, requiring the use of an expensive, full-sized industrial robot and specialised computer equipment, but this is no longer the case. Mitsubishi's "micro-robot" performs in the same way as its bigger brothers in response to simple commands from a personal computer.

The Movemaster RM-101 leaves a good impression. It is robust and well engineered, and its streamlined appearance and quite, smooth operation indicate that it is anything but a toy.

As Mitsubishi says, the Movemaster robot is for research, for practical applications, for education and training, or "just for fun", although it will be the well-heeled hobbyist who can justfy the $2295 price tag (plus tax) simply for fun and games. Mitsubishi Australia see the major market as schools and tertiary institutions and they are undoubtedly correct. Considering the facilities offered by the RM-101 and the price-tag of comparable industrial robots the Movemaster offers robotics training at a bargain price.

For further information on the Mitsubishi RM-101 Movemaster robot contact Mitsubishi Electric Australia Pty Ltd, PO Box 1567, Macquarie Centre, NSW 2112. Phone (02) 888 5777. The RM-101 will be distributed in NSW by Nexus Electronics Pty Ltd, 339 Pacific Highway, Crows Nest 2065. Phone 922 1722.

Anyone for tea? The RM-101 is capable of precise movements.

ELLISTRONICS

PROPRIETARY LIMITED

289 Latrobe Street, Melbourne 3000. Phone: (03) 602 3499 Telex AA37758 Listron

DATA $7 BOOK

MICROPROCESSORS

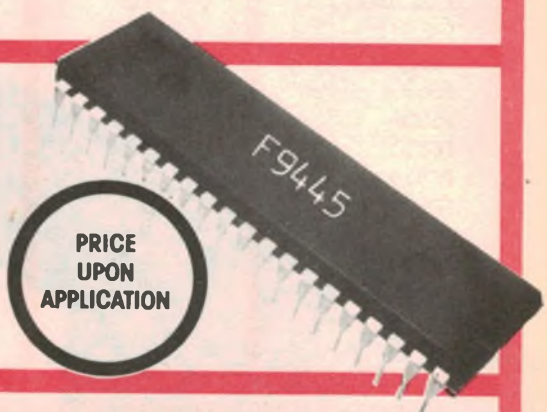
The Fairchild F38E70 is a complete 8-bit micro-computer on a single MOS integrated circuit. The F38E70 is functionally identical to the F3870, except the F38E70 has 2K bytes of EPROM in place of 2K bytes of ROM. The device features 2048 bytes of EPROM, 64 bytes of scratchpad RAM, a programmable binary timer, 32 bits of 1/0, and single +5 V power supply requirement.

PRICE UPON APPLICATION

$3.95

The F6800 is a monolithic 8-bit microprocessing unit (MPU) forming the central control function for the Fairchild F6800 family. Compatible with TTL, the F6800, as with all F6800 system parts, require only one +5.0 V power supply and no external TTL devices for bus interface. The F6800 is capable of addressing 65K bytes of memory with its 16-bit address lines. The 8-bit data bus in bidirectional as well as 3-state, making direct memory addressing and multiprocessing applications realizable.

The F9445 is a 16-bit microprocessor implemented using Fairchild's Isoplanar Integrated Injection Logic technology. This bipolar technology and a sophisticated pipeline architecture combine to give the F9445 very fast execution times.
The processor has eight program-accessible registers and the capability of directly addressing 128K bytes (64K words) of memory. Up to 4M bytes of physical memory may be accessed using the F9444 memory management unit.
The F9445 can address 62 1/0 devices, handle 16 levels of priority interrupt, and perform fast direct memory access. It has control lines to provide operator-console functions and has an on-chip self-test program.



PRICE UPON APPLICATION

$12.50

The Fairchild F6809 8-bit Microprocessor is an advanced, high performance member of the F6800 family. It offers greater throughput, improved byte efficiency, and increased adaptability to various software disciplines, including position-independent code, re-entrancy, recursion, block structuring, and high level language generation. The F6809 is compatible with all F6800 peripheral devices and is upward source code compatible with F6800-series microprocessors. The device is available in three frequency ranges: 1.0MHz, 1.5MHz and 2.0MHz.

welcome here

Bankcard Mail Orders Welcome

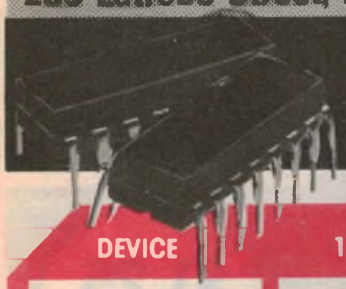
Please debit my Bankcard.
Bankcard No. .....
Expiry Date .....
Name .....
Signature .....

Prices subject to change without notice. Phone or write for quantity discounts.
MAIL ORDERS: To ELLISTRONICS, 289 Latrobe Street, Melbourne, Vic 3000.
Minimum pack and post $2.00. Phone (03) 602 3499

ELLISTRONICS

PROPRIETARY LIMITED

289 Latrobe Street, Melbourne 3000. Phone: (03) 602 3499 Telex AA37758 Listron



MICROPROCESSORS

DEVICE	1-9 PRICE	10-49
3850	7.30	5.95
3851	11.58	9.26
3852	10.09	8.07
3853	7.30	6.08
3854	8.30	6.90
3856	13.70	11.40
3861A	10.09	8.07
3861B	10.09	8.07
3861C	10.09	8.07
3861D	10.09	8.07
3861E	10.09	8.07
3871E	10.09	8.07
3871F	10.09	8.07
3871G	10.09	8.07
3871H	10.09	8.07
F3870	POA	POA
F38E70-2DC	POA	POA
F6800	3.95	3.25
F6802	5.37	4.50
F6808	3.50	2.95
F6809	12.30	10.26
F6810	2.65	2.20
F6820	2.35	1.95
F6821	2.35	1.95
F6840	4.55	3.78
F6844	9.66	8.05
F6845	9.66	8.05

DEVICE	1-9 PRICE	10-49
F6847	6.10	5.10
F68488	6.15	5.12
F6850	1.98	1.65
F6852	2.00	1.68
F6854	6.59	5.49
F6856	26.00	22.00
F6882	3.98	3.30
F68A00	4.48	3.70
F68A02	6.15	5.14
F68A09	22.00	18.90
F68A10	3.05	2.54
F68A21	2.68	2.25
F68A40	5.23	4.36
F68A44	14.30	12.30
F68A45	10.95	9.25
F68A50	2.30	1.95
F68A52	2.60	2.16
F68A54	7.56	6.30
F68B00	5.10	4.23
F68B02	6.95	5.80
F68B09	POA	POA
F68B10	3.45	2.86
F68B21	3.05	2.50
F68B40	5.60	4.90
F68B45	12.56	10.46
F68B50	2.58	2.15
F68B52	2.96	2.47
F68B54	8.60	7.17

	PRICE
F9443DC F9445-16DC F9446DC F9447DC F9448DC F9449DC	UPON APPLICATION

PRODUCTS MANUFACTURED BY

FAIRCHILD

A Schlumberger Company

ONE OF THE WORLDS LEADING SEMICONDUCTOR MANUFACTURERS

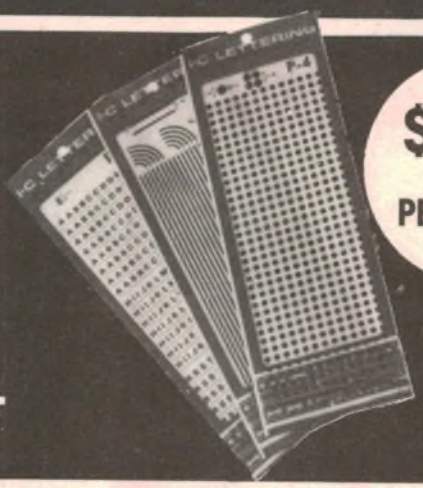
ELLISTRONICS

PROPRIETARY LIMITED

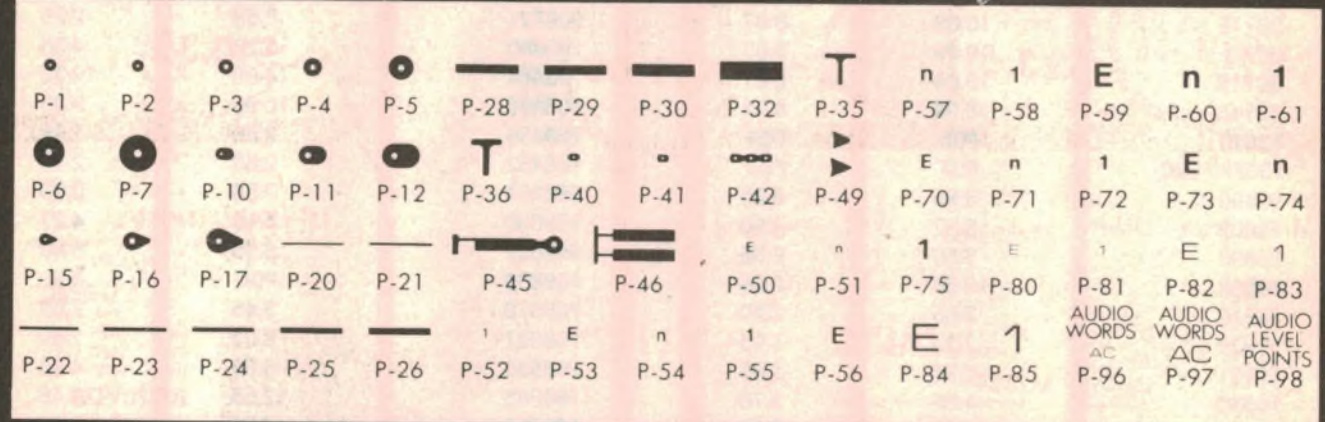
289 Latrobe Street, Melbourne 3000. Phone: (03) 602 3499 Telex AA37758 Listron

IZUMIYA I. C. LETTERING

Increase your circuit design speed and accuracy with **IZUMIYA I-C PC ART WORK MATERIALS.** I.C. lettering is an etch resistant product and can be used for Electronic Drawings or transferred directly on to the P.C.B. to produce Prototype Circuit Boards. **IDEAL FOR BOTH THE PROFESSIONAL AND HOBBYIST.**



$1.25 + TAX PER SHEET



Z80 SERIES MICROS

		1 to 4	5 to 49	50 up
Z80A CPU	4MHZ	4.56	3.40	2.66
Z80 CPU	2.5MHZ	4.29	3.20	2.50
Z80B CPU	6MHZ	9.40	7.00	5.49
Z80A DMA	4MHZ	16.10	12.00	9.40
Z80 DMA	2.5MHZ	12.22	9.10	8.35
Z80A P10	4MHZ	4.56	3.40	2.66
Z80 P10	2.5MHZ	4.29	3.28	2.50
Z80B P10	6MHZ	9.40	7.00	5.49
Z80 S10.2	2.5MHZ	12.08	9.00	7.06
Z80B S10.2	6MHZ	24.17	18.00	14.12
Z80A CTC	4MHZ	4.56	3.40	2.66
Z80 CTC	2.5MHZ	4.29	3.20	2.50
Z80B CTC	6MHZ	9.46	7.00	5.49

		1 to 4	5 to 49	50 up
Z80A S10	4MHZ	12.35	9.10	7.22
Z80 S10	2.5MHZ	12.08	9.00	7.06
Z80B S10	6MHZ	21.50	16.00	12.56
Z80A S10-1	4MHZ	12.35	9.10	7.22
Z80 S10-1	2.5MHZ	12.08	9.00	7.06
Z80B S10-1	6MHZ	21.56	16.00	12.56
Z80A S10-2	4MHZ	12.35	9.10	7.22
Z80 S10-2	2.5MHZ	12.50	9.30	6.97
Z80B S10-2	6MHZ	30.00	25.00	19.95
Z80A S10-9	4MHZ	7.90	5.60	4.34
Z80 S10-9	2.5MHZ	7.90	5.60	4.34
Z80B S10-9	6MHZ	14.65	10.95	9.42
Z80A DART	4MHZ	9.40	7.00	5.49
Z80 DART	2.5MHZ	9.40	7.00	5.49
Z80B DART	6MHZ	18.80	14.00	10.99

LARGER QUANTITIES – PRICE ON APPLICATION

PRICES PLUS 20% SALES TAX

ELLISTRONICS

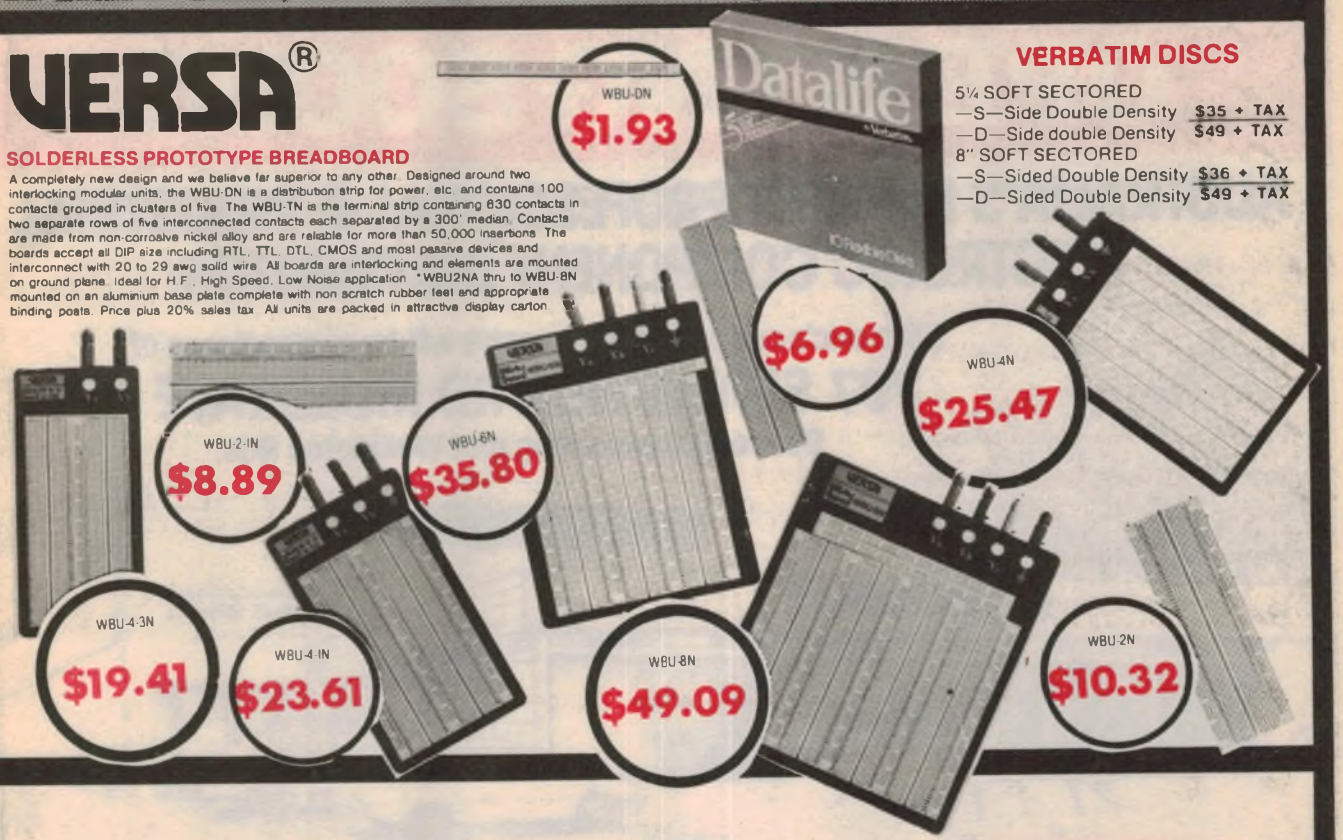
PROPRIETARY LIMITED

288 Latrobe Street, Melbourne 3000. Phone: (03) 602 3499 Telex AA37758 Listron

VERSA®

SOLDERLESS PROTOTYPE BREADBOARD

A completely new design and we believe far superior to any other. Designed around two interlocking modular units, the WBU-DN is a distribution strip for power, etc. and contains 100 contacts grouped in clusters of five. The WBU-TN is the terminal strip containing 630 contacts in two separate rows of five interconnected contacts each separated by a 300° median. Contacts are made from non-corrosive nickel alloy and are reliable for more than 50,000 insertions. The boards accept all DIP size including RTL, TTL, DTL, CMOS and most passive devices and interconnect with 20 to 29 awg solid wire. All boards are interlocking and elements are mounted on ground plane. Ideal for H.F., High Speed, Low Noise application. *WBU2NA thru to WBU-8N mounted on an aluminium base plate complete with non scratch rubber feet and appropriate binding posts. Price plus 20% sales tax. All units are packed in attractive display carton.



VERBATIM DISCS

5¼ SOFT SECTORED
—S—Side Double Density $35 + TAX
—D—Side double Density $49 + TAX
8" SOFT SECTORED
—S—Sided Double Density $36 + TAX
—D—Sided Double Density $49 + TAX

MITSUBISHI DISK DRIVES

M2896-63

Slimline 8" Disk Drive, Double Sided, Double Density, No AC Power Required, 3ms track to track, 1.6 mbytes unformatted, 77 track/side, 10^9 bit soft error rate

$525 + tax Box & Power supply to suit $95 + tax

M2894

Standard size 8" drive, Double sides, double density, 3ms track to track access, 1.6 mbytes unformatted, 77 track/side, 10^9 bit soft error rate.

$495 + tax Box & Power Supply $95 + tax

M4854

Slimline 5¼" disk drive, Double sides, double density, 96 track/inch, 9621 bits/inch, 1.6 mbytes unformatted, 3ms track to track access, 77 track/side

$395 + tax Box & Power Supply $65 + tax

M4853

Slimline 5¼" disk drive, Double sides, double density, 1 mbyte unformatted, 3ms track to track, 80 track/side, 5922 bits/inch, Steel band drive system.

$375 + tax Box & Power Supply $65 + tax

MPI DISC DRIVES

(to suit Tandy & system 80 etc computers) with Box & Power supplies

1 DRIVE

B51	$265 + tax
B52	$375 + tax
B91	$460 + tax
B92	$550 + tax

2 DRIVES

$525 + tax
$650 + tax
P.O.A.
P.O.A.

C. Itoh PRINTERS

PRO-WRITER 8510A
120 CPS Dot Matrix Parallel

STARWRITER F-10
40 CPS Daisy Wheel

MODEL 1550

ELLISTRONICS

PROPRIETARY LIMITED

289 Latrobe Street, Melbourne 3000. Phone: (03) 602 3499 Telex AA37758 Listron

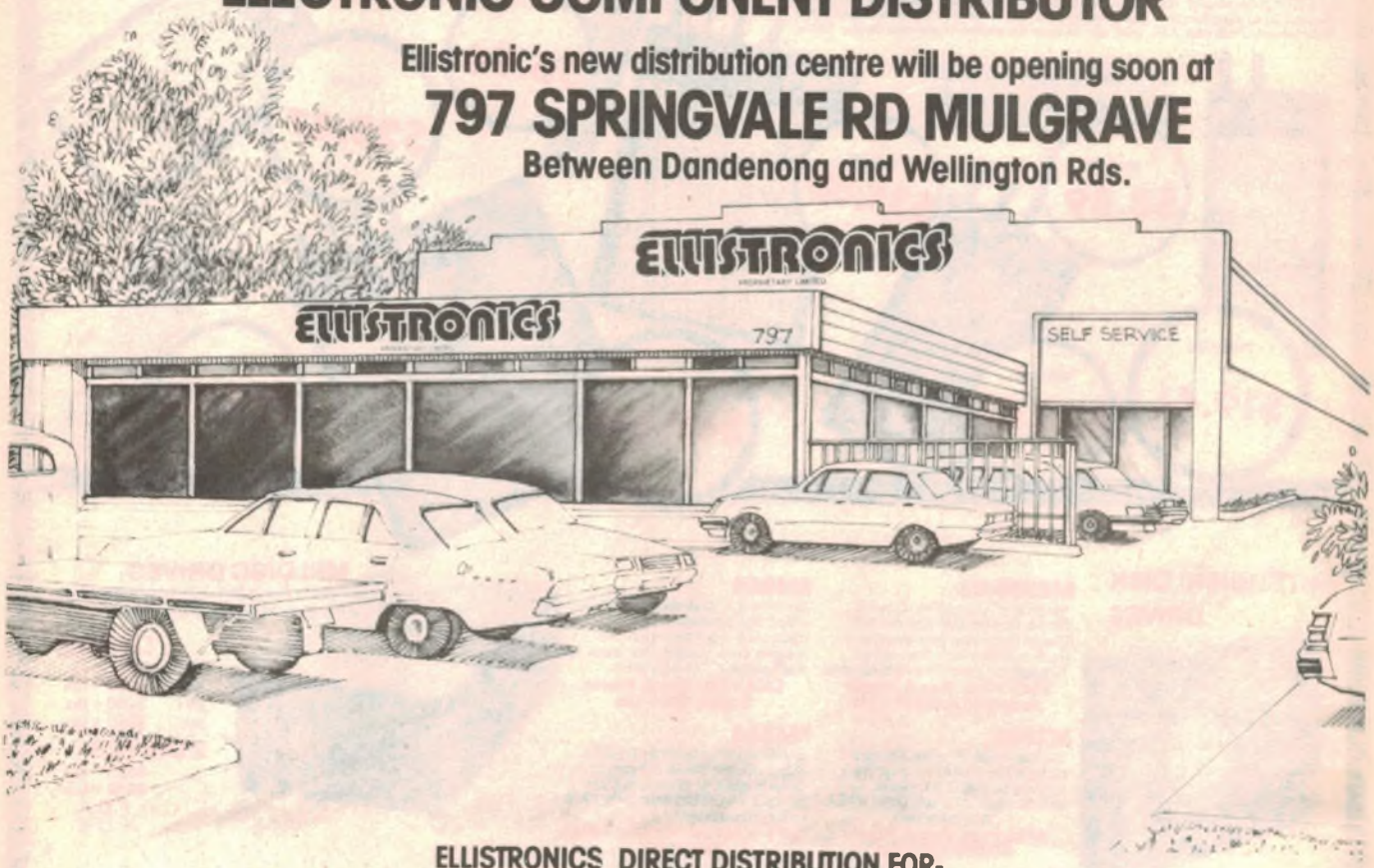
OPENING SOON!

AUSTRALIA'S LARGEST PROFESSIONAL & INDUSTRIAL ELECTRONIC COMPONENT DISTRIBUTOR

Ellistronic's new distribution centre will be opening soon at

797 SPRINGVALE RD MULGRAVE

Between Dandenong and Wellington Rds.



ELLISTRONICS DIRECT DISTRIBUTION FOR-

T&B/Ansley
The mass termination company

FAIRCHILD
A Schlumberger Company

IZUMIYA I·C INC.

RECTRON

VERSA

POMONA

SGS

CooperTools
Technology and Service

OK Industries Inc.

An interview with Barry Jones

Australia has a new Minister for Science and Technology, Mr Barry Jones. He is a passionate advocate of high technology "sunrise industries" for Australia and has played a major role in shaping the new government's policies on science and technology.

by PETER VERNON

Barry Jones has been persistent in his espousal of a collection of social models which have come to be called the "information society". He has seen the ideas that he writes and speaks so skilfully about ignored or rejected as visionary and gone on to steer them through the long hurdle of party debate guiding the framing of the ALP "Technology Task Force Report of 1980".

Now the concepts outlined in this report and in Barry Jones' book "Sleepers Wake!" reflect the official policies of the Government of Australia. What results can we expect from this new approach, an approach which in its essence rejects the "user pays" principle in communications and other basic services and recognises the need for far-reaching changes in industry and attitudes to technology?

The Minister was in Sydney recently on the occasion of the 75th anniversary of the Australian Bureau of Meteorology and we took the opportunity to ask him a few questions on the course of science and technology under a Labor government.

Mr Jones, what will be your first priority as Minister for Science and Technology?

I think the first priority is really to change Australia's technological base. I think that we put the greatest emphasis in the policy on the sunrise industries, because it seems to me that our range of options is really fairly limited. We obviously can't guarantee success in any of these areas, but we can pretty clearly guarantee regression with the economy if you don't work in that area. What struck me increasingly in my researches (I mean even since "Sleepers Wake!") has been the different impact of technology on different types of economies. For example, if you've got a dynamic economy where you've already got a high growth rate, or a tendency to a high growth rate, the impact of new technology will be almost entirely positive, but if you've got an economy that's either static or regressing, it seems to me that the impact of new technology is catalytic. Certainly in the case of regression, it simply speeds up the regression, and if you've got an economy that is, for example, manufacturing-based that's doing very badly (as ours is at the moment) and you introduce new technology you'll probably just decimate the labour force but you may not produce anything very good out of it either. Trying to graft new technology onto a moribund base is a bit like trying to treat an 80-year-old cardiac patient by giving him pep pills and a track suit and running shoes. You know that whatever the results are they'll be very dramatic either way, but there's a fair chance that you'll fail.

So you don't see technology as a panacea then?

Well, technology is not in itself a panacea. There are a number of cases, a dramatic number of cases actually, where technology has been introduced in the Third World, and you haven't had a community that's really been able to use it properly, where it's really produced quite adverse effects. I think we are paying a very heavy penalty for the running-down of our R&D base over a long period, and the running down of our intellectual base generally and our education base in particular. It's extraordinary when you come to think of it . . .

The Williams Report on Education, Training and Employment – I said this in the book – the Williams report in 1980 said that of NSW school leavers that, I think, 17% were subliterate and subnumerate and that another 32% were semi-literate and semi-numerate. Well, if you've got 49% of your school-leavers in that situation that is not a very happy augury for what is going to happen in the future.

Similarly that report of the Council of Adult Literacy said that 10% of Australian adults were functionally illiterate. (Now, I think their methodology might be open to some question. You don't really know if that 10% is an overstatement or an understatement.) Let's assume that it is correct, and reflect – remember that the 10% in any case would not be evenly spread. You wouldn't have the same figure in Pymble or St Ives that you have in Macdonaldtown or Green Valley. It would mean that in those areas particularly in the highly specialised areas with overconcentration in the economy that you've got a labour force which is really a victim of educational and cultural inadequacies, where it's going to be very difficult for them to make the transition, you really do see the enormous social problems associated with overspecialised economies like Wollongong.

If you're a 55-year-old Ukrainian steelworker and you've worked there for 30 years, doing nothing else, as a process worker it's a bit tough to turn around and say "Well, now's the time to pick up your traps and go on and make your fortune somewhere else" – its completely unrealistic. And also it makes the whole idea of retraining a bit hollow. You can't say "Do a course, you'll be right. You can become a data analyst or something". Its just completely unrealistic.

AS NEAR AS YOU'LL GET TO A SMALL VARIABLE TRANSFORMER

The Ferguson PL1.5-18/20VA Multi-tap Low Profile Transformer

Ideal for development situations or where the secondary voltage needs to be easily adjustable. Takes you from 1.5V to 18V in 1.5V steps. Simply plug and unplug the pinlok connectors till you get the voltage you want. Twin secondaries provide up to 2.2A. Numerous centre-tap configurations.

•SERIES CONNECTION (1.11A)
1.5V, 3V, 4.5V, 6V, 7.5V, 9V, 10.5V, 12V, 13.5V, 15V, 16.5V, 18V

Additional Series Configurations (1.11A)
9V-6V-1.5V-0-1.5V-6V-9V or
9V-7.5V-3V-0-3V-7.5V-9V

Centre Tap Configurations (1.11A)
1.5V-0-1.5V, 3V-0-3V, 4.5V-0-4.5V,
6V-0-6V, 7.5V-0-7.5V, 9V-0-9V

•PARALLEL CONNECTION (2.22A)
1.5V, 3V, 4.5V, 6V, 7.5V, 9V

CHECK THE WHOLE FERGUSON LOW PROFILE RANGE

- 20VA, 40VA and 60VA ratings - use two to get 120VA
- Most have twin secondaries to give centre-taps if necessary
- Secondary voltages from 6V to 40V
- Secondary currents up to 6.6A
- Safe - made to conform to relevant clauses of Australian Standards and Telecom Australia specs.
- Pinlok quick connect connections • Made in Australia

TALK TO FERGUSON – THE AUSTRALIAN COMPANY WITH NEARLY 50 YEARS EXPERIENCE OF MANUFACTURING IN AUSTRALIA FOR AUSTRALIAN CONDITIONS

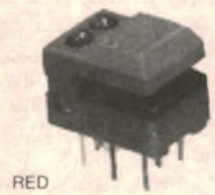
FERGUSON

FERGUSON TRANSFORMERS PTY LTD

331 High Street, Chatswood N.S.W. 2067. Tel. (02) 407 0261. Telex AA25728
Branch Office: 181-183 Hawke Street, West Melbourne Vic. 3003
Tel. (03) 328 2843 Telex AA33510

NEW MP01 NEW MP01 NEW MP01 MP01 MP01 MP01 MP

AN EXCEPTIONAL MECHANICAL PUSHBUTTON SWITCH FROM C&K . . . AN EX


RED


WHITE


GREEN


ORANGE


BLACK


BLUE


YELLOW


GREY

YES, C&Ks NEW MP01

is a versatile, long life switch module suitable for data entry or function control in individual or multiple keyboard arrays.

- ☐ 6 cap styles, with and without LEDs available in 8 colours.
- ☐ Easily installed with field replaceable caps.
- ☐ Choice of 3 coloured LEDs.
- ☐ Minimum life — 1 million electrical cycles.
- ☐ Withstands wave soldering temperatures.
- ☐ High temperature thermoplastic case.
- ☐ SPDT momentary switching function.
- ☐ Call us NOW for free, informative technical literature.

C&K COMPONENTS

C & K Electronics (Aust.) Pty Limited
15 Cowper Street, Parramatta, NSW 2150
PO Box 229 Parramatta, NSW 2150
Telephone (02) 635 0799 Telex AA23404

Agents Melb. 598 2333 Adel. 277 3288 Bris. 369 1277
Perth 275 5522 Hobart 34 2233 Launceston 31 6533

Well, then, what will be the government's approach to technology?

Well, I think you can safely say that the greatest single generator of employment, in past economic history, and I think it'll be the same in the future, is in fact the growth rate. I'm not saying that the new technologies will in themselves be large employers. Obviously they're not. Clearly, the mining industry say, is not a big employer. Less than 0.6% are employed in mining in Australia, but out of proportion to the number of people employed it is a great wealth generator.

Now, I've also quoted in the book something called "Okun's law". Okun was an American economist who originally argued that for every 3% of GDP growth you get a 2% increase in employment. A lot of the economists in Australia haven't caught up with the fact that before he died he revised that, he said he thought he over-stated it, but it was about half-and-half, that for every 3% of economic growth you get a 1.5% growth in employment. Now that's not to say that the specific new technology itself is the generator – it's the wealth generator. In other words if you're earning more there will be a predisposition perhaps to travel more, to use more petrol, buy more clothes, buy more books etc, and that will really make a very significant contribution to the employment of people both directly and indirectly and I think that's essentially correct. What I've argued – I suppose it was implict in "Sleepers, Wake!" but I didn't put it in this form – if you look at the whole trend of employment, from before the industrial revolution, you can really state it in one long proposition.

There are three phases. Phase one is where you have the majority of people working for the majority of their time in producing necessities. We call them "poor" countries. In other words the majority of people spend the majority of their time getting shelter, water, food, warmth and that's about it. Then you have the industrial revolution, which means a transition to where, not a majority, but where perhaps the most dynamic single sector of the economy is producing tangible goods, is producing not always consumer goods, but certainly producing tangible goods, building materials, railway lines, later on cars, electrical equipment, manufacturing equipment and so on. Then you get a transition – and this is the stage we are in now – where the majority of people are in fact employed in the provision of services, many of them really quite marginal, which depend more and more on the discretionary use of income. That includes areas like entertainment, gambling, eating out and beauty care and so on. They're not necessarily areas that you would regard as essential and in fact the trend in societies like our own is increasingly to sub-contract out things that we really could do ourselves. We could walk, but we get someone to drive us. We could repair our own shoes but we don't. We could cut our own hair but we choose not to do it. to give a couple of examples; in Australia there are far more hair-dressers than there are steel-workers.

Now people . . . at first when you say that, they react and say "That couldn't be right" but when you come to think of it it obviously is. I mean every town has a hair-dresser, has its own beauty-care workers. Not every town has a steel-works, and increasingly the steel-works would be more and more automated with fewer and fewer people. So you've really got the creation of an enormous number of jobs which really depend on high living standards to sustain them. The service has a cash value, that's what you pay over, but the service isn't worth anything to anybody else, you receive the service and that's it.

People are often flummoxed when I quote these figures, but between 1965 and 1982 there were 2,060,000 new jobs created in Australia, and when I ask people what's the contribution of manufacturing they quite often say "50% or 30% or something" and are taken aback when I say that the answer is –7.3%. Manufacturing did not contribute one job to the 2,060,000 that were put in over that period. Because in a way people have a curious stereotype in their minds about what people actually do. Overseas there's a stereotype that the typical Australian is a farmer of some sort, or a shearer, and we think that's ridiculous.

And yet it is curious that if you ask people at random and say "give me an example of a typical Australian worker" they'll almost invariably say "a process worker in a factory". But the process worker in a factory is really becoming an endangered species. I think quite an interesting illustration of this was the last Labor Party conference, held in Canberra in July. Of the 134 delegates and proxies there, two were blue collar workers, one was a housewife and one was a farmer. The remaining people, the other 130, were all members of the information sector of the economy. Now of course many of them had begun as blue collar workers but they'd made the transition to shop steward, union secretary and so on all the way up. But one thing that you could be absolutely certain of was that they had no intention whatsoever that their own children would follow on the original career path that they had.

You've mentioned "Sleepers, Wake!" Can we look forward to a government policy shaped by that book?

Well, to a large extent it already is. The thinking of "Sleepers, Wake!" has penetrated the industrial policy which was announced by John Dawkins in the course of the campaign and which is carried on by John Button as the incoming Minister. A lot of the things recommended have in fact already been incorporated in party policy, like the national information policy, and I think you'll see the impact of it, both directly and indirectly through the Department of Science and Technology and also through the CSIRO.

And the Technology Task Force Report of 1980? Will that be implemented?

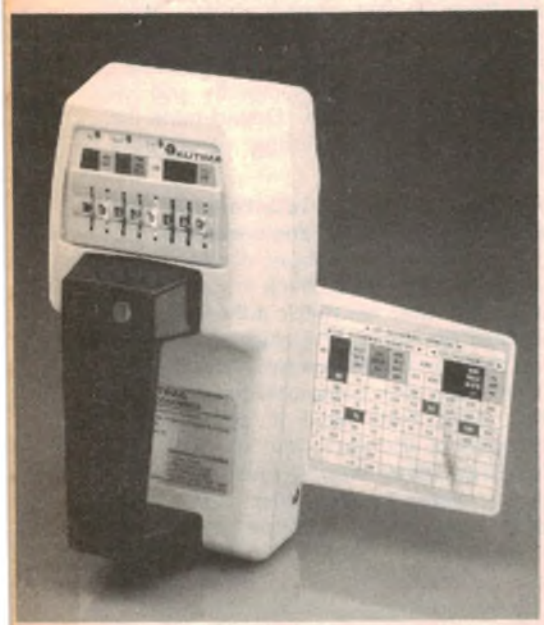
Well, yes, a fair amount of the report was in fact adopted. I think in some ways it's a pity that we didn't adhere to our original timetable. The original plan being that we'd finish the task force report 12 months after being told to do it, and that we'd then have it disseminated throughout the party and we'd have a long argy-bargy about it with the various policy platforms. But what in fact happened was that the report, instead of taking a year to write, took in fact two and a half years to reach consensus on it. Incidentally, Bob Hogg who is now the personal assistant to the Prime Minister was the chairman of the report and I suppose I was the secretary or something, I sort of pulled the whole thing together. Unfortunately the timing of our national conference had changed. We had a special conference to look at the socialist objective and with a view that there might be an early election we had a conference (that was the Canberra conference) which really just updated policy in specific areas, but there really wasn't time for that long, drawn-out debate on it. But I think increasingly the principles set out in that report have really just become the conventional wisdom.

> "I think we are paying a very heavy penalty for the running-down of our R&D base over a long period."

One of the points raised in that report was the relevance of the traditional work ethic and the need for a new analysis of the workforce which includes voluntary work, hobbies and household management as sectors of the economy in their own right. How does a government go about changing the concept of work,

continued on p141

Heart Pacemakers: Australian success story



A typical external programmer used to monitor an implanted pacemaker and, if necessary, re-program it without recourse to surgery.

To anyone faced with the prospect, the idea of an implanted heart pacemaker can be rather disconcerting, with plenty of "old wives tales" to back up their fears. Yet the truth is that both the devices and the associated surgery have advanced enormously in recent years; to the point where it has changed from being frightening to being almost fashionable — like being a member of an exclusive club.

by PHILIP WATSON

It is not surprising that most people know so little about the subject, but it is unfortunate that so many wrong ideas persist. It is also unfortunate that so little is known about one Australian company's contribution to the very high standard of these devices, which now exists world-wide.

This story is based largely on the growth of this Australian company; Telectronics Pty Ltd, of the Sydney suburb of Lane Cove. But, inasmuch as this company has contributed so much to the development of cardiac pacemakers, it is also a story about the development of pacemakers in general; the first very elementary devices, the problems, the setbacks and the ultimate solutions, followed by the gradual development of more elaborate designs aimed at providing more flexibility, control, and monitoring of the implanted device.

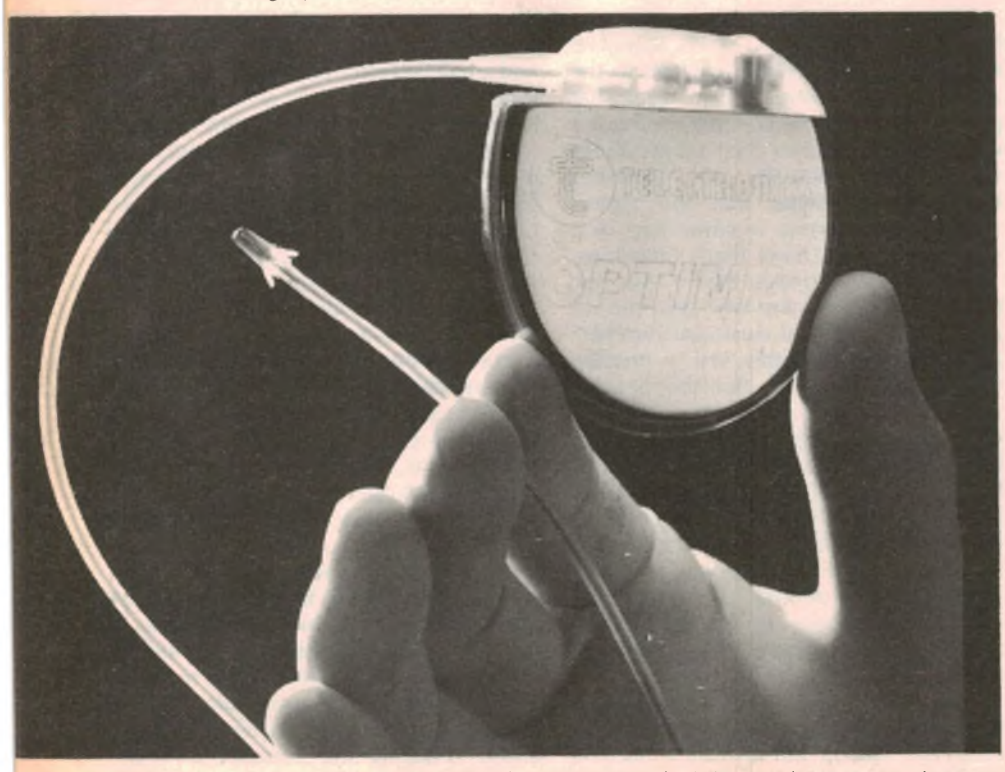
The basic concept of a pacemaker is simple enough; if a heart does not receive, naturally, the regular electrical impulses which cause it to beat, then it is possible to generate these pulses artificially and apply them to the heart via electrodes attached to it. If properly applied, the heart will respond just as it would to the natural impulse.

The snag, of course, was to find a practical way of doing this. If the pulses had to be generated outside the body, how could they be taken inside the body to the heart? Well, that was tried, but without much success. The obvious alternative was to put all the equipment inside the body, but how could it be made small enough and how could it be powered for long enough to make the idea worthwhile?

The development of the transistor, compact high energy batteries, and miniature components provided the starting point. Two engineers, Wilson Greatbatch and Ake Senning, both of the USA, working independently, produced the first implantable pacemakers in 1958. (Wilson Greatbatch now makes the batteries used in pacemakers.)

In Australia, Telectronics began research into pacemakers in 1962, when Geoff Wickam and Keith Jeffcoat created the Telectronics model P1. These two gentlemen eventually became director and senior executive, respectively, of Telectronics. (Before joining Telectronics, Keith Jeffcoat was a technical journalist on the staff of "Electronics Australia").

The first human implant in Australia was in January 1963, using a model P1.



The Telectronics Optima-MP pacemaker. It is typical of the modern pacemaker and one of the most successful general purpose types so far developed.

Age doesn't matter. Mrs Maria McKerlie, of Melbourne, with her 10-month-old son, Shane, who was recently successfully fitted with a pacemaker.

The model P1 was a simple pulse generator, built around transistors and discrete components, and powered by mercury cells. It was encapsulated in epoxy to protect it from body fluids. It was a bipolar device, ie, feeding two electrodes fitted directly to the heart.

For a variety of reasons the P1 models did not have a very long life, ranging from about three weeks to nine months, one of the main problems being moisture penetration.

Models P2 and P3 followed but were used only for experimental purposes. Following some orignal research, the model P4 was developed (1965) and incorporated an original Telectronics development; reduction of the pulse width to 0.5ms, with a consequent useful increase in predicted battery life.

The model P5 (1967) incorporated a sealed battery container to counter the moisture penetration problem, thought at that time to be dure to encapsulation failure around the leads. P5 models survived for over 30 months and in some cases up to four years.

The model P6 (1968) may perhaps be regarded as introducing the modern pacemaker concept; the idea that the pacemaker should be able to adjust itself, or be adjusted in situ, to suit the body's varying requirements. In the case of the P6 it was Telectronics first "demand" model, though the idea was not original.

Prior to this all models had simply delivered regular pulses at a rate set, according to medical instruction, before implantation. This "100% pacing" condition is not always necessary, or even desirable. The heart will very often continue to generate its own pulses for most of the time, only dropping out occasionally, but potentionally fatally.

Pacemaker Syndrome

While the heart is functioning normally the generation of pulses is not only wasteful but, more importantly, can conflict with the heart's natural pulses, causing a form of distress known as "pacemaker syndrome".

Pacemaker syndrome can manifest itself in various forms and degrees of patient discomfort. In the simplest case it may amount to nothing more than producing an extra beat of which the patient becomes aware, and the effects of which are mainly psychological; ie, the patient is reminded that he is using a pacemaker every time this happens.

Somewhat greater discomfort is caused if the heart's natural rhythm and the pacemaker beat assume a certain relationship, such that the heart pumps less blood than normal. This can cause a degree of breathlessness.

In regard to the very early pacemakers, which delivered quite high energy pulses by modern standards, a heart/pacemaker conflict created a risk of ventricular fibrilation; a potentially fatal condition if not treated immediately. With the modern "demand" type pacemaker there is very little chance of such a conflict occurring but, even if it did, the minimum energy pulses used in modern pacemakers would be very unlikely to create such a risk.

Demand System

In the "demand" system the pacemaker, having delivered a pulse, monitors the heart in anticipation of a natural pulse. If this does not occur within a prescribed number of milliseconds the pacemaker delivers another pulse, and another, until a natural pulse is detected. When this happens, the pacemaker cancels its own pulse and remains dormant until the next failure of the natural pulse.

While the concept was not original, Telectronics did contribute an improved immunity to external electrical interference, which was a problem with early "demand" models.

The model P7 (1969) was another first for the company; the first use of a monolithic integrated circuit in a pulse generator. By replacing the majority of discrete components with an integrated circuit, reliability was increased, the battery drain reduced, and the physical size decreased.

But the moisture penetration problem remained. By now, research had indicated that it was fundamental to the epoxy; that the moisture permeated the epoxy, rather than penetrating faulty seals. The idea of a sealed metal can had been considered, but presented several problems, including that of escape for the hydrogen gas generated by the mercury cells. (With epoxy encapsulation, the gas could permeate the epoxy, as did the moisture.)

At this stage Telectronics decided to change to a sealed titanium case, titanium having the desirable properties of high corrosion resistance and strength. At the same time, however, it presented its own problems. It is expen-

Heart Pacemakers: Australian success-story

sive, it is difficult to work, and it requires a very high welding temperature. In fact, the popular opinion was that the Telectronics concept was just not possible.

Nevertheless, they went ahead and, in 1971, produced the model P8; the first hermetically sealed pulse generator in a titanium case. The hydrogen problem was taken care of by means of a hydrogen absorbent inside the case, and the high welding temperature needed to seal the case, without cooking the contents, by a carefully worked out combination of fast welding and external heat sinking and cooling.

And that was the breakthrough; not only for Telectronics, but for the pacemaker scene world-wide, because it is now history that the development was an unqualified success, eventually adopted by all the major manufacturers.

Indifferent electrode

The P8 was also the company's first unipolar device. As already explained, bipolar devices provide two leads and electrodes, usually for fitting to the outside of the heart, but this latter arrangement is now used only in special, rare, cases. The modern technique is to use the metal case as one electrode, called the "indifferent electrode". This makes contact with the flesh at the site of the implant.

The active electrode is then applied directly to the heart, and in a rather novel manner. A popular implantation site is in the upper chest, just below the right shoulder blade. Here the implanting surgeon has access to a small vein which leads directly to the heart. The electrode is introduced into the vein at this point and, in the nature of a catheter, fed down it into the right ventricle of the heart, its exact position being monitored on a fluoroscope.

Once in position the lead is connected to the pulse generator by means of a sealed plug and socket, the generator implanted, and the pocket stitched closed. In the event that the generator has eventually to be changed, the lead need not necessarily be removed; the new generator is simply connected to it, with a minimum of surgical trauma.

In fact, the whole implantation process is so simple, compared with the original approach, that it can be done under local anaesthetic and the patient can normally leave hospital in about two days.

One problem associated with the hermetically sealed case concept was that of providing a sealed terminal to bring the pulses out of the case and feed them to the electrode lead. It was a difficult problem, but Telectronics finally solved it.

The crux of the problem is that titanium has a temperature coefficient of expansion quite different from that of common insulating materials, such as glass and most ceramics, and this conflicted with the high temperatures involved in welding the cover to the case.

The final solution was a ceramic material with a high alumina content which will actually bond to titanium, which is also used for the terminal. The end result is an insulator which is bonded to both the terminal and the case, making a perfect seal. Nevertheless, the manufacturing process involved is quite complex.

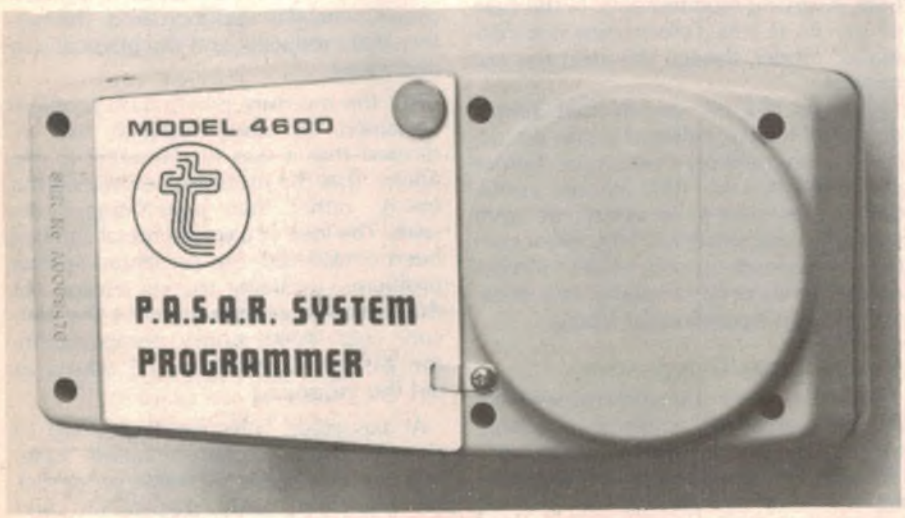
As a further protection, the terminal and the end of the lead which mates with it is covered by a silicone rubber shroud. The lead is secured in the terminal by a grub screw, tightened by a miniature allen key pushed through the shroud. A characteristic of the silicone rubber is that it is self sealing for small holes.

In 1973 the company produced the models P9 and P10, which incorporated refinements of the P8. One of these was to limit the area of the indifferent electrode by coating most of the case with a silicone elastomer. When using the whole case as the electrode it can make contact with a muscle at the implantation site, causing muscle twitch. By using only a small specific area, this can be kept clear of muscles.

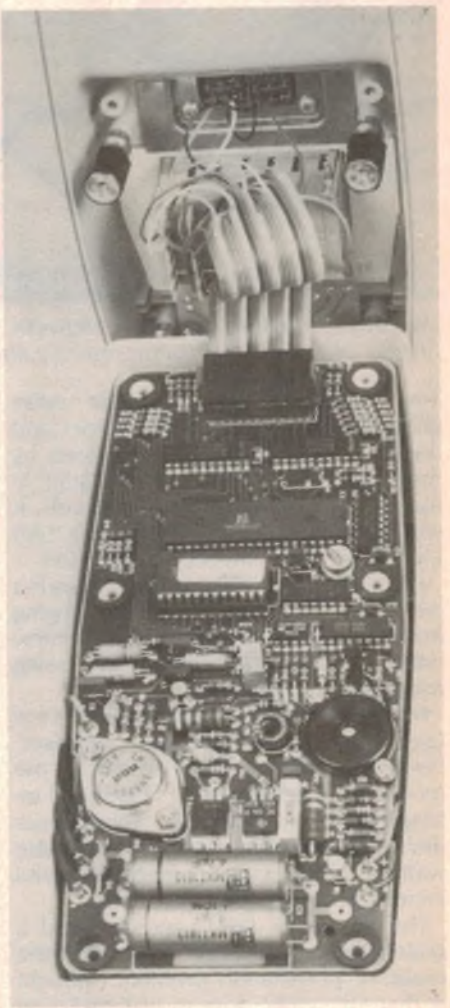
Lithium iodine battery

The next major step was the introduction of the lithium iodine battery. The lithium iodine version is one of several lithium batteries which have been developed in recent years. (See "Electronics Australia" for October, 1979.)

While it has some characteristics which limit its usefulness in more conventional roles – such as a high internal resistance



The underside of a pacemaker programmer, showing the outline of the heavy duty electromagnet which actuates a tiny reed switch in the pacemaker.



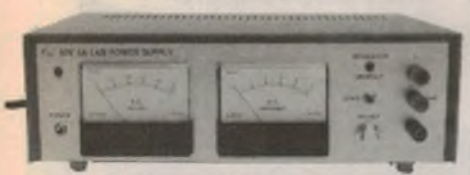
This interior shot of a programmer gives some idea of the electronic complexity involved.

"HIGH TECHNOLOGY - LOW COST"

8 CHANNEL MIXER KIT

Ref: EA March/April 1983
This great 8 channel 'live' mixer is perfect for bands, churches, theatre groups, home recording, disco etc.
Each input channel accepts either microphone (balanced) or line (1V) levels. Powerful equalisation foldback effects facilities are provided. The left and right master channels can drive balanced or unbalanced lines with 5 band "graphic" equalisation. Separate foldback and "effects" are provided.
The unit can be rack mounted or housed in a console chassis (which accommodates the power supply). Attractive wooden end-pieces finish the console to form a professional looking unit.
Complete 8 channel mixer
(19" rack mount) Cat. KJ6504 $495.00
Console mount chassis, power supply and wooden end pieces
Cat. KJ6505 $98.00
You end up with a $1500+ unit for under $600

50V/5A laboratory power supply



By far the most exciting high power supply we have seen! Using the latest switchmode principle, very little energy is wasted with high dissipation in the regulators — a cause of considerable heat dissipation and high hardware costs.
The Jaycar kit comes with every originally specified component down to the last nut and bolt. Also included are special Scotchcal meter scales. Beware of inferior kits that do not supply such components. (Not for sale as a separate item).
Cat. KE1520

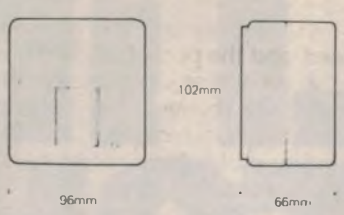
GRAB ONE NOW — $149.00

HEAVY EQUIPMENT HANDLES

No, they are NOT toilet roll holders! They are UK-made quality "REAN" brand speaker cabinet/equipment cabinet handles — as used in the famous "Marshall" PA gear.
They flush-fit with the side of the cabinet and use minimal internal space.
Cat. HS8010 $7.95

Quality at low prices!

IR 20 Passive Infra-Red Detector



A truly extraordinary device. The passive IR detector is the classic adaption of military hardware for commercial use. This device is basically a box measuring 96(W) x 102(H) x 66(D)mm. On the front face is a "window" with a deep red IR filter across it. Directly behind the window is a high gain IR "antenna" or "lens" (choose which word you prefer). At the focal point of the antenna is a super-duper IR photodiode.
The heat radiated from a human body can be detected up to 20 metres away! The unit will operate reliably over a very wide temperature range and is not nearly as subject to the annoying "false triggering" found so often in microwave or ultrasonic surveillance systems. The microchip electronics in the unit ensures further reliable operation with a "memory latch" system. A LED on the panel indicates that the unit has been triggered.
Cat. LA5010

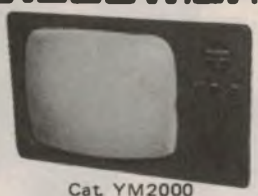
Specification

Range	20 metres/90° field of view using 9 short range and 9 long range zones
Size	96mm x 102mm x 66mm
Sensor	Dual element pyro-electric detector
Temperature Range	10°C to 40°C
Alarm Memory	LED alarm stored in armed state displayed in disarm state
Track Test	LED operates in disarm state
Relay Output	SPCO 1A/30V
Current Consumption	25mA typical at 12v DC
Supply Voltage	12v DC (10-16v DC)
Weight	200g

ONLY $149.50

Will directly interface with 90% of existing alarm systems. . .

video monitor



Screen — 12"
Display area — 80 characters by 24 lines
Input — RCA
Bandwidth — 10Hz-20MHz
Input sig. 0.5 to 2.0 pp composite, sinc neg.
240V AC & 12V DC
Weight 8.6 kg

Cat. YM2000

$199

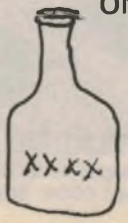
green screen

MICON DATA CASSETTE
Cat. YD1950 ONLY $49.50

ALCOHOL BREATH CHECKER

Ref: EA May 1983
Don't get caught by the random breath units. Use this handy checker to determine your relative degree of inebriation. Complete kit all parts supplied. Cat. KA1522

ONLY $29.95



Sub-Woofer Sensation

Ref: EA July/Aug '82
Special system price for JUNE ONLY!
Buy the complete system and save a fortune!

Subwoofer Speaker
Normally $79.00 THIS MONTH $69.00
Subwoofer Amplifier Module
Normally $79.00 THIS MONTH $69.00
PF4361/1 Transformer
THIS MONTH $39.50
Cabinet (Pre-cut Kit)
Normally $79.00 THIS MONTH $69.00
SAVE $30.00

The Cabinet can be purchased SEPARATELY for $69.00 — But not the others
(Note that we no longer supply the metal cabinet for the subwoofer amp. A suitable equivalent cabinet is available for $47.50 Cat. HB5412)

Cat. AS3250

SAVE

Cat. KA1454

(Transformer) Cat. MM2015

Cat. KA1452

BBD EFFECTS BOX Ref: EA June 1983

Fantastic low-cost instrument using the versatile MN3001 Bucket-Brigade Delay line to achieve brilliant sonic effects.
Now you can emulate the commercial rock groups with Phasing, Flanging, Reverb and Echo. The Jaycar kit includes all components INCLUDING IC sockets and the TU-04 box. (Not cut down but this is easily done).
Jaycar has a specially built cabinet for this kit with all holes pre-punched etc., at only $10 extra but only if you buy the original kit from us. Available as a separate item for $29.50.
COMPLETE KIT Cat. KE1522 $79.00
Special cabinet to suit Cat. HB6445 $10

YOU CAN NOW PURCHASE ITEMS FROM JAYCAR THROUGH

ALL REPAYMENTS INCLUDE INSURANCE HFC

Customers must satisfy the requirements of HFC to purchase. All repayments are monthly

Micrograsp Robot Kit
$12.01 per week over 12 months
Series 5000 Power Amp
$7.39 per week over 12 months
Series 5000 Pre-amp
$6.93 per week over 12 months

JAYCAR

SEE THE OTHER JAYCAR ADS IN THIS MAGAZINE FOR OUR STORE ADDRESSES AND PHONE NUMBERS. . . .

MULTIRAIL SWITCHING POWER SUPPLIES

More choice, more performance, more efficiency, more back up and support — at a truly competitive price.

- ☐ Single, three & four rail outputs
- ☐ 240V/120V AC input
- ☐ 3.5kV isolation
- ☐ 50KHz switching
- ☐ Standard models
- ☐ Custom design available
- ☐ Output overvoltage shutdown
- ☐ Australian design & manufacture
- ☐ 5 year guarantee
- ☐ Short circuit protected
- ☐ Full local technical back up & service
- ☐ DCLO signal
- ☐ Convenient plug in connectors
- ☐ High efficiency
- ☐ Fan output
- ☐ Compact, rugged, reliable

For complete data, call Scientific Electronics or the distributor in your state.

Scientific Electronics The Power Supply Specialists.

Scientific Electronics
6 Holloway Drive, Bayswater,
Victoria, 3153
Tel. (03) 762 5777 Telex AA 36308

MADE IN AUSTRALIA

Distributors: N.S.W., Electronic Developments 438 2500.
S.A., Graphic Electronic Industries 42 6655. **W.A.,** W.J. Moncrieff Pty. Ltd., 325 5722.

Heart Pacemakers: Australian success-story

and a high manufacturing cost – it has others which make it ideal in the pacemaker role. It has a very high energy density, a long shelf life (typically less than 5% loss in 10 years), optimum performance at 37°C, and a slow decline in voltage at the end of its life. The latter point is important because it provides ample warning before total failure.

Typical batteries have capacity ratings of 2.5AH and 3AH, the 2.5AH model being about 7.5mm thick and in the shape of a 27mm radius semi-circle. In one of the latest design pacemakers, drawing 20μA when pacing, it has a projected life of 11 years at 100% pacing. Where it functions only intermittently, it has been suggested that it could last as long as 25 years. (This pacemaker draws only 5μA when inhibited.)

Telectronics was not the first manufacturer to use the lithium iodine battery, but was well to the fore in investigating its possibilities. As a result, in 1974, they introduced the Series 12 pulse generators, incorporating the Wilson Greatbatch WG702 lithium iodine battery. A new case was designed, rectangular in shape, with rounded sides and bottom, and 16mm thick.

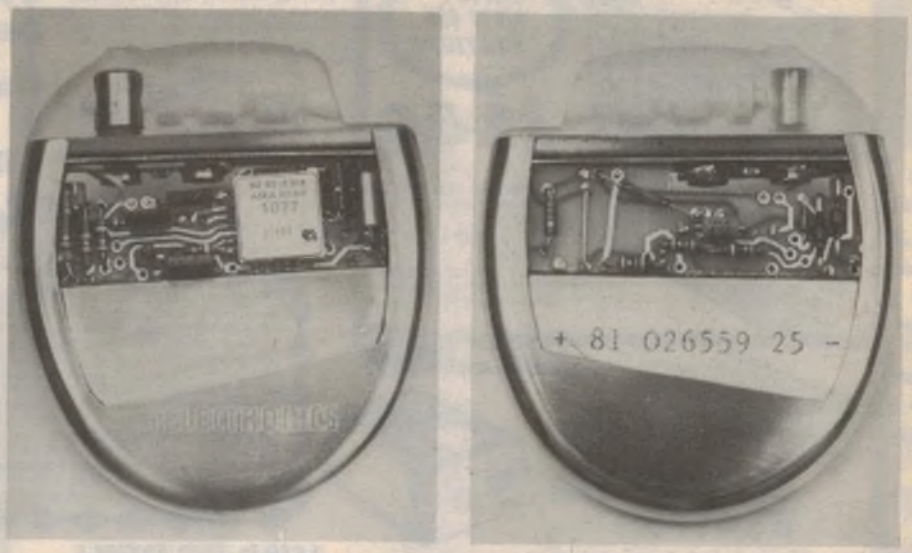
It was deep drawn from a flat sheet of titanium – a very complex process involving some 14 separate drawing operations. The basic shape proved very effective and was used for subsequent series 13, 14, and 15, up to 1977, but with the height trimmed to provide a variety of sizes to suit a range of models.

A later version, the slimline series introduced in 1977, retained the same basic shape but reduced to 11mm thick. This continues to be used for a wide range of models but a new and even smaller case design has since been added. This is only 9mm thick, 51mm wide, and with the silicone rubber top added, makes a package 56mm high; smaller than an old-fashioned pocket watch.

Its method of construction is also new, and avoids the problems of deep drawing. It is made from two shallow (about 4.5mm) elliptical dishes which are welded together, then sliced off at one end. It is used for one of Telectronics latest and most popular models; the Optima-MP.

In fact, the Optima-MP, while not the most elaborate of the Telectronics range, is an excellent example of the modern pacemaker and the electronic advances which have been made since the introduction of the integrated circuit and the titanium case.

Following the "demand" concept, mentioned earlier, other limitations were investigated and overcome. Broadly speaking the problem was that of an implanted device with a set of fixed parameters which may not necessarily remain optimum.



Interior of an Optima-MP. The square component in the left picture is the special IC, and the reed switch (angled) is in the right picture. The battery fills the lower half of the case.

External programming

What was needed was a device which could be re-programmed, after implantation, without recourse to surgery. The result is the modern programmable pacemaker in which a whole range of operating parameters can be changed, and set up in any combination, by means of an external program unit.

The heart of the Optima-MP model is an elaborate IC, designed by Telectronics engineers and manufactured by another Australian company specialising in high technology products; Amalgamated Wireless Microelectronics of the Sydney suburb of North Ryde. It is designed to be programmed by means of a coded sequence of pulses, generated externally.

The pulses are magnetic, generated by a large and powerful electromagnet in an external programmer. They are sensed in the pacemaker by means of a tiny reed switch, the glass of which is a mere 6mm long and about 1mm diameter. As well as the electromagnet, the programmer contains all encoding circuitry, switches, indicators, etc to enable it to program the pacemaker in any combination of parameters. In use, it is simply placed over the implantation site.

In the case of the Optima-MP the basic pulse rate may be varied from 30ppm (pulses per minute) to 150ppm in steps of 5ppm over most of the range and 10ppm at the extremes. The pulse amplitude and width may also be varied; through the range 2.5, 5, and 10 volts and 0.25, 0.5, 0.75, 1.0ms. In combination these provide 12 values of pulse energy.

The sensititvity of the pacemaker to the heart's own pulses, for "demand" operation, is also variable over the range 1.3, 1.7, 2.3 and 2.9mV. In addition, there are two other variable parameters; the refractory period and the hysteresis, which need a little more explanation.

The refractory period is that period after the delivery of a pulse, but before the pacemaker begins to monitor for the next natural heart pulse. It is provided to guard against spurious voltages which may exist after a pulse and which might otherwise cause false triggering. Values available are 250, 312, and 437ms.

The refractory function is also used to guard against external electrical interference, should it penetrate the filters provided, An interference pulse detected after the refractory period can cause another refractory period to be initiated or, if the interference is severe, the system will switch to a fixed pacing mode.

Hysteresis is best explained by an example. Assume that the pacemaker is set to provide a minimum rate of 70ppm, even though the heart may be functioning naturally above this rate for most of the time. If then the heart rate drops naturally to around 70ppm, as when the patient goes to sleep, the pacemaker may try to take over, causing the "pacemaker syndrome" already described.

The hysteresis function is designed to allow the natural heart rate to drop substantially below the selected minimum rate before the pacemaker

NEW ZEALAND

THE COMMUNICATOR VHF RADIO

SUITS NEW FM STATIONS

OVER 6,000 SOLD

NZ $149 P&P $5.50

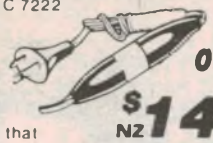
Cat D 2833

Now you can listen to stations that are not intended for general listening!

FEATURES:
- Listen to AM/FM/U.S. CB/Aircraft Marine, etc
- Unique battery/tuning meter
- Mains or battery operation
- Carry strap & telescopic antenna

TAPE HEAD DEMAGNETISER

If your tapes sound fuzzy it could be magnetism on your tape recorder heads. This unit removes magnetism so you can get the best from your recorder. Cat C 7222



ONLY NZ $14.95 P&P $2.00

NEW ZEALAND'S LOWEST PRICED HOME COMPUTER

that's the amazing

DICK SMITH WIZZARD

FULL COLOUR AND SOUND!

NZ $495 Cat No. X 1600 P&P $5.50

The secret of the Dick Smith WIZZARD is its plug-in BASIC computer cartridge which provides all of the powerful programming facilities of a personal computer. It has a deluxe 'QWERTY' keyboard with high tactile response keys. The whole keyboard is easily removed for service (if ever required!) and there's provision for joysticks to be plugged in. The only comparable computer system available anywhere in the world costs over $200 more than the Dick Smith WIZZARD. It's ready to use - including the deluxe keyboard and cartridge.

FREE! A superb computing manual 'DICK SMITH'S FUN WAY INTO COMPUTING' - written especially for the Wizzard. You won't believe how easy it is to understand computing. Cat B 6195 NORMALLY VALUED AT $9.95. (offer to purchasers of wizzard only)

CASSETTE STORAGE MODULE - you can save your programs on ordinary audio cassettes. Cat X 1607 - only $129.00 P&P $5.50. - includes Demonstration Tape.

'FIRST BOOK OF WIZZARD PROGRAMS' - 18 new and exciting programs to try out on your Wizzard. Cat B 6196 - $9.95 P&P $1.00. **GREAT SAVE!** If you purchase X 1600, X 1607 and B 6195 P&P will only be $5.50 for all three items.

PROFESSIONAL SOLDERING STATION - HOBBYIST'S PRICE!

The Exclusive DICK SMITH

SOLDERING STATION

Compare our soldering station with others. Ours features variable temp. control (200-500 Celsius) with temp. meter. And its fully approved by the Energy Authority. Comes with iron, holder, sponge & manual.

ACCESSORIES Cat T-2000

Replacement Tips:

Medium Chisel	T-2002	NZ $5.95 EACH
Thick Chisel	T-2004	
Fine Conical	T-2006	

P&P $1.00

Replacement Sponge T-2010 NZ $1.90 P&P $4.00

NZ $99

MINI PC DRILL

The mini PC drill is directly imported by Dick Smith Electronics. Although the drill is very small in size, the output is excellent for PC board work. It is completely self contained and runs off 4 'AA' cells. The drill is extremely easy to use as the on/off switch is in a very convenient position. Because there are no trailing wires it makes work on PC boards, jewellery, model making, craft work, etc very easy indeed.

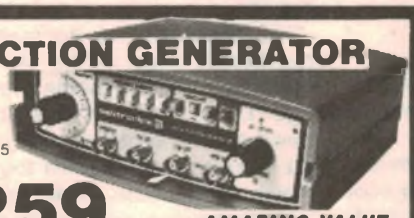
NZ $29.95 P&P $3.00

Cat T 4750

STAND to suit:

NZ $19.75 P&P $2.00 Cat T 4752

FUNCTION GENERATOR



Cat Q 1225

NZ $259 P&P $5.50 AMAZING VALUE

Get the accuracy & performance you can rely on every time with this low low cost Function Generator.

FEATURES: wide 1Hz to 200 kHz frequency range ● Sine, square, triangle and separate TTL square wave output ● Continuously variable output to 10V P-P ● Frequency sweepable over 100:1 range ● Short circuit proof outputs ● Graduated frequency dial with fine adjustment control.

LCD MULTIMETER with Capacitance Check

Yes! It not only features the normal ranges found on a digital multimeter, it also has five ranges of capacitance checking, two ranges of conductance AND a diode check position! All this in a very accurate (less than 0.25% on DCV) and high impedance (10Mohm) instrument that is good enough for the designer's test bench, but has a price low enough for the hobbyist.

All this, plus overload protection, automatic polarity, 2.5mm LCD digits - and measurement to 10A AC & DC!

Complete with Test Leads, carry case and full instruction manual.

NZ $149.95 P&P $5.50

(NEW MODEL)

Cat Q 1460

LOW COST SOLDERING IRON

DON'T PAY $25.00

Quality 'Antex' brand. This general purpose soldering iron can be plugged into the 240V AC mains and will give 25 watts of heat very quickly. It has a stainless steel barrel and comes with a copper tip. Complete and ready to use with cord and three pin mains plug ready attached. Cat T 1300

TIP TO SUIT T 1301 NZ $3.60

NZ $19.95 P&P $2.00

(EXCLUSIVE TO D.S.E.)

NEGATIVE ION GENERATOR

Get the benefits of negative ions. World-wide research has proven they're of benefit to sufferers of a huge range of illnesses! This deluxe ion generator plugs into power point and uses virtually NO power. Amazing value.

Cat Y 9000 P&P $4.00

'NZ MADE PRODUCT' NZ $99

REMOTE CONTROL 4Ch DIGITAL PROPORTIONAL

Cat Y 1240

Great for model cars, boats, planes, Daleks, etc. Four channel digital proportional type complete with servos.

NZ $279 P&P $5.50

XENON TIMING LIGHT

NZ $29.95

NEW MODEL

Do it yourself Xenon timing light lets you cut down on fuel & maintenance costs. Full instructions supplied.

Cat A 8508 P&P $3.00 Cat A 8508

FREQUENCY COUNTER

VALUE AT

Cat Q 1300

NZ $259 P&P $5.50

This American developed - 9 digit 600MHz Frequency Counter is a top quality instrument with more features and better accuracy than any other comparable unit and it costs far less! FEATURES: ● 9 digit resolution for more precise readings ● Excellent 30mV sensitivity up to 600MHz ● 3 switch selectable gate times ● 10MHz crystal controlled time base for greater accuracy ● 2 separate inputs for added versatility ● Front panel sensitivity control.

DICK SMITH Electronics

98 Carlton Gore Road,
Newmarket, Auckland 1
Telephone: 504 409

Bankcard welcome here

VISA

DSE/NZA495/JCP

SECRET

Limited quantities of EA & ETI magazines available from DSE up to 6 weeks sooner than news stands

MAIL ORDERS: Private Bag, Newmarket

SPEEDY MAIL ORDER SERVICE Just phone Auckland 504 409, ask for mail orders and quote either your Bankcard or Visa card No. Your order will receive immediate attention.

7 Day Satisfaction Guarantee

If you're not completely happy, you can return your purchase within 7 days in original condition & packing for a full refund! You owe nothing - not even an explanation. (SPECIALLY EXTENDED TO 14 DAYS FOR MAIL ORDERS)

NEW ZEALAND

Heart Pacemakers: Australian success-story

takes over. But when it does take over, it brings the rate back to 70. Four hysteresis values can be selected.

There is also a threshold measuring facility which, by means of a train of progressively smaller pulses, enables a doctor, using an ECG, to determine the minimum pulse level needed to reliably stimulate the heart. Other routine checks include battery condition, etc.

And all this in a package 56mm x 51mm x 9mm!

Memory included

There is another, more elaborate, version of the Optima-MP – the MPT model. This is fitted with an 8kHz telemetry link by means of which all the parameters previously programmed into it can be read out, on demand, via the programmer. It also has a memory in which is stored the number of times the pacemaker has been activated since last interrogated, also accessible via the telemetry link.

As we mentioned earlier, the Optima-MP is not the most elaborate Telectronics model, even though it is a good example. There are two other more elaborate units worth mentioning; the PASAR system and the Autima DDD, both aimed at specific heart problems.

The PASAR system is designed to correct certain types of tachycardia; a tendency for the heart to beat at an excessive rate. It functions by delivering an extra stimulus to the heart at a certain critical time after the heart's natural (but too rapid) pulse. Finding the critical period for each patient or condition is the problem. The PASAR system sweeps through a range of times until it finds one which restores a normal pulse rate. The range over which it sweeps can be programmed externally.

The Autima DDD is a dual chamber pacemaker; it has two electrodes, one each for two of the heart's four chambers, the right atrium and the right ventricle. While capable of functioning as conventional "demand" pacemaker, delivering pulses as required to the right ventricle, its main role is to overcome a specific condition whereby there is a loss of synchronism between the pulsing of these two chambers.

Normally, there is a delay of about 200ms between these two pulses, which ensures maxium pumping action, but failure of certain nerves can upset this synchronism. The Autima DDD can ensure that both chambers pulse at a desired rate and, in addition, that they remain properly synchronised. In fact a number of operating modes are possible, with a wide range of operating parameters, programmable externally.

Another view of the Optima-MP, again emphasising its small size.

Even more important than the facilities which a pacemaker provides is the reliability of each individual unit and, in many ways, it is a good deal harder to provide. Working out a particular design, complex though it may be, and proving it, is a one-off operation; ensuring that each unit which leaves the factory will last for its expected life is an on-going production responsibility where vigilance cannot be relaxed for a moment.

Quality control

Apart from such reliability as can be built in to a design, based on experience and sound engineering, the main responsibility is in the actual production process. At Telectronics it starts with the selection of a set of components for each unit. To take care of normal manufacturing tolerances a group of components is selected and assembled in a test jig, maintained at 37°C, to ensure that, as a group, they will fall within acceptable limits.

Once selected, the group is packaged in a plastic bag, given a number, and tagged with a record of the tests, including the name of the operator and the number of the test jig used. This record remains with the unit as it progresses through the various production processes until the completed unit is ready for packaging. The record is then filed so that a complete history of each unit is always available in the event of a query.

Extensive testing is carried out during production; virtually a complete test for each production stage. Where skilled work is involved, as in soldering components to a printed board, the operators are highly trained. No dip soldering is employed, each joint being made individually, and it takes about three months to train an operator – on dummy boards – to the standard of skill required.

As assembly nears completion it moves into, first, dust free rooms, then into clean rooms, and finally into sterilisation rooms. As packaged, they are sterilised and sealed, with sterilisation details included.

It is impossible to give a full picture of the tests and inspections involved, but the reliability statistics are most impressive. For all models the cumulative survival figures consistently run in excess of 99%; a typical figure being 99.88% after 30 months operation. The reliability figures are also many times greater, sometimes by as much as 10, than those set down by the Nuclear Pacemaker Program of the US Nuclear Regulatory Commission.

When it is considered that all the facilities described can be provided, with this order of reliability, in a package having, typically, a volume of about 20ml, the magnitude of the design task, the massive step forward in technology, and the skill and care of the work force involved becomes apparent. And all this has been achieved by an Australian company which, starting from almost nothing, is now a world-wide organisation.

As well as its factory and research laboratory in Sydney, Telectronics has a factory in Milwaukee, USA, and another in Chatellerault, France. Between them the three factories with associated subsidiaries, branches, and distributors, cover the Australasian and Pacific areas, the Americas, and Europe. In this regard 60% of Australian manufacture is exported. Almost all research and development is carried out in Australia, and Telectronics corporate headquarters is located in Sydney.

The Telectronics success story is an outstanding example of the fact that, in the realms of high technology, Australia can more than hold its own with the rest of the world, not only technologically, but economically as well.

FORUM

Conducted by Neville Williams

Wholesale, retail, sales tax and all that!

The draft of the Radiocommunications Bill, 1983, discussed last month, is not the only source of confusion for the electronics industry. It would appear that many readers are thoroughly puzzled about the prices quoted in advertisements in this and other magazines, and the presence or otherwise of that elusive component called sales tax.

I have described sales tax as "elusive" because, in some advertisements, the prices are quoted "Including sales tax", while others invite you to add "Add sales tax where applicable". A few advertisers mix both methods while still others don't even mention tax. Why?

Then again, on the assumption that the imposition of sales tax is indicative of a wholesale transaction, readers may be prompted to speculate whether certain advertisers are wholesalers or retailers.

If the former, how is it that they appear to be offering goods directly to consumers? If the latter, is it possible that the goods could be obtained more cheaply from a wholesaler? If not, why not?

I must confess to not having paid too much attention to such matters of late but, when I started asking questions around the industry, I found some strongly held views about the labels "wholesale" and "retail", about tax collection and advertising policies and some very bitter condemnation of the other fellow's way of doing things!

TAX FORMULA?

The Taxation Office also came in for its share of criticism, with some executives expressing the view that the sales tax formula no longer fitted the electronics industry, as at present constituted. It belonged to the past rather than the present, they said.

When I first entered the industry, in the '30s, the component vending business was quite tightly structured. In Sydney, I remember firms like Bloch & Gerber and Fox & McGillicuddy – names that are now but a memory – which were suppliers to "the trade". They bought parts in bulk from manufacturers and importers and sold them to the smaller set makers, servicemen and local retailers.

Many such suppliers, in those days, would not even serve you unless you had a company order for the required parts or, at the very least, were known personally to be "in the trade" by the man behind the counter.

Citizen Joe Blow, who needed a replacement valve or a couple of replacement capacitors, was supposed to buy them from his local retail radio shop or, failing that, from a more cooperative wholesale supplier – at full retail price!

Business rivalry notwithstanding, the system was supported by the industry at all levels, with fervent backing from the trade press. A wholesaler who stepped too obviously out of line could find the supply of components cut off.

The system provided the appropriate framework for the collection of sales tax. Wholesalers were charged with the responsibility of collecting the required percentage tax on the wholesale price – assumed to be the last in-trade transaction before the item was sold to the consumer. The tax was included in the retail price, of course, but the consumer was hopefully not supposed to notice it!

In the course of time, however, and particularly following the war, the rigid wholesale/retail system began to disintegrate, for a variety of reasons:

- Local radio shops found it more profitable to concentrate on radio receivers and appliances. They lost interest in spare parts and small components. That left the way open for larger, centralised suppliers, specialising in components and kits and providing both counter service and mail order.
- The appearance of specialist suppliers coincided with a rash of re-equipment and home-building by forces-trained enthusiasts, many of them doing radio service as a sideline. Traditional wholesalers tended to relax their once rigid rules to take in some of the action!
- As the parts and kitset suppliers expanded, they built up enough "clout" to bypass the wholesaler/middleman completely and buy directly from local manufacturers or importers. Some even set up their own direct import links.
- The banning of retail price maintenance in Australia, and limitations imposed overseas on exclusive distribution agreements dealt further body blows to the traditionally structured system.

The end result is that, in the electronics industry at least, the traditional wholesale/retail relationship has become fragmented, leading to some confusion in regard to the imposition and collection of sales tax.

MUST BE COLLECTED!

But, confusion or no, one thing is certain: sales tax has to be imposed, collected, documented and accounted for in a way that will satisfy the Tax Office. That means that there has to be an identifiable "wholesale" price, whatever the nature of the supply chain from source to consumer. In this context, companies may adopt quite different methods.

Some suppliers, it would appear, begin with the assumption that many of their stock lines are bought predominantly by people "in the trade". They see themselves as wholesalers in respect to such lines and therefore advertise them at a basic price plus tax.

The approach is justified on the basis that it more accurately represents the true position and is more convenient for "trade" customers – particularly those who are entitled to buy tax-exempt or are able to quote a tax number.

For some lines the advertiser may be an appointed distributor, in which case the role of a wholesaler and the collection of sales tax, where necessary, is an obligation anyway.

On some other lines, tax may already have been paid so that, effectively, they are being retailed tax-free. Hence the possible inconsistencies within the one advertisement.

Critics of this general approach claim that it can be misleading because readers notice the prices in bold type but not necessarily the endorsements "plus tax", etc. For the same reason, mistakes in ordering can readily occur, necessitating correspondence to clear up misunderstanding.

No less seriously, the method concentrates tax collection and docketing at the point of sale, making it even more labour intensive and costly. In effect, it becomes a tax, not only on the item itself, but on the cost of selling it!

DIFFERENT APPROACH

The alternative approach, adopted by several of the larger component suppliers is to have their own associated wholesale company, which does all the buying for the retail outlet(s), and supplies their needs in response to inter-company orders.

The wholesale operation is computer based, with records and accounting fully automated. When stock is drawn for issue to a retail outlet or branch, the computer initiates an invoice, etc, showing the catalog/item numbers and the wholesale price of each item based on buying price plus the appropriate overhead charge. The correct sales tax is added, and otherwise documented for separate audit – all automatically.

With sales tax thus accounted for in the most economical manner, over-the-counter or mail order sale can thus proceed with a minimum of further documentation – and handling cost. Supporters of the system claim that, by such methods, it is possible to "retail" components at a lower price than would be practical on a "wholesale" basis – this for a given level of company profitability.

As for customers who wish to purchase components from such a retailer on a tax-free or tax-number basis, the same obliging computer, I am told, can readily come up with the tax-exempt prices.

As to the merits or otherwise of the respective approaches – or variations therefrom – it is not for me to offer an opinion. I am merely observing that that's the way companies operate and therefore the reason why they do what they do in respect to sales tax collection.

If one can invoke that now much overworked term, the "bottom line" is probably the nett cost of the item(s) to you as an EA reader/consumer. It's of secondary importance whether the vendors are seen as wholesalers, retailers – or clearance houses for surplus stock!

To change tack somewhat, part of the motivation for this particular instalment of "Forum" was a letter to hand from A.McD of Salisbury, Qld.

He begins by referring me to an editorial by Les Bell in the Jan/Feb issue of the magazine "Your Computer". The opening paragraphs refer to sales tax and read as follow:

"Sales tax is already a point of some contention in the microcomputer industry. However the situation is not helped by the ignorance of some dealers as to how sales tax is calculated.

"A retailer should calculate sales tax at 20% (or whatever the going rate) on the wholesale price of the goods. If you are offered a software package at $100 plus 20% sales tax, either you are being charged too much tax, or the dealer is selling the package for the same price as he paid for it.

"It makes one wonder about the ability of some dealers to support what they sell when they can't even perform a simple sales tax calculation."

Motivated – and perhaps puzzled – by that reference, A.McD penned a letter to this column. Correction: he didn't pen it or even type it; he ran it off on a dot matrix printer! It begins thus:

Dear Sir,

Sales tax – its calculation and collection

I refer you to a copy of the editorial from the January/February issue of the computer magazine "Your Computer". Mr Bell has made a very brief mention of what appears to be the incorrect application of sales tax. I have taken an interest in the calculation of sales tax for a number of months now and have also obtained a booklet from the Taxation Department to try to better understand the theoretical application of the tax.

Basically, as I understand it, sales tax should be calculated on the last wholesale price at whatever the going rate is, and this amount can then be recovered from the end user (the purchaser) although this amount of tax theoretically is not disclosed in the price charged to the purchaser.

People pay sales tax assuming the amount of tax they pay is what the retailer has paid or will pay to the Taxation Department. The retailer is only seen to be a collection point of the tax for the government. However, this is not what appears to be the case in many instances.

At this point, A.McD looks at certain products advertised recently. I do not propose to disclose any details because there is speculation about malpractice and, in that context, some of the implications may be mistaken, unfair and possibly libellous. But A.McD makes the following points.

● Some advertisers show a tax-exempt price plus an amount of sales tax that has

"HEY"

When your in the market for a car you head for "Auto Alley"—
For you, the electronic enthusiast, tradesmen, hobbyist or just an electronic Nut, we've created "Silicon Alley" - better known as York Street. So no matter what you need in electronics, drop your soldering iron and come on in. (OOP'S switch it OFF first)

sinclair ZX81
HOME COMPUTER

Price Reduction June

SUDDENLY, HOME COMPUTING IS WITHIN THE REACH OF EVERYONE

ONLY $149.95

Includes Power Supply

YES, THE NEW SPECTRUM HAS ARRIVED

Sinclair Spectrum 16K	**$315.00**
Sinclair Spectrum 48K	**$450.00**
Sinclair Printer	**$175**

LOOKING -TO - BUY a multimeter. We recomend KAISE Digital Model 6221 @ **$79.00.**
We also stock other models:

	Trade	Tax incl
SK6330 Auto range - hold - Buzz - 10A AC/DC	$121.50	$138.51.
SK6440 Auto range - 24 Ranges - 10A AC/DC	$ 85.00	$ 96.90.
SK6400 Auto range - 20 Ranges - 0.8% Acc	$ 75.50	$ 86.07.
SK6221 Auto range - hold - Buzz - 10A AC/DC Econ.	$ 69.95	$ 79.00.

Plus of course all models of Fluke Hand held's including their latest 8060B at **$484.00** + Tax. Other instruments include Standard Escort, Anigawa, Trio, Hitachi, Aaron and Goodwill.

These are just a few of the many 100's of up - to - date Electronic items on display at:-

DAVID REID ELECTRONICS LIMITED
127 York Street, Sydney, 2000.
or Telephone (02) 29.6601

CONTROVERSIAL NEW HOBBY SWEEPS AUSTRALIA!

THOUSANDS ARE GLUED TO THEIR SCANNERS IN DEFIANCE OF THREATENED BANS . . .

Scanning is the fastest growing hobby in the world, and these units represent the 'state of the art' in scanning technology.

Just think – you can hear almost anything, from harbour control nudging a supertanker into its berth, to exciting conversations from cars speeding along city streets! All the emergency services, authorities and forces . . . and of course there are thousands of amateur and C.B. radio operators. Plus the thousands of stations on the band that we don't know about yet, (we're waiting for you to tell us about them!) You can surely see why so many people all over the world are being 'turned on' by this fascinating new hobby.

BEARCAT SCANNER 200FB

ONLY $349

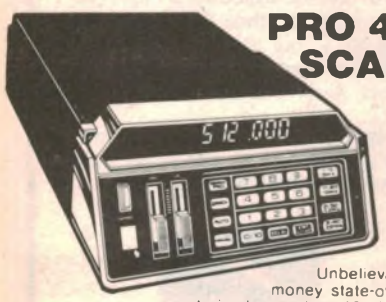
The economy scanner with deluxe features: Extended frequency range, 16 ch. memory, priority and lockout capabilities, delayed channel access . . . and so much more! Incredible value! **Cat D-2801**

ONLY ~~$285~~

BEARCAT 150

Amazing value – microprocessor control for under $300! Features 15 ch. memory, lockout and delay facilities, touch-sensitive keypad, etc. Ideal monitor for business, emergency services, news gatherers, and others. **Cat D-2800**

PRO 40 SCANNER



ONLY $399

Unbelievable value for money state-of-the-art computerised scanning: 40 ch. memory, all channels fitted, auto search mode, splashproof keyboard, full band search facilities, priority channels & channel delay built-in . . . plus, plus, plus! **Cat D-2805**

SCAN-X ANTENNA

Pick up extra stations! Ultra-wide bandwidth (65 - 520MHz) enables you to get the most from your scanner. Complete with mast clamps & 15 metres of cable. Can also stand alone on patio, roof, etc. A must for the serious scanner. **Cat D-4430**

ONLY $49.95

Stocks available end of June

DICK SMITH ELECTRONICS

See page 98 for full address details.

A501.CT

obviously been worked out on some lower figure. If one knows the rate of tax applicable to the article, it is a simple matter to determine the lower figure, thus arriving at the cost price to the vendor and the amount of mark-up.

● When an advertisement says "Add sales tax" (e.g. 20%) the purchaser (the end user) may naturally assume that he should add 20% to the advertised price. However, the amount of tax recovered from the purchaser may be much greater than that for which the vendor is actually liable, if the kind of mark-up referred to earlier applies across the board.

A.McD continues:

Perhaps I am missing the point. I don't think I am, and so consider the whole topic worthy of discussion in your "Forum" column.

If sales tax is being incorrectly calculated, applied and collected, who is getting the excess tax? Is it the retailer making another 20% profit on his cost price over and above his markup or is he collecting and paying excess sales tax to the government?

I look forward to your indepth informative comments in your column.

Perhaps "Electronics Australia" should instigate a policy requiring all advertisers to show prices to end users at the inclusive tax price as very few tax exempt purchasers would use Electronics Australia as their catalog. If a tax exemption is applicable, the purchaser could write to ask for the tax free price.

Commenting on this letter, in the light of what was said earlier, both Les Bell and A.McD refer to a "retailer" imposing sales tax. This is virtually a contradiction in terms, although understandable enough. In the course of discussion we even came across a surplus clearance dealer who, faced with a professional level purchaser, quotes a "wholesale" price and adds sales tax!

Basically it gets back to the uncertainty mentioned earlier: who, in this day and age, is a purely casual consumer, an in-the-trade buyer, a retailer or a wholesaler?

I followed up A.McD's observations without getting very far.

When I asked about the application of sales tax to the full point-of-sale price, I was told (a) that it was classified as a wholesale transaction to an in-the-trade consumer and (b) no tax had been paid previously and it therefore had to be collected then and there, anyway.

In the other situation, where the tax was obviously based on a lower figure, I was told that the supply chain for the particular items was such that they had had to pay it and this was therefore the amount that had to be recovered either from the purchaser or previous supplier. In respect to these items, it was virtually a retail sale.

You find it confusing? You're not the only one!

Nor is it easy to draw conclusions about whether various vendors are being diligent, dilatory, devious or dishonest. Maybe one could discover examples of each — but only if one had the authority to ask questions and demand answers. In the meantime, it is probably going too far to assume that vendors generally are manipulating the system illegally to their advantage.

One thing that did come through in conversation was a certain "respect" for the sales tax authorities. Vendors were well aware of the results of "overlooking" sales tax. They end up having to pay it themselves!

I guess that brings us back to the point we made earlier: for most customers, the "bottom line" is still the total amount you have to pay to vendor A or B or C for the items you want.

A ROLE FOR E.A.?

In his last paragraph, A.McD suggests that Electronics Australia should instigate a policy requiring all advertisers to show prices to end users at the inclusive tax price . His reason: "few tax exempt purchasers would use Electronics Australia as their catalog".

Unfortunately for A.McD's logic, that last premise is at variance with what many advertisers tell us. Time and again we hear of outstanding response from tax-exempt and in-trade buyers to advertisements in "Electronics Australia", unquestionably the most widely read electronics journal in the nation — trade or otherwise.

For many such advertisers, it would appear that wholesale transactions account for more than 60% of their revenue, thereby validating their posture as a wholesaler.

Other advertisers question the claim on the basis of their own trading — but this may simply be due to their own posture as a retailer. It's one of the things they argue about and one of the reasons for the emotion surrounding the issue!

As far as this magazine is concerned, we would be exceeding our rights if we tried to tell advertisers how to conduct their affairs or, for that matter, the Taxation Office either! Nor can we elect ourselves to the role of judge and jury in industry arguments. If companies quite openly structure their sales tax arrangements in particular ways, and the taxation authorities are content, it would be presumptious of us to intervene.

KALEX

● 3M SCOTCHCAL

METAL LABEL
☆ Red ☆ Black ☆ Blue on Aluminium
☆ Black on Gold

PLASTIC LABEL
☆ Red ☆ Green ☆ Black
☆ Blue on Transparent
☆ Red ☆ Black ☆ Blue
☆ Green on White
☆ Black on Yellow

REVERSAL FILM
☆ Negative Material
☆ Laminating Film

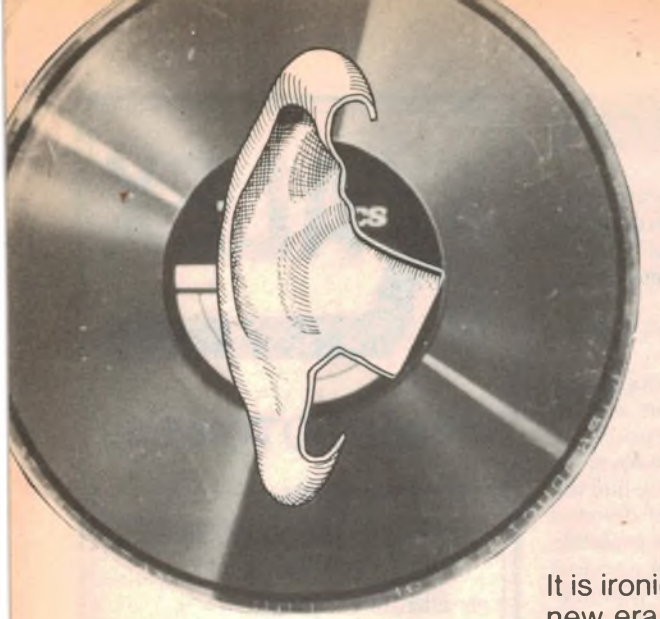
● 3M INT
Now available in Black, White, Red, Blue, Green, Yellow

● RISTON 3000
Sensitised PCB

● KALEX
UV Light Box
Etch Tank

KALEX

101 Burgundy St, Heidelberg 3084
(03) 458 2976 Telex AA 37678
MELTON (03) 743 1011.



An exasperating human problem . . .

HIFI SOUND . . . BUT LOFI EARS

It is ironic that, at the very time when we are most excited about a new era of high quality sound in the home, we are putting at risk the very organs we need to hear that sound. So look after your ears; they're the only ones you'll ever have!

by Neville Williams

It has taken about 100 years to progress from the primitive phonograph of Thomas A. Edison to the cause of all the present excitement: the laser-read compact disc.

But for all of that time — and longer — we have been working on the gradual destruction of our ears. Years ago, we blasted them with noisy machinery, pneumatic drills and rivet guns. Now we have more fashionable methods.

As if it isn't enough to have ears grow old and sluggish with age, we hasten the process with rock bands and hifi headphones — both capable of creating a sound pressure level, where it matters, of 120dB or more.

And, if ears have grown old and sluggish, whether naturally or prematurely, of what possible interest are those tiny whisps of sound, now exposed by the elimination of recording noise? Both may lie below the threshold of hearing!

And what of the rich overtones on the strings and the oboe? Overtones? What overtones?

NO INSTANT CURES

What makes it worse is that ears are not like eyes. One can suffer with hypermetropia (long sight), myopia (short sight), presbyopia (loss of lens flexibility) or astigmatism (misshapen lens) and yet retain virtually normal vision with the aid of contact lenses or spectacles.

But that very common effect — progressive loss of aural sensitivity — whether natural or aggravated, general or concentrated at the higher frequencies, is normally incurable and irreversible. Nor can it be compensated by artificial aids, at least not to hifi listening standards.

The inherent limitations of diminished hearing and of practical electronic aids make it impossible to recover the frequency response, dynamic range, distortion levels and directional perception of normal hearing. Artificial aids may restore communication but that's about all.

If and when implants are devised to bypass the faulty functions, the position may be more hopeful but, in the meantime, guard the hearing you have as well as you can for as long as you can!

Fig. 1, reproduced from our one-time "HiFi Stereo Annual", illustrates the physical structure of a human ear. It comprises three distinct sections; the outer ear, the middle ear and the inner ear.

The outer ear comprises three main components, of which the most obvious is the outer appendage, known as the auricle or pinna. Apart from its usefulness in supporting spectacles, the auricle or pinna modifies sound wavefronts entering the second component of the outer ear, the ear canal. The brain can ultimately interpret the modified wavefronts as supplementary clues to the source of individual sounds.

The ear canal is a fleshy tube which attains dimensions giving it a broad resonance effect which more than doubles the subjective intensity of sounds in the region 2000 to 5500Hz — the frequency range which we hear best.

At the inner end of the ear canal is a tough, flexible membrane called the eardrum, which seals off the outer ear from the middle ear. The eardrum vibrates in sympathy with the incident sound pressure waves and transfers

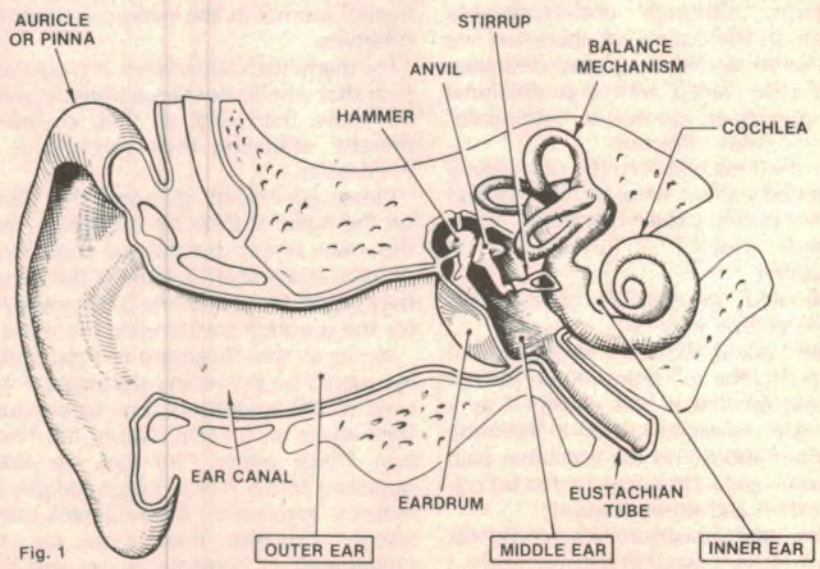


FIG. 1: Illustrating the structure of the human ear. While part of a remarkable sense, it is nevertheless vulnerable to age, infection and physical damage.

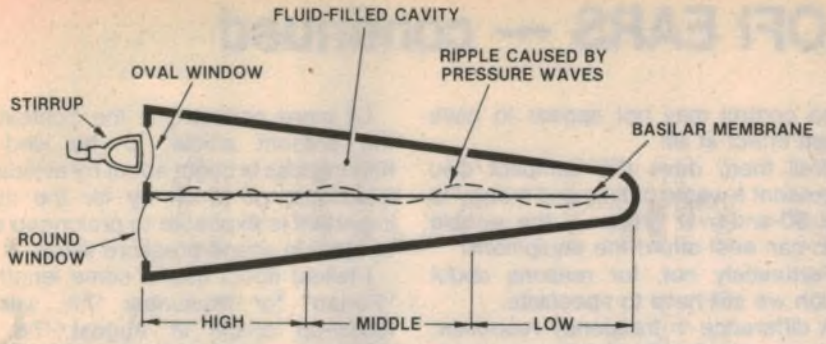


Fig. 2

Fed with sonic impulses via the "stirrup", the cochlea is nature's counterpart of the microphone, transforming physical vibration into electro-chemical nerve impulses. Loss of aural acuity usually occurs first at the higher frequencies.

the vibrations to the smallest bones in the body. The three bones, the hammer, anvil and stirrup, pass the vibrations on to the inner ear, an organ which has to do with both hearing and our sense of body balance.

As the ultimate destination of the sonic energy, the cochlea is nature's own microphone transuducer, turning sonic information into nerve impulses. A tapered, convoluted fluid-filled tube (Figs. 1 and 2) it is divided along its length into two compartments by the basilar membrane.

Sonic impulses are transferred from the stirrup (or stapes) to a small, bony oval-shaped piston at the large end of the Cochlea — the "oval window". The impulses travel through the liquid in one compartment to the small end of the cochlea, then pass through a small aperture and back along the second compartment to the larger end. Here they encounter the so-called "round window", which reflects the sonic energy back the way it came, much as an object will reflect wave energy in water.

"ELECTRICAL" SENSORS

The interaction of the initial and reflected sonic wavefronts sets up "standing wave" effects in the cochlea liquid, causing physical ripples in the central basilar membrane. These ripples trigger responses from an array of something like 24,000 nerve ends distributed along and within the cochlea. In its own mysterious way, the human brain is able to translate the resulting electrical nerve signals — digital rather than analog in character — into separately identifiable signals, each with its own pitch, intensity and phase.

It is, in fact, easy to become quite carried away when extolling the virtues of human ears in prime condition. To quote from our "HiFi Stereo Annual".

"Are our ears so discriminating that we need hundreds of dollars worth of audio equipment to provide the same listening satisfaction as when hearing the real thing?

"The answer to that is an emphatic yes! The human hearing apparatus — the ear, auditory nerves and hearing centres in the brain — make up one of the most discriminating mechanisms in the world of nature.

"Our ears are capable of hearing a tremendous range of frequencies and amplitudes of sound without damage.

"Many people can detect changes in pitch of only one part in 1000, and even an untrained ear can tell the difference when the same note on the musical scale is played on two different kinds of instrument.

"We can hear a mosquito buzzing outside the window screen and the next instant listen to a jet aircraft roar overhead. The difference in intensity of those two sounds is a ratio of about 1 to 10,000,000,000.

"The human ear is capable of hearing sounds within a frequency range of about 20Hz to 20,000Hz" . . . and so on.

Another writer draws attention to the "automatic volume control" mechanisms in the human ear, accounting for its ability to cope with the enormous dynamic range mentioned above, hopefully without suffering permanent damage.

A sudden loud bang, he explains, causes a reflex action in two tiny muscles located in the inner ear. One — the tensor tympani — contracts and stiffens the eardrum, so that it cannot vibrate as freely as it would otherwise do. The other — the stapedius muscle — immobilises the stirrup-shaped stapes, preventing it from delivering excessive input to the inner ear.

Much has been written, too, about the ability of the human auditory system to concentrate on one particular sound source in a noisy environment: on one speaker in a restaurant; one instrument in a group. Indeed, there are occasions when the auditory system may reject all sound turning it into a sonic blur that does not disturb concentration; or something even more remote that does not disturb sleep.

And there's the matter of audio signal phase — the subject of much discussion and argument in recent years. Human hearing is amazingly sensitive to phase, runs the argument, and much of that indefinable satisfaction which is either apparent or not apparent in hifi sound reproduction is traceable to phase discrepancies in the system. So we've had a spate of linear phase loudspeakers and, now, linear phase phono cartridges.

THERE ARE PROBLEMS . . .

Such a recital of the magic of human hearing is likely to induce a warm glow in the reader: "they're talking about me and my ears!" But, unfortunately, that may not be the case, for at least two major reasons:

- If the blush of youth in your cheeks has given way to the mantle of maturity, it is statistically a virtual certainty that the keen edge of your hearing has been perceptably blunted — purely as a function of age.

- If your ears have been subjected to protracted periods of very high level sound, whether in the context of entertainment or employment, there is a strong chance that they will exhibit losses additional to those due to ageing. This, irrespective of other possible physiological trauma.

In respect to ageing, a broad rule of thumb suggests that, if a young child is credited with the ability to hear sounds up to 20,000Hz, they will exhibit a loss of treble response at the rate of about 2000Hz per decade. On this basis, one can draw up a table correlating age with the upper limit of hearing. The assumption is that the aural response will be rolling off through the nominated frequency with a fairly pronounced cut-off beyond it. (See table.)

While these figures may appear to be rather disturbing to hifi conscious listeners, they are in no sense exaggerated. In his book "About Your Hearing", one of hifi's father figures — Gilbert Briggs of Wharfedale — published a set of curves derived by R.

AGE TAKES ITS TOLL!

AGE IN YEARS	UPPER LIMIT OF HEARING
10	18,000Hz
20	16,000Hz
30	14,000Hz
40	12,000Hz
50	10,000Hz
60	8,000Hz
70	6,000Hz
80	4,000Hz

HIFI SOUND BUT LOFI EARS — continued

Hinchcliff, Journal Acustica, 1959. The curves show hearing loss in dB over a range of frequencies from 250Hz to 12,0000Hz for subjects 20 to 70 years of age.

It is noted in the caption that the curves are based on "a random sample population of clinically normal female ears which have not been exposed to the sort of noise levels that are common in industry". It is noted further that female subjects retained a generally better high frequency response than male subjects. Broadly similar information is quoted by a writer in "Audio" magazine (December '82, page 44) from the "Handbook of Noise Measurement".

FAMILIAR FORMAT

Purely to present this information in a more readily recognisable form, we had our draftsman rearrange it into the usual frequency response format. The curves ignore the expectedly superior hearing of children and take, as reference, clinically normal 20-year-old female ears. The derived curves involve a certain amount of freehand extrapolation but they can still be taken as being well "in the ballpark" for typical age/hearing loss relationship.

Two points are obvious from these curves: one is a ready explanation of why ageing grandparents may frequently find it necessary to "beg your pardon". To them, speech is quite muffled.

The other is that, beyond about age 50, your amplifier system is beginning to sound much as it would to a young person, with the tone control turned to minimum treble. To a 70-year-old, the tone control may not appear to have much effect at all!

Well then, does the compact disc represent a waste of time and money to the 50-and-over group — the people who can best afford the equipment?

Fortunately not, for reasons about which we still have to speculate.

A difference in frequency response, as such, may not be all that apparent to the 50-and-overs but the clean, hard transients can still be obvious by contrast to what they have been accustomed to.

And the reduction in harmonic distortion can certainly be evident as an uncanny clarity, which is missing if the compact disc has been remastered from a tape.

As for background noise, the difference may not be as obvious as to a younger person but a difference there can be over the low and middle register, where rumble and acoustic feedback betray the mechanical nature of the conventional phono system.

All is not lost, by any means!

HEARING PROBLEMS

But — and it is a very significant but — the foregoing figures and remarks apply to people with what has been described as "clinically normal" hearing. While this term has to be very broad in its interpretation, there can be little doubt that a significant number of Australians have clinically sub-normal hearing.

In some cases, the problem is congenital, in others traceable to trauma of one kind and another. Such problems should logically be referred to a specialist for whatever treatment may be available.

Of more concern, in the context of the present article, is the kind of hearing loss brought about by avoidable situations, of which by far the most important is exposure to prolonged and excessive sound pressure levels.

I talked about this at some length in "Forum" for November '77, with a follow-up article in August '78. In between, reader support and concern was virtually unanimous: readers, through ignorance, had indeed suffered hearing loss over the years; others were still being subjected, against their will, to objectionable — if not dangerous — sound pressure levels.

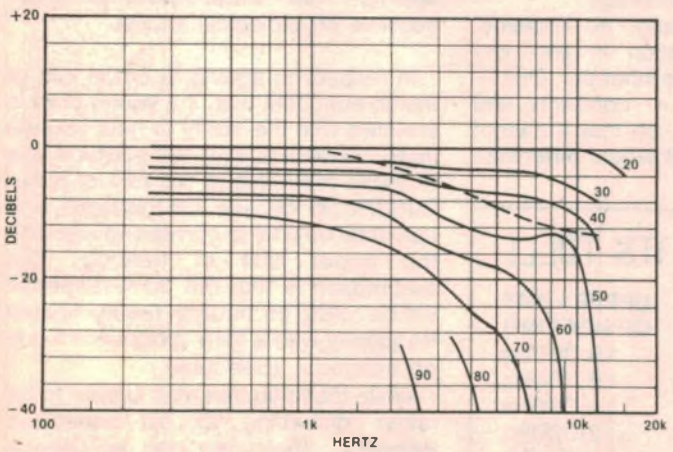
THE NOISE HAZARD

The accompanying noise level table, which quantifies what we are talking about, is reproduced from our August '78 issue.

Looking at this table, the reader may well ask: "What happened to the ear's automatic volume control function", mentioned earlier, and reputed to protect our hearing against exposure to loud noise?

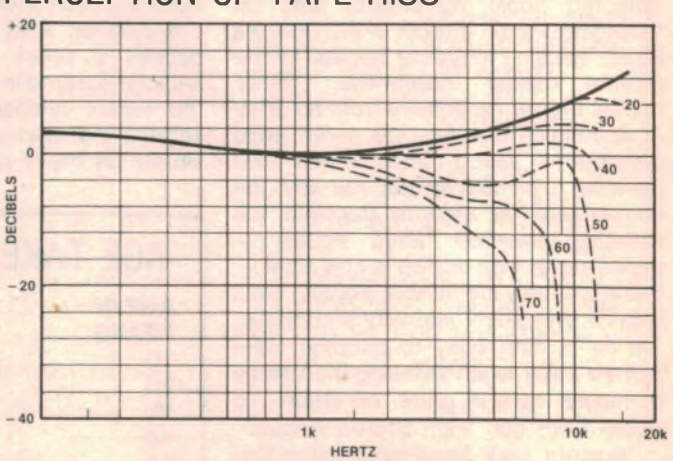
The explanation, it would appear, is that the spontaneous tensioning mechanism in the ear can cope with sound level variations within the "Safe" range and perhaps somewhat beyond it, and it can cope with very loud sounds, provided they are infrequent and of short duration. However, when faced with very loud, sustained sound, the muscles gradually let go, allowing the high level impulses to reach the cochlea. It is then that the damage occurs, with the hair-like nerve ends for the higher frequencies being particularly vulnerable.

FREQUENCY RESPONSE V. AGE



With "clinically normal" hearing of 20-year-old females referenced to 0dB, these curves give some idea of the gradual loss of hearing acuity with advancing age, the loss being particularly apparent at high frequencies.

PERCEPTION OF TAPE HISS



Taken from BASF literature, the heavy curve shows the noise energy distribution of a typical good quality compact cassette tape. High frequency loss with advancing years renders the hiss level progressively less obvious.

Once destroyed, they can never regenerate.

In practical terms, males were at one time more at risk than females, because of their likely exposure to factory noise for much of their adult life and their possible involvement in noisy activities at other times.

Nowadays, we seem to have learned some lessons in these areas, with noise abatement programs operating in factories and the more frequent wearing of earmuffs where high noise level cannot be avoided.

The trouble is that modern technology has now put powerful amplifier systems into everything from rock music venues to theatres, cars and private homes. And with them has come the cult belief that, for sound to turn you on, it has to be at deafening level. How else can it shut out every other stimulus? What's more, if you don't like it that way you must be a bit odd!

As if that's not enough, modern technology has provided us with personal cassette/radio players, and with miniature hifi stereo headphones which, if driven hard enough, can deliver sound pressure levels of 120dB or more — and that is also in the "Injurious" range.

So, if you really want to add further "decibels down" to the inevitable effects of ageing, it is not necessary to take up the trade of a boilermaker or a rivetter. Anyone can achieve the same result by spending a few hours a week at a disco, or playing super-loud music at home, or cultivating high frequency deafness in comparitive isolation with the aid of a powerful headphone stereo system.

What's more, the new deafen-yourself-with-music syndrome is appropriately non-sexist; male and female have equal access to the method. In fact, they often tend to do it in pairs!

Is that all?

No, not quite!

According to our medical correspondent, another effective way of turning down your biological tone control is to swim frequently and dive deeply in polluted water.("Is there any other kind, these days?" he asked!).

Entering the body through the mouth and nose, bacteria from polluted water can travel up the Eustachian tube and set up infection in the middle ear. Too many episodes like that can take their own special toll.

And that brings us right back to where we started:

If the blush of youth in your cheeks has given way to the mantle of maturity, you can still anticipate a pleasurable listening experience from compact discs — provided you've taken reasonable care of the two bits of audio equipment for which no replacements are available — your ears!

But, if you're fortunate enough to be still young, and look forward to the day when even the compact disc will be primitive and obsolete, spare a thought for those tiny nerve ends in your ear which dislike loud sound so much that rather than listen, they lie down quietly and die!

NOISE LEVEL TABLE

INJURIOUS RANGE:	
140dB	Jet engine at 25m
130dB	Rivet gun
	Pain threshold
120dB	Propeller airliner, 50m
DANGER ZONE:	
110dB	Pneumatic rock drill
100dB	Metalworking shop
90dB	Heavy transport truck
SAFE RANGE:	
80dB	Busy street
70dB	Private car
60dB	Ordinary conversation, 1m
50dB	Low conversation, 1m
40dB	Soft music
30dB	Whisper at 1m
20dB	Quiet dwelling
10dB	Rustling leaf
0dB	Threshold of hearing

MICRO PROFESSOR
unique technology

Learn Computing with the **MPF-I**

- Fully documented
- Fully expandable
- Four optional boards
- OEM as well as Education

A **Z80** based micro-computer with extensive (4) teaching manuals for as little as **$138** + ST

Personal Computing with the powerful **MPF-II**

- At home
- In the office
- In education
- For entertainment

Compact. dynamic design, 64K RAM, 16K ROM, Basic, Apple-soft compatible, Mixed text and graphics, six colours and more for only **$549** + ST

1983-84 EMONA Test/Measuring Instruments and Computer Products CATALOGUE!

Send 65c stamps

EMONA ENTERPRISES PTY LTD
Sales and Showroom
CBC Bank Bldg
661 George Street, SYDNEY 2000.
Tel: (02) 212 4815

UHF CB SUPERSTAR NEW

40 Channels in your hands!

The latest in technology of synthesised UHF hand-held transceivers is certainly this fantastic little EMTRON 470S.
If you require 40 ch and high power then the Emtron 470S is for you!

$475 tax inc

Features:

- ★ 40 channels
- ★ Synthesised
- ★ 0.3 or 3 watt output
- ★ Condenser mic
- ★ Nicad battery pack
- ★ No crystal

This unique 40 Channel UHF, CB high power hand-held Transceiver is ideal for long range communications under the worst conditions.

Send 65 cents stamps for our **1983**

ELECTRONICS & COMMUNICATIONS
CATALOGUE

emtronics
649 GEORGE ST, SYDNEY
PH: (02) 211 0531

Audio-video Electronics

HIFI • HOME VIDEO • PROFESSIONAL AUDIO

BASF: Audio/video tape seminar

In Australia for a working holiday, Ontje Arpe, Chief Engineer for Video Applications at BASF, Mannheim, Germany, talked with Australian technical journalists, recently, during a one-day seminar in Melbourne.

Hosted by BASF's Australia's General Manager (Consumer Products) Horst Hanfeld, the seminar was conducted along informal lines, followed by a wide-ranging question time. Providing the answers proved no problem to Ontje Arpe, who had been involved in video tape recording equipment, before joining BASF 10 years ago. He is currently an active member of both the DIN and IEC Standardisation Committees.

Mr Arpe made the interesting point that tape cassette manufacturers do not have the same freedom to innovate with VHS and Beta cassettes as they do with the compact audio cassette. While audio cassettes must obviously remain compatible with available decks, latitude has developed over the years, involving both the nature of the tape and mechanical details of the cassette itself. Hence the succession of "discoveries" and "improvements" which have featured in audio cassette advertising.

In the case of video cassettes, manufacturers are licenced by JVC and Sony, originators of the VHS and Beta systems. Under the terms of the licence, cassettes must adhere quite closely to system standards. These involve both the mechanical and electrical performance of the tape and the design and performance of the cassette bodies.

Thus, while BASF may use a chromium dioxide coating rather than a doped ferric formulation preferred by another company, both would be aiming to meet the same basic standards demanded for the respective systems. One tape may be better than the other in certain respects (and vice versa) but the differences between premium brands will be marginal rather than momentous.

Similarly, cassette bodies may vary somewhat in the tightness of manufacturing tolerances and in surface cosmetics but the basic structure does not vary.

What about those companies which are offering cassettes for both formats, apparently without being formally licenced to do so?

Mr Arpe agreed that this was cause for considerable concern by licencees such as BASF but that, in the ultimate, action really had to be initiated by the licensers. Perhaps neither wanted to be seen as over-anxious to jump on small, battling enterprises, particularly where national sensitivities were involved.

Questioned about specific aspects of tape performance, Mr Arpe made the following points:

DROPOUTS: Dropout count figures for video tape have to be treated with considerable caution because modern domestic VCRs include drop-out circuitry which renders most occurrences subjectively invisible. So, while the ideal is no electrical dropouts at all, the dropouts that really count are those which are actually apparent to the viewer.

HEAD WEAR: The small size and uniformity of BASF's chromium dioxide particles produces a coating which is notably smooth, rather than the reverse. In fact, the Beta system was designed on the assumption that chromium dioxide tape would be used. For commercial reasons, the VHS system was developed around high energy tape of another kind but, nowdays, both options are acceptable for both systems.

TAPE FADE: After repeated playings — say 100 or more — the colour image on video tape may tend to fade to some extent. This is due to gradual demagnetisation of the particles but the tape itself is unaffected. A new recording on the same cassette will be completely normal.

On a quite different subject, Mr Arpe was asked about the abrupt variations in the price of premium quality tapes in Australia, with 3-hour VHS cassettes being offered, on occasions, for less than $15.

Taking up this question, General

NOVEL CONFERENCE SYSTEM

A novel microphone discussion system has been released in Australia by R. H. Cunningham Pty Ltd. Called the Digimic Mini, it is a product of the International Congress Service. The system consists of central control unit, operator's console and the appropriate number of delegate deskstand units, each containing an electret microphone and a small loudspeaker. The microphones are controlled from the operator's console, while the loudspeaker in front of each delegate obviates the need for a central public address type loudspeaker system. The Digimic Mini can cope with up to 63 deskstands but larger systems are available. Details from R. H. Cunningham Pty Ltd Phone: Melbourne (03) 329 9633; Sydney (02) 909 2388.

HIGH TECHNOLOGY PERSONAL PORTABLE

Adding significantly to the art of personal stereo listening, TEAC's new "Partner" PC-7RX has auto reverse to play both sides of the cassette continuously, plus the option of dbx for high dynamic range and lowered tape noise. A slip-in AM-FM stereo tuner is available, plus mini loudspeakers and power unit to convert it into a real mini stereo system. (TEAC Aust Pty Ltd, 115 Whiteman St, South Melbourne 3205. Phone 03 699 6000.)

BASF — continued

Manager Horst Hanfeld suggested that there were various reasons, which included over-stocking, the need to turn goods urgently into capital, and package deals involving equipment and cassettes. BASF's present aim, in this rather erratic marketing environment, was to build up brand awareness so that customers would buy with an eye to quality rather than merely price.

On that note, BASF's P.R. Consultant, Graeme Kemlo added to the growing pile of video and audio cassettes on the table a handful of audio cassettes in a bright yellow wrap, plus cartons of 10 in a similar colour (pictured).

Designated as "LH Extra 1", the new cassette is to replace the present popular mass-market "LH/SM". It is described as a new high-output ferric tape with lower noise, improved high frequency response and increased dynamic range. It is being marketed in singles, 3-packs and cartons of 10, with playing times of both 60 and 90 minutes.

SANYO AUST PTY LTD have announced the release of a new mini AM/FM stereo radio/cassette player, complete with lightweight stereo headphones. Identified as the M-G30, it is finished in silver and grey, is only 3.7cm thick and weighs 400 grams, including batteries. It fits easily into a pocket or carry case with shoulder strap. The price is $99.95.

TO YOU...

This EA/Sennheiser

SPECIAL OFFER:

Sennheiser HD-40 stereo lightweight hifi headphones for $24.95

OUTSTANDING VALUE: One of Sennheiser's most popular lines, their HD-40 headphones are light in weight (a mere 60g) very comfortable to wear and with a rated response from 22 to 18000Hz. They are of "open-aire" design and take up little storage space. We have found them excellent for general hifi listening and late-night organ practice.

EASY TO GET: Clip or copy the coupon below and fill in all the details, particularly if the purchase price is to be charged to your credit card. Otherwise include your cheque or postal order. Mail to the address given below.

To EA/Sennheiser Offer
Electronics Australia, PO Box 163, Chippendale 2008

Please send me ..... pair(s) of Sennheiser HD-40 stereo headphones at $24.95 per pair (includes packing and postage).

NAME .....
(Please print)

ADDRESS .....

..... **POSTCODE** .....

☐ **I enclose cheque/postal order to the value of $** .....

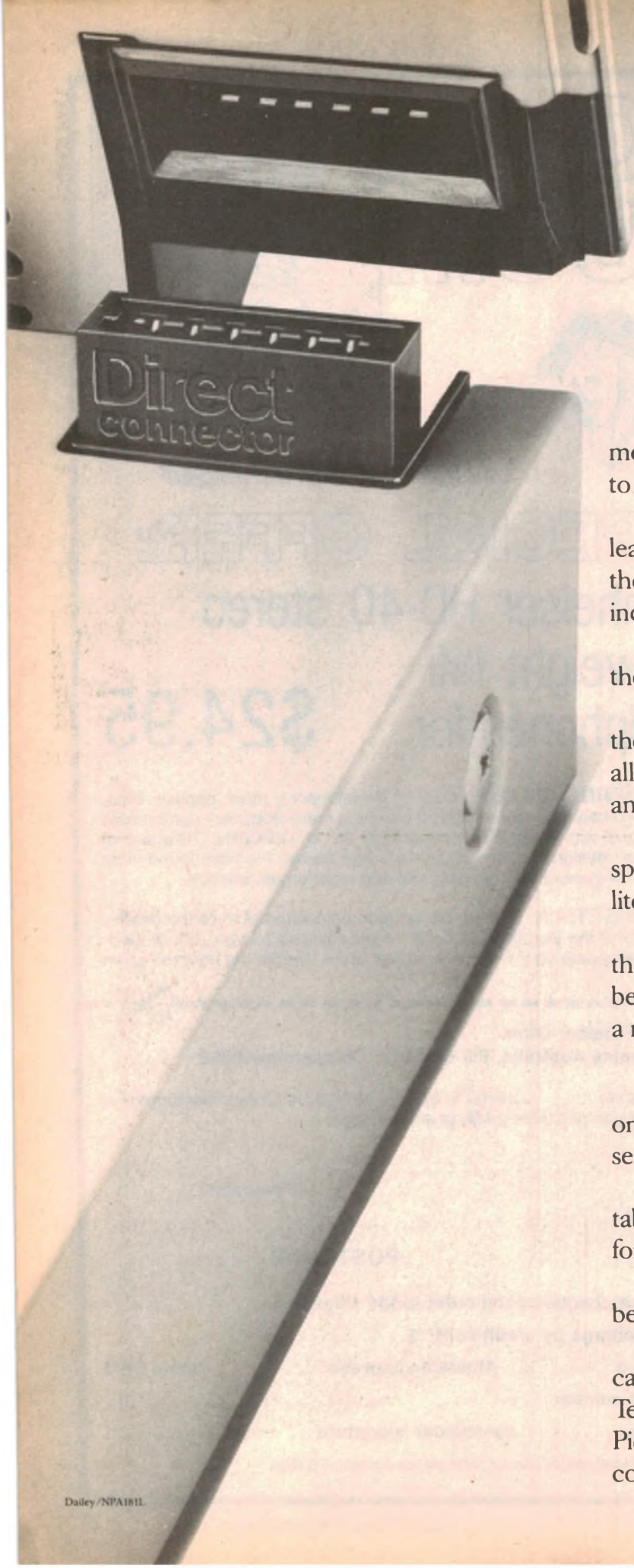
☐ **Please charge by credit card* $** .....

☐ **Bankcard** ☐ **American Express** ☐ **Diners Club**

Credit card number .....

Expiry date ..... **cardholder signature** .....

*If using a credit card, include your full name and address (not a PO Box)



Why Direct

Don't tangle with Technics.

The majority of audio systems – even the most beautifully designed – have something ugly to hide.

It's that mass of jumbled-up connecting leads that you find, all too easily, at the rear of the equipment. Not only are they ugly, they're inconvenient, too.

And as audio components become smaller, the problem becomes bigger and more unsightly.

To solve this problem, Technics developed their Direct Connector systems, which eliminate all audio connecting leads between the tuner, amplifier, graphic equalizer and cassette deck.

Each of these components features a special flip-up connector to allow them to be literally plugged in to each other!

It's an elegant piece of Technics technology that results in a stylish, neat installation that can be put together or taken down for re-location in a matter of seconds.

The 315 Series.

But Direct Connector capability is not the only innovative feature in this new and compact series from Technics.

The SL-5 direct-drive, linear-tracking turntable employs its own plug-in connector system for the pickup cartridge.

This unique Technics development has been adopted as a World Standard.

It means you can compare and evaluate cartridges from leading manufacturers like Audio Technica, Ortofon, Shure, Stanton, Empire, Pickering, ADC and, of course, Technics without conventional setting up procedures.

Dailey/NPA181L

Technics developed Connector systems.

No adjustment of tracking weight or bias correction is needed.

The innovations continue in the rest of the components: the SU-5 amplifier includes a Super Bass switch to enhance the bass response of a speaker system without inducing bass boom; the ST-5 quartz synthesizer digital tuner provides random access memory for 16 pre-set stations; the SH-E5 graphic equalizer – offers adjustment of 12 audio bands from 16Hz to 32Hz on each channel; whilst the RS-5 cassette deck – has soft touch controls, auto selection of metal, CrO_2 and normal tape settings plus convenient Cue and Review functions.

Finally, a pair of SB-F5 speakers with horn-type tweeters and bass reflex porting turn the high quality electrical signals of the rest of the system into the high quality sound you expect.

Compact components, full-size warranty.

All components in this series are perfectly matched in styling and performance.

And all are covered by a full 2-year warranty backed by Technics' reputation. Visit your Technics stockist soon and experience the superb styling and brilliant sound of Technics' compact Series 315 for yourself.

Technics 2 Two Year Warranty

Technics

National Panasonic (Australia) Pty Ltd

Expanding the music experience.

Dailes NPA181R

Hifi Review

Marantz SD 820 DBX cassette deck

This month we feature a cassette deck from Marantz that uses not just one but two microprocessors! — one for bias adjustment and one for tape transport control. Also included are three noise reduction systems, Dolby B, Dolby C and dbx to further whet the appetite. How did it measure up? — well read on and find out.

The SD 820 DBX cassette deck is one of the latest offerings from Marantz. It is a smart looking unit finished in a gold anodising and designed to fit into the medium price bracket.

The SD 820 DBX cassette deck has a combination of features not usually found on a cassette deck in its price range. These include Dolby B, Dolby C and dbx noise reduction systems plus two inbuilt microprocessors, one for recording bias and equalisation adjustment and one for tape transport control. In addition, an external timer may be connected to the rear of the cassette deck to enable it to either record or play back at a certain time.

A remote control unit is also available for the SD 820 and consists of a small palm sized box which connects to the SD 820 via a 5m lead. The remote control contains duplicates of the tape transport controls and operates in parallel with the normal front panel controls so that either may be used to control the cassette when the remote control is plugged in.

The front panel controls include cassette eject, timer and power on/off switches located to the left of the cassette transport housing. At the bottom centre of the front panel are the tape selector and noise reduction system push buttons. The right hand side of the front panel contains the tape transport controls, computer bias and mic/line selection pushbuttons. At the extreme right of the front panel are two vertically mounted slide controls which are used to adjust the record level.

In the upper centre of the front panel is a recessed area covered with clear plastic. This houses the peak-reading LED meters, a tape counter and several LED indicators which show the tape type and noise reduction system selected. The least significant two green LED segments on the left and right channel level meters serve as "power on" indicators and remain illuminated while ever there is power applied to the cassette deck.

LED Sequence

Each LED level meter contains 20 segments — 16 green and 4 red. The green segments cover the range −20 to 0dB while the red segments cover the range +1 to +6dB; the green segments are arranged to illuminate two at a time while the red segments illuminate one at a time.

Physical dimensions of the SD 820 are 416 x 300 x 100mm (W x D x H), while the mass is 5.6kg. Power consumption is 30W.

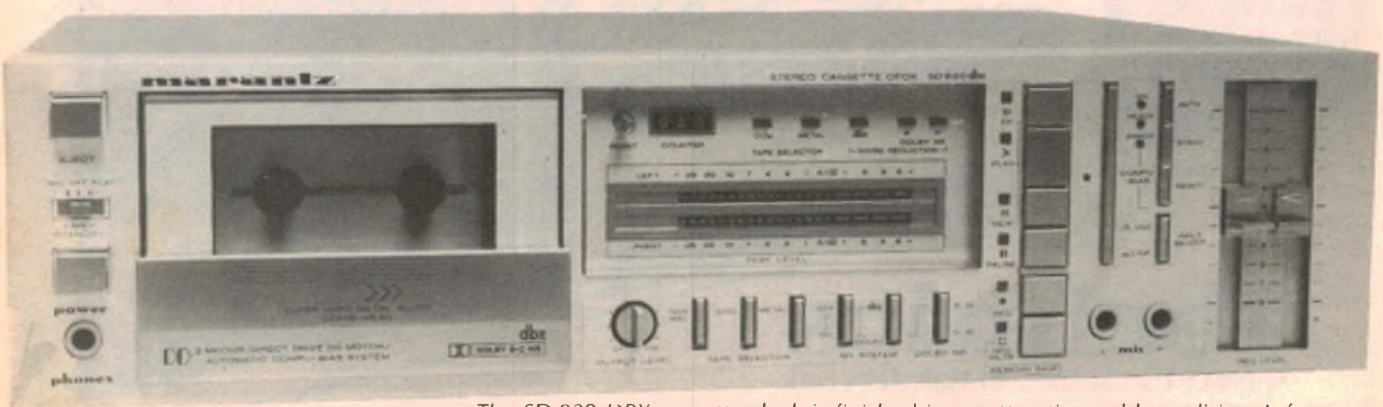
The front panel controls are sensibly located and easy to use although the lettering could do with an increase in contrast to make it a little more legible. This applies to the tape transport controls in particular since a delay in finding the correct one can result in overshooting the mark when recording or using fast forward or rewind.

The tape transport mechanism is controlled by a microprocessor and this allows several additional features to be included besides the basic transport functions such as play, rewind, etc. These additional features include automatic fast forward or rewind to any of 30 selections before or after the current selection, automatic replay of a single selection or the entire tape side, and a record mute button which places a four second blank onto the tape.

As mentioned earlier, the SD 820 is fitted with three noise reduction systems. Two of these, Dolby B and Dolby C, work by applying boost to low level, high frequency signals before they are recorded on tape. Upon playback, the high frequency signals are cut by the same amount as they were initially boosted, resulting in a decrease in tape hiss.

The improvement of Dolby B and Dolby C over no noise reduction system is shown in Fig. 1. As can be seen, low frequency noise is not reduced but the more objectionable midrange and high frequency noise (hiss) is reduced considerably.

In fact, noise reduction with Dolby B is about 10dB between 3 and 10kHz. With Dolby C maximum noise reduction is about 20dB, and is greater than 15dB over the range 700Hz to 10kHz. Subjec-



The SD-820 DBX cassette deck is finished in an attractive gold anodising. It features three noise reduction systems plus a computer optimised bias adjustment.

tively, switching in Dolby C appears to halve the background noise of Dolby B. The two noise reduction systems are incompatible however, and tapes recorded using Dolby B, for example, cannot be played back using Dolby C without affecting the frequency response of the playback signal (and vice versa).

The third noise reduction system fitted to the SD 820 is dbx, which works on an entirely different principle to Dolby. With dbx, the dynamic range of the signal about a reference point is compressed by a factor of two and this compressed signal recorded onto the tape. Upon playback, the dynamic range of the compressed signal is expanded by a factor of two to give the original signal.

When tape noise at −50dB is expanded along with the compressed signal, its level drops to −100dB rendering it virtually inaudible. In practice this ideal noise floor of −100dB is not usually achieved due to noise limitations in the rest of the playback circuitry. Noise reduction in the SD 820 with dbx switched in is about 30 to 40dB and this reduction extends over the whole frequency band rather than just at the higher frequencies as occurs with Dolby.

A further advantage of dbx is that the overload margin of the tape is effectively doubled due to the compression applied to the recorded signal.

Are there any disadvantages to dbx? Yes, there are several, the major one being the price (dbx circuitry adds about $100 to the cost of the SD 820). The action of the dbx circuit may also become audible during signal transients or at low signal levels.

Compu-Bias

As mentioned earlier, a second microprocessor (called the Compu-Bias microprocessor) has been incorporated into the SD 820 to provide optimum adjustment of the record level bias and equalisation. The need to fine tune the bias level for best recording characteristics is shown in Fig. 2.

In Fig. 2a, the distortion and the output level at 1kHz versus bias current is shown. It can be seen that the minimum distortion and the maximum output level points do not line up so any bias setting chosen will be a trade-off between acceptable distortion and output level.

Fig. 2a does not tell the whole story however, for the curves shown also vary with frequency. This is displayed in Fig. 2b where the output level at various frequencies is plotted against bias current. Since tape characteristics vary between manufacturers, only a cassette deck which can alter the recording bias could be expected to get the maximum performance out of each different tape.

To start operation of the Compu-Bias circuit, two buttons, the Auto and Start buttons, are pressed in this order. When the Auto button is pressed, the microprocessor checks the cassette's safety tab and stops operation if the tab has been removed.

When the Start button is pressed, the Compu-Bias microprocessor assumes control of the tape transport mechanism, placing the SD 820 into record mode. It then simultaneously records a 1kHz signal and monitors the playback. If no playback signal is received the microprocessor assumes the heads are positioned on the leader tape and continues recording for 10 seconds.

If no playback signal is received after 10 seconds, the automatic bias and equalisation selection operation is reset and the standard bias and equalisation settings used. The "error" LED is then illuminated to indicate that a fault has occurred.

To select the correct recording bias, a 1kHz signal is recorded in both channels while the bias is increased in steps. There are 32 steps in all, each step lasting 80ms. The playback signal is monitored while the bias is adjusted and the bias level which results in the maximum playback signal level for both channels is stored in memory.

If an error occurs during the first attempt at automatic bias selection, the procedure is repeated. If an error occurs on the second attempt, the system is reset and standard bias and equalisation settings used. As before the "error" LED illuminates to indicate that a fault has occurred.

After the recording bias has been optimised, the record/playback sensitivity at 1kHz and the recording equalisation at 7 and 15kHz are selected. The recording sensitivity and equalisation are adjusted so that the record/playback output level corresponds to a reference level stored in memory. To fine tune the adjustment, this procedure is repeated three times at frequencies of 1, 7 and 15kHz in that order.

If the optimum sensitivity and equalisation settings are not found the first time the procedure is repeated. If they are not found the second time the "error" LED lights, the system is reset and the standard settings used.

At the end of the Compu-Bias adjustment procedure (which only takes a few seconds), the tape is rewound to the original starting point and a four second blank recorded. The microprocessor now places the SD 820 in the record-pause mode and returns control of the tape transport mechanism to the user.

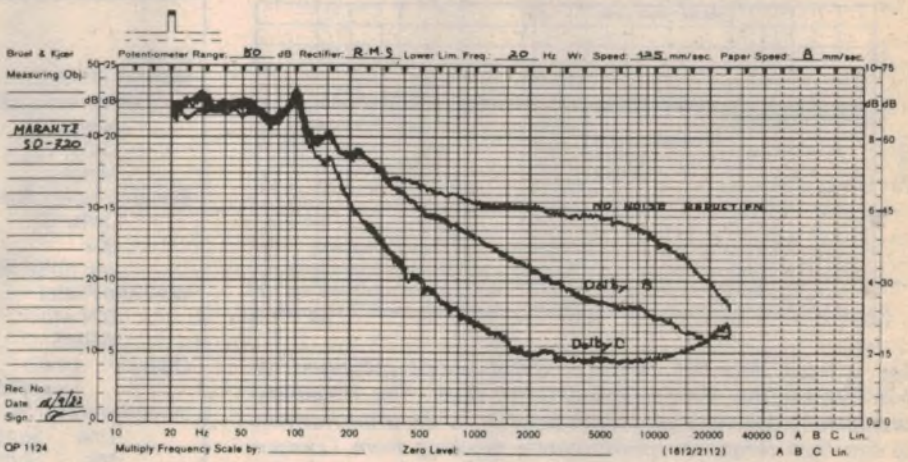
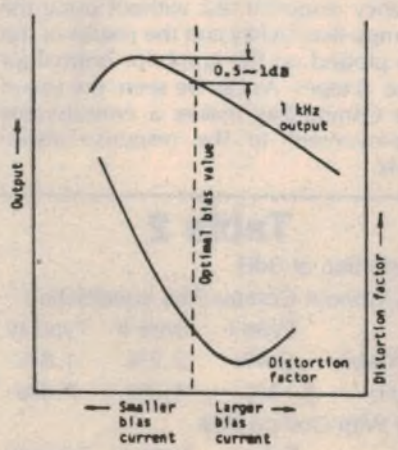


Fig. 1: The large decrease in high frequency noise when using Dolby is evident in this graph of the output noise versus frequency.



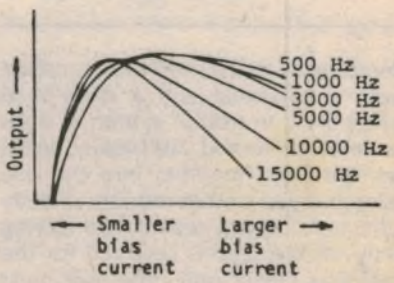
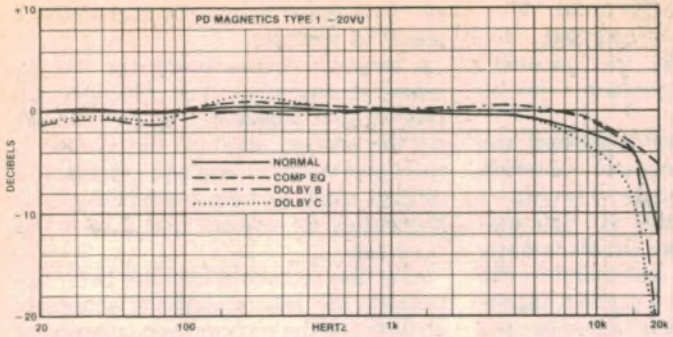
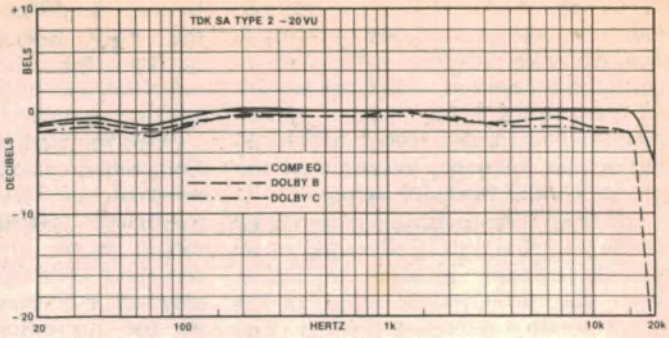
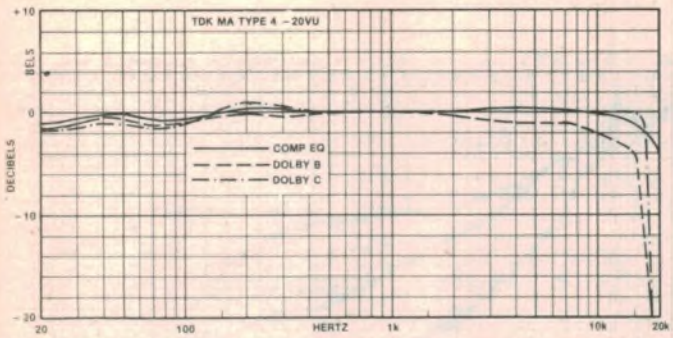


Fig. 2a (left) shows the change in output level and distortion versus changes in bias current. Fig. 2b (right) shows how the output level is dependent upon frequency as well as bias current.







SPECIFICATIONS

Motors		2 x DC	
Number of heads		3	
Frequency response w/o Dolby			
Normal		20-17	Hz-kHz
CrO_2		20-19	Hz-kHz
Metal		20-22	Hz-kHz
Signal-to-Noise ratio (CrO_2) (1kHz)			
Dolby C		75	dB
dbx		85	dB
w/o noise red.		60	dB
Wow and Flutter			
DIN wtd		0.06	%
WRMS		0.03	%
Outputs Line	Level/Imped	400/5	mv/kΩ
Headphone	Level/Imped	50/180	mv/k
Inputs level at O VU			
Line	Sens/Imped	65/50	mV/k
Mic	Sens/Imped	0.3/10	mV/k

Fig. 3 (right) lists the electrical specifications published by Marantz for the SD820 DBX cassette deck. The frequency response curves for type I tapes (top) show the improvement in the high frequency performance resulting from Compu-Bias.

A lithium battery is used to provide power to the Compu-Bias memory so that even with the mains power disconnected, Compu-Bias settings are remembered. Three tape settings can be remembered, one for metal, one for CrO_2 and one for normal tapes. To recall a setting from memory it is simply necessary to press the Auto button. The machine senses the tape type in the machine and recalls the appropriate data from memory.

Table 1

Signal to noise ratios (ref 0dB)

	Type I	Type II	Type IV
No noise reduction	51	54	53
Dolby B	56.5	57	57
Dolby C	58	58	59
dbx	80	80	80

Literature on the SD 820 varies, calling it both a two-head and a three-head cassette deck. In truth it is both; it does have separate record and replay heads which are fitted together into the one housing but you cannot monitor directly off the tape as you record. Monitoring directly off the tape is reserved for the Compu-Bias circuit only. The user must be content with monitoring off the input circuits as in a two-head cassette deck.

The specifications for the SD 820 are tabled in Fig. 3 so that an easy comparison may be made with our test results.

We have summarised the results of our frequency response tests into three graphs. These graphs correspond to the three settings of the tape selector switch, ie normal, CrO_2 and metal tapes. Each graph was recorded at −20dB and shows the effect on the frequency response of using either Dolby B, Dolby C or no noise reduction when taping.

We used the Compu-Bias system to optimise the bias settings before each frequency response run since we believe most people will use the Compu-Bias facility when taping. We made one frequency response test without using the Compu-Bias facility and the results of this are plotted on the graph for normal (or type 1) tapes. As can be seen, the use of the Compu-Bias makes a considerable improvement to the response above 7kHz.

Table 2

Distortion at 0dB

(a) Without Compu-Bias equalisation

	Type I	Type II	Type IV
100Hz	2.4%	2.2%	1.6%
1kHz	3%	1.3%	1.4%

(b) With Compu-Bias

	Type I	Type II	Type IV
100Hz	≈ 5%	3.1%	2.1%
1kHz	≈ 5%	2.8%	1.7%

Since the improvement in response using Compu-Bias is basically the same for all tape types, we have not repeated the test on the graphs for the other tape types.

Frequency response tests for the dbx noise reduction system were not performed since the action of the RMS level detector in the dbx circuitry causes different response errors to be obtained when recording tones as compared to music. With a tone, any errors in the tape response are doubled due to the expansion applied upon playback.

Since music usually contains energy spread across most of the frequency band, an error in the playback level of a portion of this band will not change the overall RMS level by a large amount. Hence, the error induced in the frequency response of the signal will be essentially that of the tape alone, and no error doubling will occur.

One of the features revealed by the frequency response curves is that an MPX filter is switched into circuit whenever Dolby B or Dolby C is used. This accounts for the slightly poorer high frequency performance when using Dolby B or Dolby C.

In our opinion, manual switching of the MPX filter would be better. Many tuners these days have more than adequate suppression of the 19kHz pilot and additional MPX filters only serve to further roll off the high frequency performance.

Continued on page 150

ALTRONICS KITS COST MORE

Around $1 more

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

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

ALTRONICS • BANKCARD JETSERVICE DELIVERY NEXT DAY • ALTRONICS

OUR BEST SELLING POWER SUPPLY KIT EVER

3–32 volt output at 1 amp UNDER $40

THE ALTRONICS POWER SUPPLY

Based on EA LM 317K Project

Every workshop, school and hobbyist should get one now ! ! !

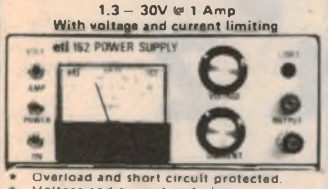
- Fully projected from thermal runaway and short circuits.
- Voltage and current metering.
- To—3 regulator plus powerfin heatsink.
- Fully documented, every last part included.

K3200 . . . . . $42.50

ETI 162 BENCH SUPPLY

1.3 – 30V @ 1 Amp

With voltage and current limiting



- Overload and short circuit protected.
- Voltage and current metering.
- Regulation — better than 0.2% zero to full load
- Hum and noise on output — less than 1MV at full load.
- LED indication of current limit.

Exclusive — fully S.E.C. Certified Mains Transformer supplied.

If you're considering buying this kit from your local supplier or one of our competitors — first ring and ask them if the mains transformer is S.E.C. certified to ASC126 — chances are that it won't be.

K3205 . . . . . $49.50

DUAL TRACKING POWER SUPPLY

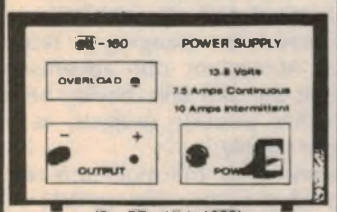
+ 1.3 to + 22V @ 2 AMPS : + 5V @ 0.9 AMPS

The ideal power supply for the audiophile experimenting with linear OP amp designs in which split supply operation ensures improved distortion and noise figures.

- Fully protected against short circuits, overloads and thermal runaway.
- LED indicator for regulator dropout.
- Floating ground.
- Uses 0.25% linearity 10 turn pot — tracks within 1MV.
- Voltage adjustable to within 10MV.

K3220 (EA MARCH 1982) . . $86.00

13.8V HIGH CURRENT SUPPLY



(See ETI JULY 1982)

- Output voltage — 13.8 Vdc.
- Output current — 7.5A continuous 10A Intermittent
- Regulation — 0 to 7.5A : 50MV

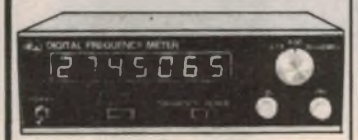
Save the expense of a mains powered rig. Kit complete in every way.

K3250 . . . . . $84.00

DIGITAL FREQUENCY METER

7 Digit Resolution, measures period and frequencies to • 500 MHz

Professional unit — cost a fraction of similar built-up units.



This project is "so easy to construct", virtually all components mount on one single PCB, ensuring success even for the "not so experienced" constructor.

Use of the latest LSI circuitry ensures impeccable performance from the completed unit. This is further ensured by our use of top grade components.

NOTE: (Altronics use only the specified intersil LSI — beware of inferior kits that do not conform to the original design.

Frequency measurement to 500mHz (with optional Prescaler) in 3 ranges — 0—10MHz, 0—50MHz, 10—500MHz • 4 gating times — 0.01, 0.1, 1, 10 seconds.

Period measurement for accurate low frequency counts, 4 ranges — 1, 10, 100, 1000 input cycles • resolution 0.1us.

High Input Sensitivity — 10MV to 30MHz. 100MV at 50MHz • 1MOHM input impedance, 200MV @ 500MHz @ 75 OHMS input impedance.

Accuracy — typically better than 0.005% uncalibrated.

Exclusive Altronic Kit Features

- IC sockets provided throughout
- low aging 10.000 MHz XTAL.
- Genuine Fairchild High Brightness FND 507 display's.
- Quality ABS plastic case — deluxe front panel.
- Complete kit as specified by EA includes instructions, all cables and every last nut, bolt and washer.

K2500 . . . . . $119.50

DECIMAL POINT FOR K2500

READ FREQUENCY DIRECTLY IN MHz and PERIOD IN US.

K2502 . . . . . $7.50

PRESCALER FOR K2500

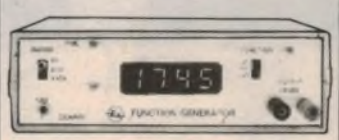
ALLOWS FREQUENCY MEASUREMENT TO 500MHz

K2501 . . (essential option) . . . $26.00

FUNCTION GENERATOR

(with digital display)

Sine, triangle and squarewaves : 15Hz – 250KHz.



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

A truly versatile unit at a bargain price.

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

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

K2505 . . . . . $85.00

ANALOG / DIGITAL STORAGE CRO ADAPTER

(See EA Nov 1980 and March 1981)

Unit enables indefinite storage of non-repetitive waveforms at a fraction of the cost of conventional storage CRO's. National semiconductors A—D/D—A conversion techniques allow analog signals up to 100KHz to be stored • two channels while in digital mode • positive and negative edge triggering • AC/DC/HF and LF rejection • timebase tracer for accurate frequency measurement • accurate down to 1.9Hz Analog mode — 1us Digital Mode • delayed trigger 10us-1s • sensitivity — 160MV P—P — 1 MEG (Analog)* standard TTL and CMOS levels 3-15 volt supply (Digital).

The features of this unit are to numerous to list, yet is simple to operate.

Be assured of quality with an Altronics Kit

1. Genuine National A—D conversion chips not second sourced dropouts.
2. All IC sockets provided (27 total — you pay no more)
3. Low capacitance coax and a full metre of rainbow cable.
4. Full instructions and every last nut, bolt and washer.
5. Deluxe mini rack cabinet.

K2600 . . . . . $189.00

DIGITAL LED CAPACITANCE METER

K 2521 . ONLY $55.00

with Deluxe Instrument Case

NEW DELUXE FINISH

We are pleased to announce the release of the Digital Capacitance Kit housed in our Deluxe H 0480 ABS Instrument Case.

This superb Test Instrument Kit now compliments our top selling Digital Frequency Counter and Function Generator Project Kit.

Electronics Australia Project. Measures capacitance of both polarized and non-polarized capacitors from 1 picofarad to 99.99 microfarads in 3 ranges.

Check values of unmarked capacitors, especially those little trimmers that are never coded.

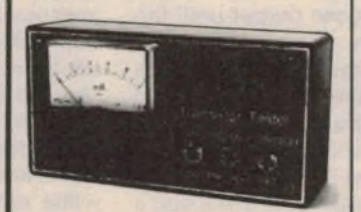
Select precise values for filters and timing networks within ease.

• • • EXCLUSIVE TO ALTRONICS • • •

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

STANDARD VERSION K 2520 (In metal case) Same Specifications . . . $49.50

TRANSISTOR TESTER

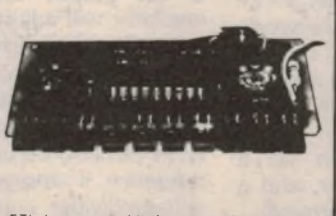


Electronics Australia Project. Tests Bipolar Transistors, Diodes, Fets, SCR's and PUT's. Excellent service aid for the hobbyist and serviceman. Complete kit and instructions.

K 2525 . . . . . $19.75

EXPANDED SCALE LED VOLTMETER

HAS MANY APPLICATIONS



ETI design suitable for lead acid wet cells, lead acid gel electrolyte, vented nickel cadmium types and so on and so on.

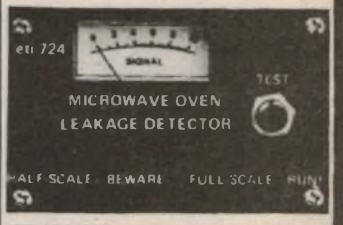
Unit covers range of 10.5v to 15v.

Determine battery condition instantly

Easy to Build!

K 4326 . . . . . $9.50

MICROWAVE OVEN LEAK DETECTOR



ETI PROJECT

Completely passive project receives microwaves via an antenna which develops a voltage across a detector diode driving the meter.

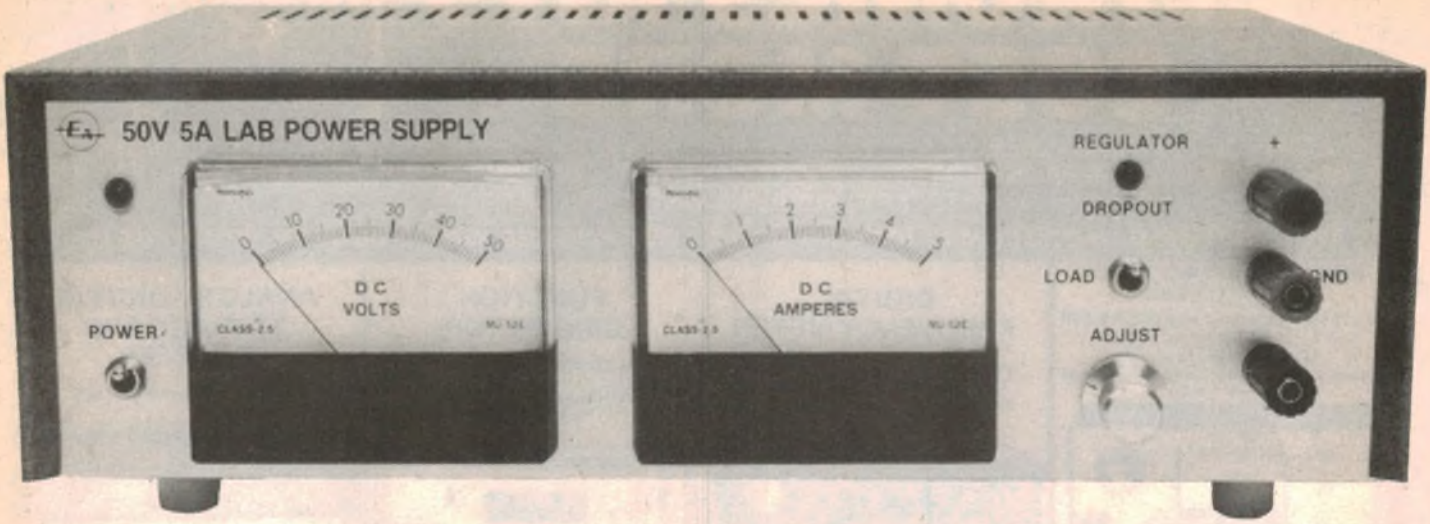
Monitor your microwave oven with this easy to build kit. All components mount on single PCB, including the meter.

Genuine Hewlett Packard Hot Carrier Diode supplied.

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

ALTRONICS • BANKCARD JETSERVICE DELIVERY NEXT DAY • ALTRONICS

FOR DESPATCH P&P CHARGES AND ADDRESS DETAILS PLEASE REFER TO OUR AD. ON PAGE 85



50V/5A laboratory power supply: Pt 2

Last month we introduced our new high power switchmode supply. We discussed the principles of switchmode operation and pulse width modulation, together with the functions of the μA494 switchmode IC. This month we present the complete circuit and constructional details.

design by JEFF SKEEN

The basic "power plant" in this power supply is a 35V 5A transformer, a 10A bridge rectifier, and a pair of 4000μF filter capacitors. In greater detail the transformer is a Ferguson PF4361 with two 35V windings which, connected in parallel, provide a current rating of 5A. The rectifier is a 100V 10A bridge, such as a VJ448, and the filter capacitors are rated at 75VW with a 5A ripple current rating, giving a total ripple current rating of 10A. A 5.6kΩ 1W bleed resistor is connected across this network.

A 10A fuse is used to protect this part of the system, and is followed by a 15V zener diode and 560Ω resistor network. This provides a +15V supply for the μA494, and for the 741 op amp and 555 timer in the regulation indicator circuit. The main positive line goes on to the pass transistor, MJ15004, then via a 0.7mH inductance, an ammeter, and a switch to the positive output terminal.

The regulator IC

The heart of the regulator system is, of course, the μA494 regulator IC. Readers may find it beneficial to refer to last month's explanatory article and diagram of this IC as an aid to the following discussion.

The oscillator, which provides the basic switching function, requires only two timing components: a .001μF capacitor and a 56kΩ resistor from pins 5 and 6 respectively to the negative rail. This gives a frequency of approximately 20kHz, although the exact value is not critical.

Pins 1 and 2 are the inputs for the error amplifier inside IC1. If a reference voltage is applied to pin 2 and a sample of the output voltage to pin 1, the regulator will adjust the output until the two voltages match.

The reference voltage is obtained from pin 14 of the μA494 in the form of a regulated 5V supply with a 20mA capacity. (It can also be used as an external 5V reference if desired.) This is fed to a voltage divider, consisting of a 1kΩ and a 1.5kΩ resistor, the junction of which provides a 3V reference. This, in turn is fed to pin 2 via a 4.7kΩ resistor. (The network between pins 2 and 3 will be discussed later.)

The sample voltage from the output is taken from a point as close to the output terminal as possible in order to compensate for such losses as ammeter resistance, wire resistance, etc, particularly under maximum current conditions. However, it is taken from the supply side of the load switch, so that it functions at all times.

This is fed to a voltage divider consisting of a 2kΩ multi-turn potentiometer and a 120Ω fixed resistor. The divider tap is fed to pin 1 via a 4.7kΩ resistor, which serves to limit the input current to the error amplifier in the event that the output voltage should rise above the μA494 supply voltage. The 0.1μF capacitor across the resistor network helps to reduce the output ripple.

The actual value of this potentiometer is not critical, provided its associated resistor is maintained in proportion. In fact, we started out with a 100kΩ unit in conjunction with a 5.6kΩ fixed resistor, and this worked perfectly satisfactorily. Our only reason for changing to 2kΩ is because a survey of our advertisers showed that the 2kΩ unit, having been used in other popular projects, is in much better supply.

At the same time, the multi-turn unit, while providing a very fine control action, is an expensive item (around $10) and some builders may be tempted to use a conventional linear pot. There is no objection to this, and it could conveniently be a 100kΩ/5.6kΩ combination.

Pins 8 and 11 of the μA494 are the collector connections of the two internal switching transistors (see Fig. 3 last month), while pins 9 and 10 are the emitter connections. These two transistors are connected in parallel and control an external BD139 transistor (Q1), thus forming what is effectively a Darlington pair. Q1, in turn, controls the MJ15004 pass transistor (Q2), and is necessary to isolate the internal transistors from excessive voltages on the base of Q2.

In greater detail, when the pass transistor (Q2) is turned off, the transistor driving its base will also be off. Thus, the collector of the driving transistor will have the full +50V output from the bridge rectifier applied to it via the 47Ω and 390Ω resistors. This voltage exceeds the +40V collector/emitter rating of the internal transistors, while the BD139 is rated to withstand this voltage.

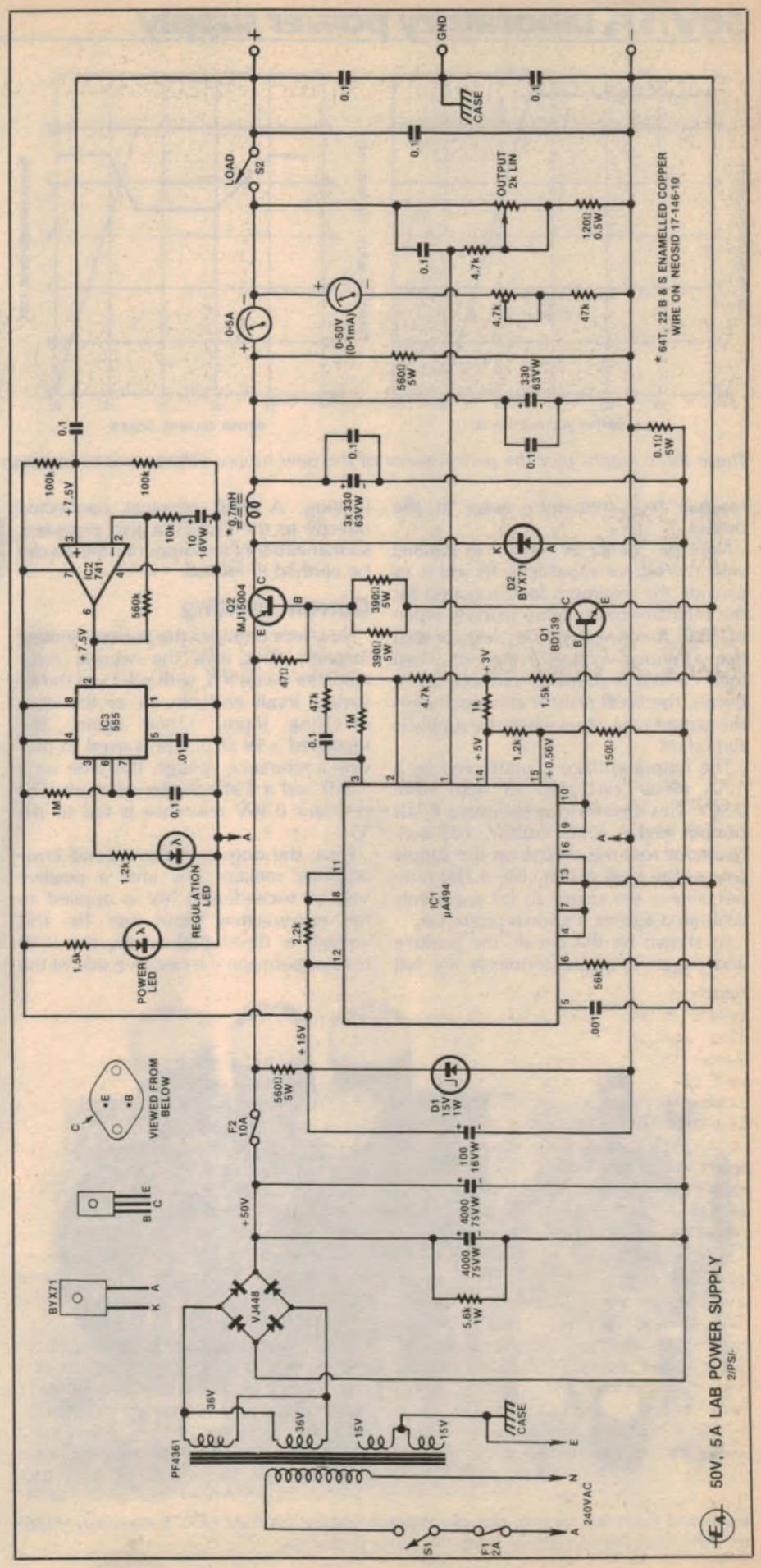
So the basic scheme is this: Q1 and Q2 are turned on and off by the two parallel connected transistors inside IC1. These in turn are controlled by the internal error amplifier, as described last month (see Fig. 2). When the oscillator ramp output is higher than the error output voltage, Q2 turns on; when the ramp output voltage is lower than the error voltage, Q2 turns off.

The network betweens pins 2 and 3 is used to provide a "soft start" when the power supply is first turned on. Pin 3 is the inverting input to the pulse width modulation (PWM) comparator, and is normally held low. While the inverting input is low, the output of the comparator will be high and, ultimately, will turn on the pass transistor.

But if pin 3 is driven high the PWM comparator output will go low, turning off the pass transistor. This is the basis of the soft start action. At the instant of switch-on, a voltage will be applied to pin 3 via the 47kΩ resistor and the 0.1μF capacitor, the latter initially offering zero impedance. Then, as the capacitor charges, the voltage on pin 3 falls, providing the soft start. When the power supply is turned off, the capacitor is discharged through the 1MΩ resistor.

From here, the basic circuit functions exactly as described in Fig. 1 last month. The relevant components are the 0.7mH inductor, diode D2, and four 330μF capacitors wired in parallel with the load. Note that the diode specified is a BYX71, a type often used in the line output stage of TV receivers. It was chosen for its fast response times.

The total capacitance across the output is 1320μF. Two 0.1μF polyester capacitors are connected across the main output capacitors as high frequency bypasses. As a further precaution, a network of three 0.1μF ceramic capacitors is connected directly across the output terminals to remove any



These three graphs plot the performance of the new supply. Efficiency is better than 60% for outputs greater than 50W.

residual high frequency noise at the output.

Note the 560Ω 5W resistor in parallel with the output capacitors. Its job is to provide the minimum load required for the regulator to continue working when no load is connected. This resistor also helps control voltage overshoot when load current is suddenly reduced. As a bonus, the 560Ω resistor also discharges the output capacitors when the supply is turned off.

The output voltage is monitored by a 1mA meter calibrated to read from 0-50V. This is wired in series with a 4.7kΩ trimpot and a 47kΩ resistor, and connected across the output on the supply side of the load switch. The 4.7kΩ trimpot allows the meter to be accurately calibrated against a known reference.

As shown on the circuit, the positive and negative output terminals are left floating. A third terminal connected directly to the chassis is also provided, so that either of the output terminals can be earthed if desired.

Current limiting

Now let's consider the current limiting function. This uses the second error amplifier inside IC1, with pin 15 as the inverting input and pin 16 as the non-inverting input. Once again, the regulated +5V at pin 14 is used to provide a reference voltage, this time via a 1.2kΩ and a 150Ω divider network. The resultant 0.56V reference is fed to pin 15.

Thus, the output of the second error amplifier remains low until a positive voltage exceeding 0.56V is applied to the non-inverting input, pin 16. This voltage is developed across the 0.1Ω resistor between the negative side of the filter capacitors and the negative output terminal. When the current flow through the resistor reaches 5.6A, 0.56V will be developed across it and applied to pin 16.

As soon as the voltage on pin 16 reaches 0.56V, the second error amplifier acts to limit the current by reducing the duty cycle of the pass transistor, Q2.

While in this part of the circuit note particularly the method of connecting the IC negative supply pin, pin 7, to the negative output terminal. This is via its own heavy duty lead from the printed circuit board (PCB) directly to the terminal, rather than to some point on the board which is, nominally, at the same potential. This is essential to preserve good regulation which can otherwise be upset, at the heavy currents involved, by small voltages developed along copper pattern conductors or in cables.

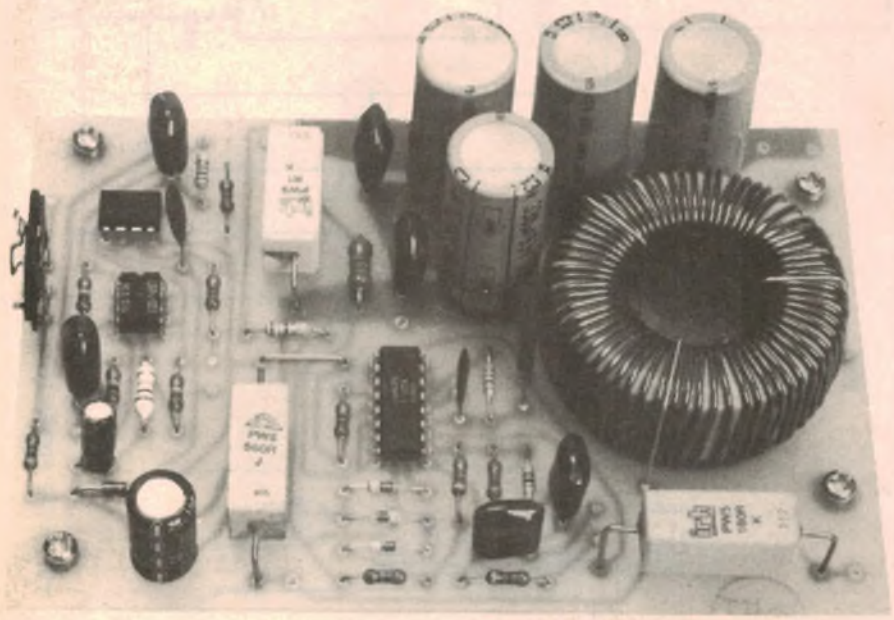
Pins 16, 13 (output control) and 4 (dead time control) also share this lead, but more as a matter of convenience than necessity.

In practice, the exact value of the 0.1Ω resistor can present a problem. If it is slightly high, current limiting may begin too soon. If so, the simple solution is to increase the 150Ω resistor in the pin 15 divider network to, say, 180Ω, or whatever value is required.

Loss of regulation

Another useful feature of this power supply is a "loss-of-regulation" indicator. Loss of regulation normally occurs as the supply is approaching the limit of its current capacity, but before actual limiting occurs. It is not possible to tell, by meter readings alone, that this condition is being approached.

The indicator operates by sensing the ripple content of the output voltage. When fully regulating, the ripple content is in the region of 20mV peak-to-peak at



Repeated from last month, this photograph shows the control PCB assembly. Note that the final version differs from this early prototype.

you can have all the features of expensive commercial amps at a fraction of their price ...when you build the

Playmaster Mosfet Amp

Why not build your own amplifier — and save a fortune?
Thousands of these Playmaster Mosfet Stereo amplifiers have now been built — many by virtual beginners! It's so easy: every detail of construction is carefully and thoroughly detailed in our exclusive step-by-step instruction manual!
You'll have a superb quality amplifier, better than many you'd pay hundreds of dollars more for. It will look so good that your friends will never believe you built it!

- State-of-the-art POWER MOSFETS
- Low noise FET input pre-amps
- Over 50 watts per channel
- Speaker switching plus loudness and muting controls
- Low distortion, high performance circuitry
- Complete with our famous step-by-step instruction manual

Cat. K-3515

$175.00

EXCLUSIVE! Professionally designed 'scratch grain' front panel matched with fully imported deluxe knobs. Beware of other kits which don't look a tenth as good!

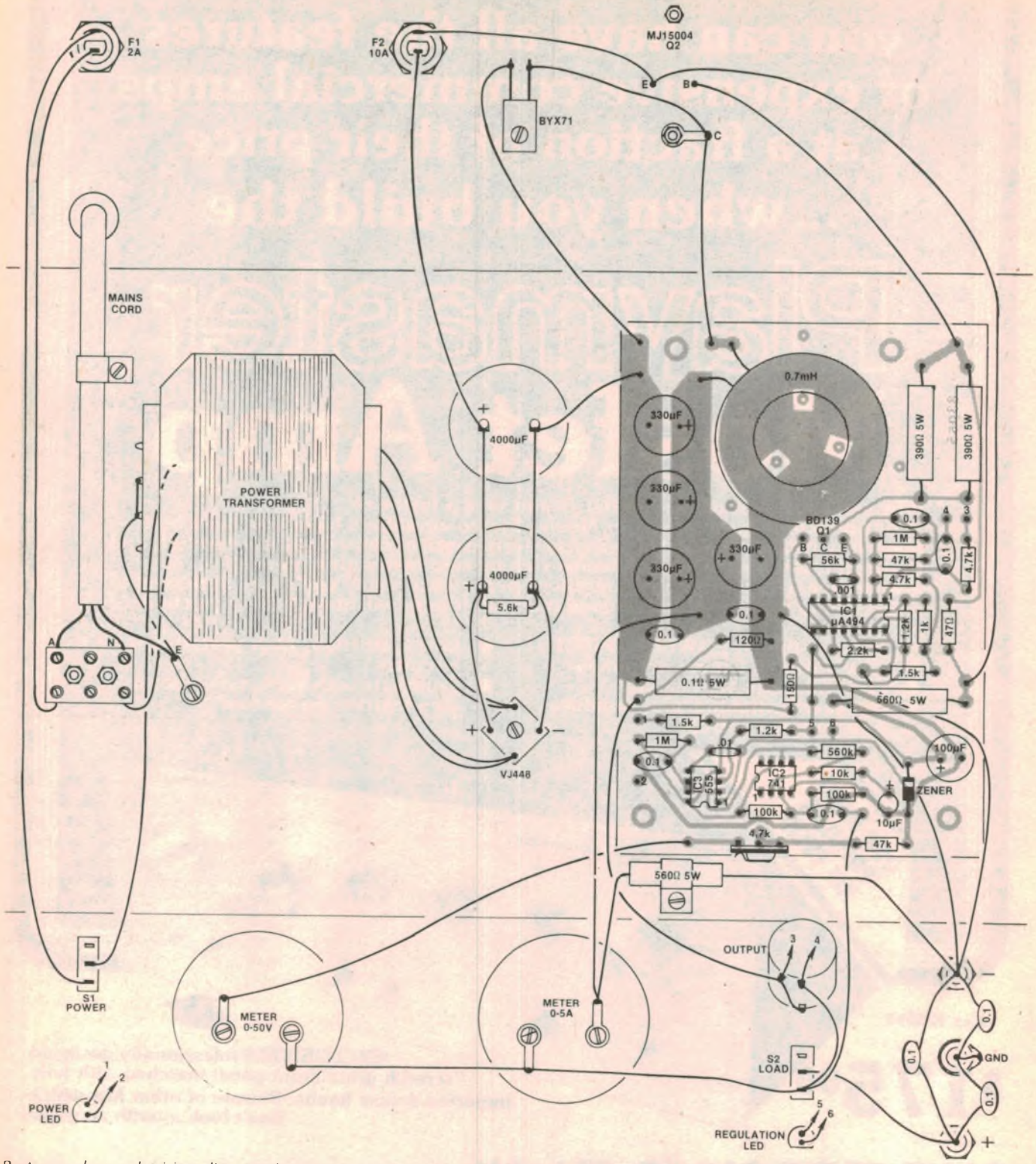
SAVE OVER $10.00: This kit INCLUDES the optional loudspeaker protector circuitry: AT NO EXTRA CHARGE!

DICK SMITH Electronics

SEE PAGE 98 FOR ADRESS DETAILS

A166M/JL

50V/5A laboratory power supply

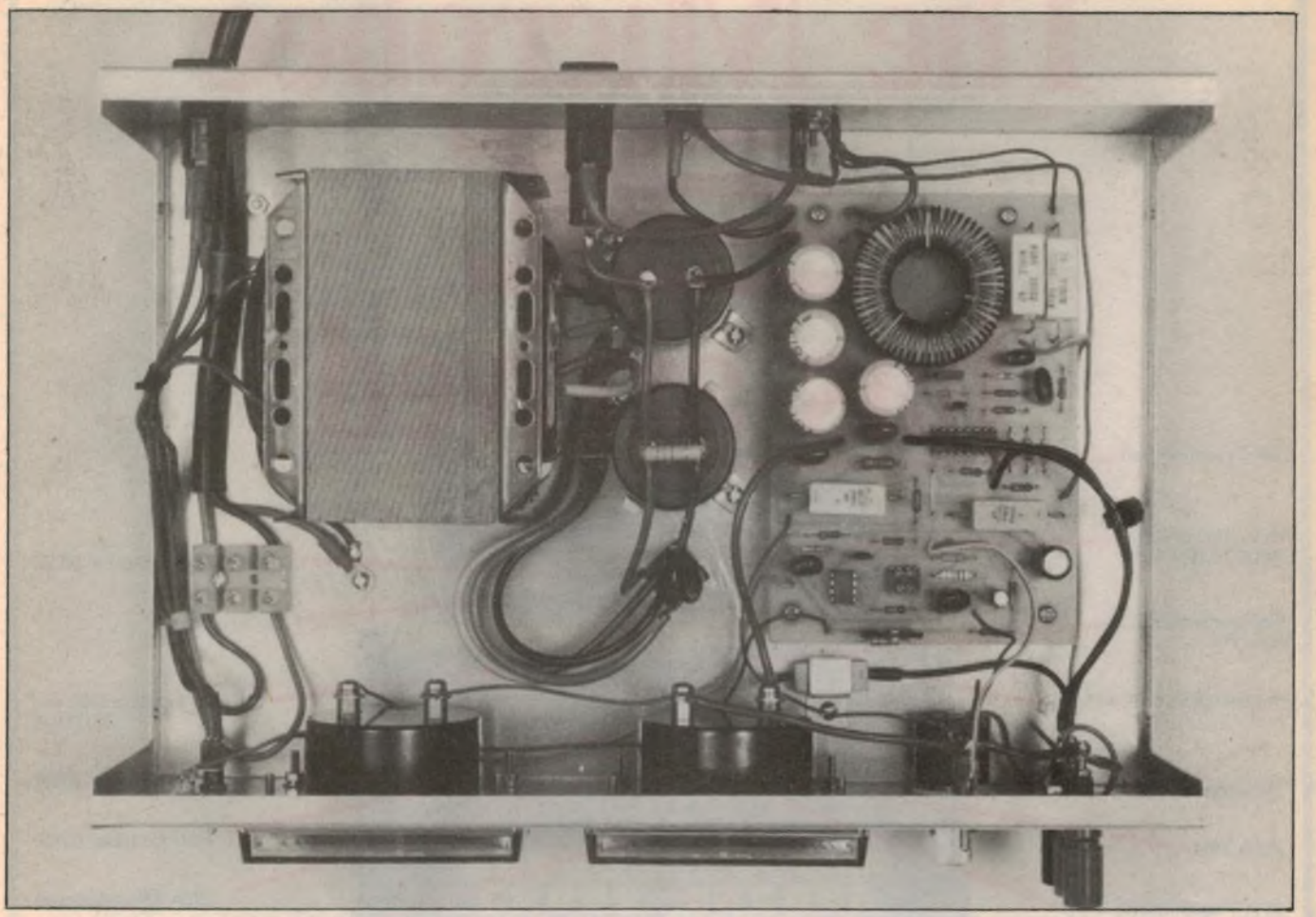


Parts overlay and wiring diagram for the 50V/5A supply. Most of the wiring should use heavy-duty 10A cable (see text).

100Hz, plus a certain (varying) amount of higher frequency "rubbish" from the switchmode function. As far as this indicator is concerned, it is the 100Hz content that it is important.

The regulation indicator consists of a 741 op amp (IC2) and 555 timer (IC3). IC2 functions as a simple amplifier while IC3 is wired as a monostable and drives a LED indicator. The ripple is picked up close to the positive output terminal, on the supply side of the load switch, and fed to the non-inverting input of the op amp via a 0.1μF blocking capacitor. This input terminal is biased at half the 15V supply voltage by two 100kΩ resistors.

As a result, the output of the op amp will also be at half the supply voltage (7.5V) with the amplified ripple voltage superimposed on it. The gain of the op amp is set at 56 by the feedback network into the inverting terminal, while the 10μF capacitor rolls off the frequency response below 10Hz.



Use this photo and the wiring diagram to position the major components in the chassis.

The output of the op amp is connected to the pin 2 trigger terminal of IC3. When the voltage on pin 2 drops to one third the supply voltage (ie, to 5V), IC3 triggers and activates the LED.

If the ripple level is 20mV p-p, the op output will be held at +7.5V DC with ±0.56V superimposed on it – ie, the output will swing between +6.94V and +8.06V. Thus, for this ripple level, the output of IC2 does not go low enough to trigger the monostable and the LED remains off.

If, however, the ripple increases to about 90mV p-p, the output of the op amp swings ±2.5V. The monostable now triggers on the first negative peak, thus lighting the LED to indicate loss of regulation. The LED remains on for as long as loss of regulation continues.

A 1MΩ resistor and a 0.1μF capacitor set the monostable period to approximately 0.1s. Thus, the LED will also "flash" briefly if the supply momentarily loses regulation when connected to a heavy load.

Whilst on the subject, it should be pointed out that loss of regulation is not a gradual process. Instead, the supply "drops its bundle" quite suddenly and the ripple content on the output rises dramatically.

Construction

Most of the components are mounted on a printed circuit board (PCB) coded 83ps5 and measuring 132mm × 92mm. This board, together with the various external parts, is mounted in a standard K&W instrument case measuring 305mm × 205mm × 95mm (W × D × H). A Scotchcal adhesive label provides an attractive front panel.

Construction can commence with the PCB assembly. In addition to the minor components, this also carries the toroid inductor and the four 330μF output capacitors. Mount the parts on the PCB according to the overlay diagram, beginning with the resistors and then moving on to the capacitors and semiconductors. Don't forget the wire link adjacent to μA494 IC, and make sure that you install the transistor, ICs and electrolytic capacitors the right way round.

An important point to note here concerns the two 390Ω 5W resistors adjacent to the toroid. These can become quite warm under some operating conditions and, to assist heat radiation, it is a good idea to mount them proud of the PCB. One is mounted about 3mm above the board and the other (nearest to the indicator) about 10mm higher, thus exposing all four sides of each resistor to the air.

The 0.1Ω and 560Ω 5W resistors should also be mounted slightly proud of the PCB.

The inductor is wound on an iron powder ring core (toroid) made by Neosid and designated type 17-146-10. It measures 44mm OD, 24mm ID, and 16.5mm thick. Note that this is NOT a ferrite core, and that ferrite should not be used.

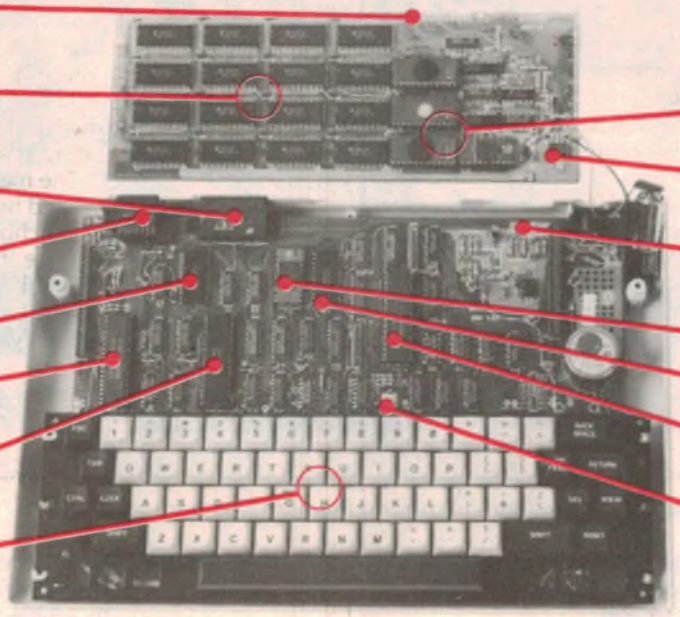
To wind the inductor you will need about four metres of 1mm (22 B&S) enamelled copper wire. Wound as a single layer, this should give about 64

We estimate that the current cost of components for this project is approximately

$140

This includes sales tax.

The Microbee IC has arrived



New from Microbee, a world first totally new concept. Now with totally integrated software such as BASIC, WORDBEE, MACHINE MONITOR, TERMINAL COMMUNICATION, the new MICROBEE 16K IC and MICROBEE 32K IC represents a major breakthrough in microcomputer technology.

The MICROBEE IC computers now all run at a FAST 3.375 Mhz, all fitted with the new 6.0 ENHANCED MICROWORLD BASIC, all are capable of 64 by 16 or 80 by 24 screen formatting.

The MICROBEE IC series are software compatible with the earlier MICROBEES and owners of earlier BEES can easily upgrade their machines. You get all the features that have made the MICROBEE what 'YOUR COMPUTER' calls "one of the success stories of the Australian computer industry", with bonus features like word processing, communications, integrated BASIC and Z80 machine code operation, the MICROBEE IC series is the ideal educational/personal computer that you take home with you.

With almost 10,000 MICROBEES sold to date, a large base of highly original and effective software for games, business and educational uses, CAN YOU AFFORD NOT TO CONSIDER this Australian designed computer for your next purchase?

MICROBEE 16K IC **$499**
MICROBEE 32K IC **$599**

microbee®

AUSTRALIA'S OWN EDUCATIONAL AND PERSONAL COMPUTER

CEAT 2644

closely-spaced turns and an inductance of about 0.7mH. Anchor one end of the wire in a vyce, move to the middle of the wire, and wind on the free end. In this way, only half the wire length has to be passed through the toroid for each turn.

This done, the other half of the wire can be wound on to complete the winding. Note that the toroid will probably only accommodate about 3.5m of wire. Terminate the start and finish of the winding by twisting the ends together for half a turn.

The ends can now be trimmed and cleaned of insulation, and the toroid mounted on the PCB. It does not matter which way round you connect the leads, but make sure that the toroid is correctly positioned before soldering.

The toroid is secured using three U-shaped pieces of tinned copper wire to clamp it to the PCB. These are soldered to three pairs of anchor points arranged so that the wire clamps do not become shorted turns. The large, circular area of copper on the reverse side of the PCB provides a small measure of shielding.

With assembly of the PCB completed, attention can be turned to the metalwork. Spray the Scotchcal label with a clear lacquer (eg, "Estapol"), then carefully affix it to the front panel. The chassis can now be drilled to accept the various parts using the wiring diagram and Scotchcal label as a guide.

The meter cutouts can be made by drilling a series of small holes around the perimeter of each cutout and then filing to a smooth shape. Deburr all mounting holes before mounting the hardware on the chassis. We used red, green and black binding post terminals for the positive, earth and negative outputs respectively.

Heatsinking requirements for the MJ15004 pass transistor and BYX71 diode are met by mounting them on the rear panel. Note that both components must be electrically isolated from the chassis using mica washers and insulating bushes. Before mounting each component, check that the contact area is free of metal burrs and smear both sides of the mica washer with heatsink compound.

Finally, use your multimeter to check that the transistor and diode are indeed isolated from chassis. The accompanying diagram shows the transistor mounting details. We strongly recommend that you fit the transistor with a TO-3 plastic cover to prevent accidental shorts to chassis.

The mating surface of the VJ448 bridge rectifier should also be smeared with heatsink compound. It is then bolted directly to the chassis using a machine screw and nut. Orient the positive and negative terminals of the bridge as shown in the wiring diagram.

One other component which needs to be mentioned is the 560Ω 5W bleed resistor across the output capacitors. This will get quite hot at the higher voltage settings and should be mounted on the bottom of the box to give it some heatsinking. It is held in place using a simple clamp fashioned from scrap aluminium.

The PCB assembly is mounted on the base of the chassis using four 12mm tapped standoffs. At this stage, however, it should simply be positioned in the chassis so that the external wiring can be completed.

Heavy duty wiring

Rainbow cable or light duty hook-up wire can be used for the following connections: to the LEDs, potentiometer and voltmeter; between the base of Q2 and the PCB; between the emitter of Q2 and the PCB; and between the load switch and the PCB. **All other wiring must use heavy duty 32 × 0.2mm cable rated at 10A.**

The mains cord passes through a grommeted hole in the rear of the chassis and is anchored with a cord clamp. Terminate the mains active (brown) and neutral (blue) leads to the insulated terminal block, and solder the earth lead (green/yellow) to a solder lug bolted to chassis near the transformer. Complete the wiring to the mains fuse, power switch and transformer using 250VAC rated hook-up wire. Sleeve the switch terminals to reduce the danger of ac-

PARTS LIST

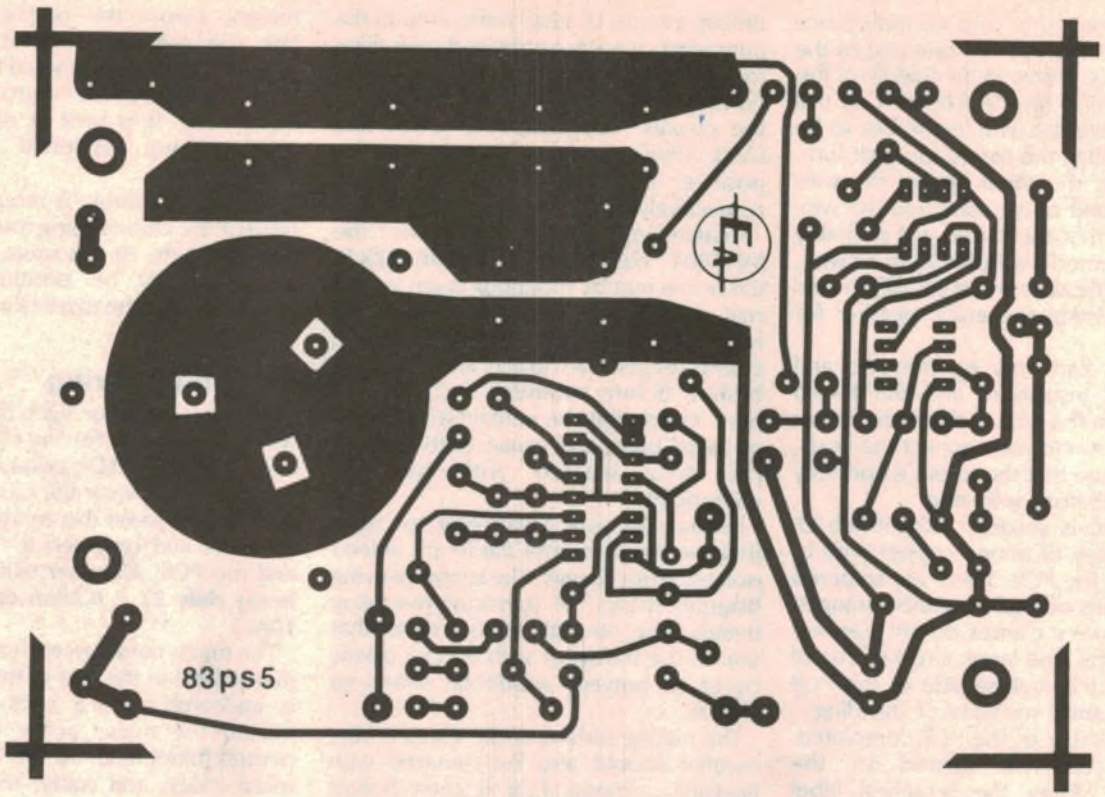
1 K&W instrument case, 305mm × 205mm × 95mm (W × D × H)
1 Scotchcal label, 302mm × 90mm
1 PCB, code 83ps5, 133mm × 92mm
1 power transformer, Ferguson PF4361
2 SPDT toggle switches
3 binding post terminals (1 red, 1 green, 1 black)
1 Minipa MU-52E 5A FSD meter, 75mm × 65mm
1 Minipa MU-52E 1mA FSD meter, 75mm × 65mm
1 0-50V meter scale
1 Neosid 17-146-10 iron powder toroid
4 metres 1mm enamelled copper wire
1 mains cord and plug
1 3-way terminal block
1 cord clamp
1 grommet
2 3AG fuseholders
1 2A fuse
1 10A fuse
4 cable ties
2 heavy duty solder lugs
4 12mm tapped standoffs
1 TO-3 mica washer
1 TO-220 mica washer
3 insulating bushes
1 TO-3 plastic cover
½ metre 32 × 0.2mm 10A cable (red)
½ metre 32 × 0.2mm 10A cable (black)

SEMICONDUCTORS
1 µA494 PWM control IC
1 741 op amp
1 555 timer
1 BD139 NPN transistor
1 MJ15004 PNP transistor
1 15V 1W zener diode
1 VJ448 bridge rectifier
1 BYX71 fast recover diode
2 red LEDs with mounting bezels

CAPACITORS
2 4000µF/75VW electrolytic, chassis mounting type
4 330µF/63VW PC electrolytic
1 100µF/16VW PC electrolytic
1 10µF/16VW PC electrolytic
6 0.1µF metallised polyester (greencap)
3 0.1µF/60VW ceramic
1 .01µF greencap
1 .001µF greencap

RESISTORS (¼W, 5% unless stated)
2 × 1MΩ, 1 × 560kΩ, 2 × 100kΩ, 1 × 56kΩ, 2 × 47kΩ, 1 × 10kΩ, 1 × 5.6kΩ, 1W, 2 × 4.7kΩ, 1 × 2.2kΩ, 2 × 1.5kΩ, 2 × 1.2kΩ, 1 × 1kΩ, 2 × 560Ω 5W, 2 × 390Ω 5W, 1 × 150Ω, 1 × 120Ω ½W, 1 × 47Ω, 1 × 0.1Ω 5W, 1 × 4.7kΩ large vertical trimpot, 1 × 2kΩ multi-turn potentiometer

MISCELLANEOUS
Rainbow cable, light duty hook-up wire, mains-rated cable, machine screws and nuts, scrap aluminium, plastic sleeving, etc.



Above is an actual size artwork for the printed circuit board.

cidental contact with the mains.

Do not transpose the connections to the fuseholder F1. By connecting the end terminal of the fuseholder to active as shown, there is less danger of receiving a shock should you remove the fuse with power still applied. We used several cable ties to keep the wiring neat and tidy.

The transformer specified for this project is the Ferguson PF4361 and, in addition to the required 36V windings, also features two 15V windings. Since these windings are between the primary and the 36V secondaries, they are connected in series and the centre tap earthed to provide an electrostatic shield. This should lessen the possibility of power supply "hash" being radiated via the mains wiring. It is also a useful additional safety measure, in the unlikely event of transformer breakdown.

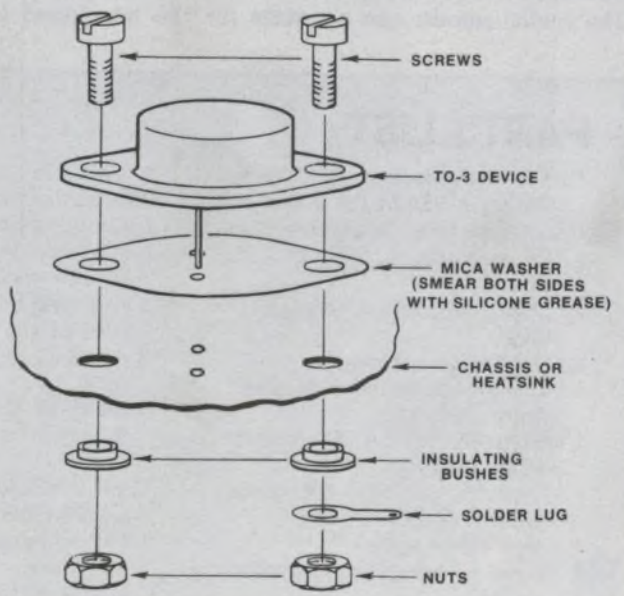
Testing

When wiring is completed, make a final check that all is correct and apply power. Connect your multimeter across the output and check that the output can be varied between about 3V and 50V DC. Adjust the 4.7kΩ trimpot so that the voltmeter reading matches the multimeter reading.

Finally, the current limiting function can be checked by connecting a 1Ω resistor across the output and slowly advancing the output control. The voltage across the resistor should limit at approximately 5.6V and the regulation LED should light. A 5W resistor should suffice for this short-term test, although it may become rather "red in the face".

Next month, we will describe how the 15V windings are used to produce balanced +12V and −12V rails. This project will involve the addition of a small add-on PCB using 3-terminal regulators, with the additional ±12V output terminals mounted to the right of the present terminals. The centre tap will remain earthed, so the 15V windings will still function as an electrostatic shield.

This diagram shows how the MJ15004 power transistor is mounted. The BYX71 diode must also be isolated from chassis.



SIXMIX

EUROPEAN SIMPLICITY

The Sixmix Mark1, 6 in/4 out mixing console offers affordable multi-track mixing capabilities, with professional features and performance. Designed for small studio requirements, audio visual presentations and sound reinforcement systems.

Its multi-patching possibilities and ergonomic design make this Dutch console an ideal tool for the serious artist.

R.H. Cunningham PTY. LTD.

146 Roden St., West Melbourne, Vic. 3001.
Telephone 329 9633. Telex 31447.

4-8 Waters Rd., Neutral Bay, N.S.W. 2089.
Telephone 909 2388. Telex 21707.

Importers of Sennheiser, Neutrik, Konig & Meyer, FM Acoustics, C-Ducer and Soundex products.

RHC018

GREAT NEW PRODU

You may have wondered why Jaycar did not (until now) sell home computers. We had many reasons but our main one was that we were not entirely "happy" with any of the units currently on the market. The closest we came to what we thought was a pretty good computer was the Apple. We thought that it was, quite frankly expensive. However it was sold and serviced throughout Australia by a reputable sales network — so there was no need for Jaycar!
That's why we got so excited when we saw the "Micro Professor MkII". It is the closest thing that we have seen to be software compatible with the Apple. Yes, we know what you're thinking. It's NOT one of those cheap Taiwanese "Apple" copies which infringe Apples' copyright. The Micro Professor MkII is a completely new and unique design in its own right. It just so happens that most of the widely distributed Apple software will run on this machine. O.K. But why so excited? LOOK AT THE PRICE! Check out the STANDARD FEATURES of this unit. Sit down. Think about it and COMPARE what you get with the Micro Professor MkII as STANDARD that are options on other machines!!

6 Colours

COMPUTER SENSATION! Only $698

MICRO–PROFESSOR II OUTSTANDING!

Low cost colour computer with APPLE compatibility*

Cat. YC1300

- 64K OF RAM SUPPLIED STANDARD all that you are ever likely to need.
- Text, Lo and Hi resolution graphics STANDARD
- Video AND TV (RF) output STANDARD
- Easy-to-use manual included in the price (over 248 pages)
- Power supply included as STANDARD
- Centronics printer interface STANDARD
- Multitech BASIC is compatible with APPLE II BASIC. Most APPLE software will run on the Micro Professor MkII

SPECIFICATIONS

CPU		R6502
ROM		16K Bytes
RAM		64K Bytes
BASIC	Interpreter	More than 90 instructions stronger than those for Apple II
Video Display	Type	Memory mapped into system RAM
	Mode	Text, low-resolution graphics, high resolution graphics (3 modes are mixed)
	Screen Format	960 characters (24 lines, 40 columns)
	Character Set	Upper case ASCII, 64 characters
	Character Type	5 x 7 dot matrix
	Graphics Capacity	1920 blocks (low resolution) in 40 x 48 array, 53760 dots (high resolution) in 280 x 192 array
	Number of Colors	8 colors
Keyboard		48 alphanumeric and function keys
Cassette	Interface	Use various cassette tapes and cartridge as data storage units
Software	Cartridge Interface	
Printer	Interface	Connects to printers with Centronics I/F
Display	Interface	Connects to color TV or video display
Remote	Control Paddle	Used for education & entertainment
Speaker		8 ohm, 55mm, 0.25W
Power		A switching power supply is provided to convert AC power to required power supply
Dimensions		241 x 175 x 30mm

*Most Apple Soft II BASIC programs will run on the MPF II.

PRO–GRADE SOLDER SUCKER

SEE REVIEW EA DECEMBER 1982
Our claim. The best solder sucker for its price in Australia!
- Unique double diaphragm design
- O-ring seal
- Spare O-rings supplied
- Teflon tip
- Self-cleaning plunger
- One hand operation
- Non slip body
- Pro-grade for heavy usage.
- 225(l) x 28(d)mm
- Spare Teflon tip $1.95

ONLY $11.95

Cat. TH1820

COOLING FANS 240VAC

Quality ball race construction, now you pay no more for quieter, much longer lasting and more efficient ball-bearing fans from Jaycar!

TWO POPULAR SIZES
12 WATTS 80x80x42(d)
$24.95 Cat. YX2510
13.5 WATTS 119x119x25(d)
$27.50 Cat. YX2514

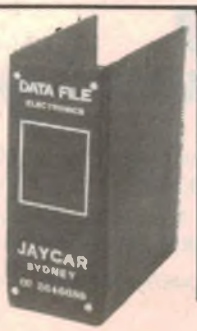
MORE GREAT KITS

Cat. No.	DESCRIPTION OF KIT	Ref.	PRICE
KA1300	FUZZ BOX COMPLETE	EA 1/81	$ 19.50
KA1320	LE GONG	EA 3/81	$ 13.95
KA1346	PC BIRDIES SHORT FORM	EA 5/81	$ 14.95
KA1370	PHOTON TORPEDO	EA 9/81	$ 29.50
KA1400	METRONOME	EA 1/82	$ 16.95
KA1402	EPROM PROGRAMMER	EA 1/82	$ 59.00
KA1406	CUDLIPP CRICKET SHORT FORM	EA 2/82	$ 12.50
KA1408	DIGITAL STORAGE CRO ADAPTOR	EA 2/82	$110.00
KA1430	VOCAL CANCELLER	EA 4/82	$ 19.50
KA1432	VOX RELAY SHORT FORM	EA 4/82	$ 14.50
KA1450	GUITAR BOOSTER	EA 6/82	$ 14.50
KA1452	SUBWOOFER MOSFET AMP	EA 7/82	$ 79.00
KA1454	SUBWOOFER ENCLOSURE	EA 8/82	$ 79.00
KA1476	STEREO SYNTHESISER SHORT FORM	EA 9/82	$ 39.50
KA1478	STEREO SYNTHESISER COMPLETE	EA 9/82	$ 49.50
KA1482	POWER UP KIT COMPLETE	EA 11/82	$ 39.50
KA1484	SUPER SIREN SHORT FORM	EA 11/82	$ 5.00
KA1490	BOGGLE GOGGLES	EA 12/82	$ 9.50
KA1492	PH METER LCD	EA 12/82	$ 69.00
KA1494	PROBE FOR PH METER WITH BUFFER		$ 69.00
KA1498	AM WIDEBAND TUNER	EA 12/82	$249.00
KA1500	LED HEAD SHORT FORM	EA 1/83	$ 9.95
KA1510	STEREO SYNTHESISER SHORT FORM	EA 4/83	$ 11.95
KA1515	ALIGNMENT KIT AM TUNER	EA 3/83	$ 7.95
KE4050	50 WATT AMP MODULE	ETI 480	$ 23.00
KE4052	100 WATT AMP MODULE	ETI 480	$ 27.00
KE4064	PREAMPLIFIER MODULE	ETI 480	$ 30.00
KE4090	GENERAL PURPOSE PREAMPLIFIER	ETI 445	$ 7.99
KE4092	AUDIO LIMITER	ETI 446	$ 12.00
KE4094	BALANCED MICROPHONE PREAMPLIFIER	ETI 449	$ 5.50
KE4105	CAR ALARM	ETI 330	$ 29.50
KE4205	LED LEVEL METER	ETI 458	$ 59.00
KE4206	MC MOVING COIL PREAMPLIFIER	ETI 478	$ 26.60
KE4207	MM MOVING MAGNET PREAMPLIFIER	ETI 478	$ 19.50
KE4210	MOSFET AMPLIFIER	ETI 477	$ 59.00
KE4220	150 WATT MOSFET AMPLIFIER	ETI 499	$ 79.50
KE4222	150 WATT MOSFET PREAMPLIFIER	ETI 498	$ 39.50
KE4225	BRIDGING ADAPTOR	ETI 479	$ 9.95
KE4405	+/– 15 VOLT POWER SUPPLY	ETI 581	$ 17.50
KE4410	POWER SUPPLY 13.8 VOLT/10 AMP	ETI 160	$ 79.50
KE4505	SOUNDBENDER SHORT FORM	ETI 492	$ 24.50
KE4552	UHF CONVERTOR	ETI 735	$ 32.50
KE4554	VIDEO MODULATOR	ETI 760	$ 12.99
KE4560	LOW OHMS METER	ETI 158	$ 29.50
KE4570	POWER SUPPLY 0–30 VOLTS 1 AMP	ETI 162	$ 49.50
KE4600	MODEM SHORT FORM	ETI 644	$169.00
KE4602	MODEM COMPLETE	ETI 644	$189.00
KJ6502	SYNTOM DRUM SYNTHESISER KIT		$ 36.50
KJ6508	CHORUS GENERATOR KIT		$ 69.95
KJ6510	SHORT FORM IONISER KIT		$ 14.50
KJ6511	FULL IONISER KIT		$ 29.50

TRANSISTOR ASSISTED IGNITION — OPTO OPTION

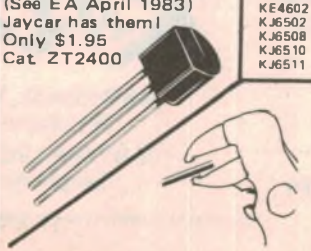
We now have the breakerless OPTO ignition kit for the popular TAI
This kit uses the genuine MIL-SPEC 5401 IC as well as the hermetically sealed Texas photodiode/transistor pair.
GRAB A KIT FOR ONLY $14.50
Cat. KA1507

MAGAZINE BINDER



Keep your precious (and expensive) magazines in order for easy reference. Smart blue colour with gold lettering. Heavy gauge and richly chromed metal fittings.
LOW IMPORT PRICE ONLY $4.95
4 up $4.50 each

2SC2545. The low noise transistor for pre-amps! (See EA April 1983) Jaycar has them!
Only $1.95
Cat. ZT2400

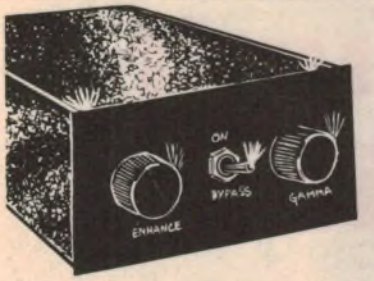


'T – REX'

Our wirestripper, nicknamed 'Tyranosaurus–Rex' is far from extinct! It's a great way to strip all sorts of cable without damaging the conductors. It's also a price breakthrough!!
- Automatically adjusts to insulation diameter.
- One hand operation.
- New low price for an automatic wirestripper

Cat. TH1824
ONLY **9.95**

CTS-FROM JAYCAR



VIDEO SENSATION AT LAST
A Video Enhancer/ Distribution Amplifier designed EXCLUSIVELY for AUSTRALIA

Jaycar has had designed a high quality, high performance Video Enhancer which is specifically for the Australian 625 line 50 frame PAL-D system.
As far as we know it is the ONLY Australian-designed, Australian-built unit available!!
But, guess what? The Jaycar AV6501 Enhancer is CHEAPER than its inferior imported Asian counterparts!!
This unit is professionally designed and University tested! It works and it works well.

SPECIFICATIONS
- 1 Maximum enhancement, not less than +8.3dB @ 2MHz
- 2 Enhance disabled (Bypass) response, DC to 5MHz, −0.5+1.0dB.
- 3 Colour Subcarrier 0dB notch frequency, tunable to 4.43 MHz, −/+ 0.6dB, all settings
- 4 Amplifier group delay, less than 0.075uS
- 5 Signal handling capability not less than 1.35 volts p-p. (Sync. is clipped first.
- 6 Power 12V AC @ 100mA
- 7 Controls, ON/OFF, ENHANCE, ENHANCE/BYPASS SWITCH, CORE/GAMMA CONTROL
- 8 Input connector, RCA socket
- 9 Output connector, RCA socket x 3

DESIGN FEATURES
- 1 A unity gain notch at the colour subcarrier frequency, whose purpose is to prevent chrominance to luminance errors at high enhance levels.
- 2 A closed loop configuration with lead lag compensation to achieve stable, well defined gain
- 3 DC coupling, eliminating large capacitors in series with the video signal and achieving DC response for applications requiring it.
- 4 Low output impedance prior to termination resistors, enabling up to three outputs to exist and be used or left unterminated.
- 5 A level dependent closed loop response or Gamma control ("Core")
- 6 Clip on negative going signals at −87 volts into 75 ohms to prevent sync errors owing to overshoot

240V POWER ADAPTOR $12.95

VALUE **$49.50**

Cat. AV6501

NOT A KIT BUILT, TESTED AND GUARANTEED KIT VERSION ONLY $39.50

Video Enhancer

NOT A KIT BUILT AND TESTED...

Cat. AV6500

$89

Unbelievable but true. This unit enables you to actually IMPROVE a copy of a recorded video tape. How? By amplifying the top end of the video signal by a small amount. This sharpens up the detail of the picture. Dubs can actually look better than the original. Works as a video distribution amplifier as well. Will drive up to 3 VCR's from one VCR input.

VIDEO STABILISER Cat. AV6502

As many of you know, many video tapes, – especially from the USA have the sync pulses suppressed to prevent unauthorised copying of the original dub. This process is fine because it hinders unauthorised re-recording (dubbing) of material. It is annoying though when you hire the original and find that the "Copyguard" is causing problems with your TV. The AV6502 re-inserts the sync pulses automatically and restores stability.
WARNING! The AV6502 is intended solely for the use above. Whilst the AV6502 will virtually remove copyguard on a tape copy (and hence restore the picture) it is against the law to unlawfully copy copyright material.
The AV6502 looks almost identical to the AV6500 **ONLY $79.95**

NEW *Touch Sensitive Light Dimmer*

Ref: EA April 1983
Complete kit including quality HPM wall plate with attractive brushed metal insert
The Jaycar kit is absolutely complete including a small dial spring which can be used to connect the PCB to the wall plate. (Beware of other kits that do not include this).
In addition to the above, we supply the High Voltage Resistors ALREADY SOLDERED in as a foolproof safety feature!
Buy the complete kit for this exciting project for only
Cat. KA-1508

only $19.95

ETI 160 POWER SUPPLY

Ref: ETI July 1982
13.8V DC 7.5 amps continuous
10 amps intermittent
Great for powering your mobile rig at home! This regulated, short circuit proof unit is perfect.
Cat. KE4410 ONLY $79.50

We are proud to announce a great new range of DIRECT IMPORT all – ABS plastic cases for the discerning electronics enthusiast. Quite frankly we are sick and tired of those black flimsy styrene boxes with their Aluminium lids. They split, they shatter and they look plain ORDINARY.
Shown below is a range of boxes that is going to revolutionise your small projects. Each box has a precision fitting MOULDED lid (in the same colour as the box) with moulded-in brushes to take metal thread countersunk screws. True quality. Naturally each box has slots formed in the sides to take PCB's etc. Most are available in 4 Beautiful colours – Black is one of them!!
Shown also are 2 new sizes of die cast box. Note the sizes.

CONSOLE BOXES

EACH UNIT HAS AN ALUMINIUM FRONT PANEL

SIZE – 161(W) x 96(D) x 39(HF) x 57(HR)mm
Cat. HB6200 – ORANGE Cat. HB6201 – GREY Cat. HB6202 – BLUE Cat. HB6203 – BLACK
PRICE 1 – 9 UNITS ONLY $6.95 EACH; 10 OR MORE $6.45 EACH

SIZE – 215(W) x 130(D) x 47(HF) x 73(HR)mm
Cat. HB6210 – ORANGE Cat. HB6211 – GREY Cat. HB6212 – BLUE Cat. HB6213 – BLACK
PRICE 1 – 9 UNITS ONLY $12.95 EACH; 10 OR MORE $11.95 EACH

SIZE – 105(W) x 143(D) x 32(HF) x 56(HR)mm
Cat. HB6220 – GREY Cat. HB6221 – BLUE Cat. HB6222 – BLACK
PRICE 1 – 9 UNITS ONLY $7.95 EACH; 10 OR MORE $7.45 EACH

SIZE – 170(W) x 143(D) x 32(HF) x 56(HR)mm
Cat. HB6230 – GREY Cat. HB6231 – BLUE Cat. HB6232 – BLACK
PRICE 1 – 9 UNITS ONLY $9.95 EACH; 10 OR MORE $9.45 EACH

SIZE – 170(W) x 214(D) x 32(HF) x 82(HR)mm
Cat. HB6240 – GREY Cat. HB6241 – BLUE Cat. HB6242 – BLACK
PRICE 1 – 9 UNITS ONLY $12.95 EACH; 10 OR MORE $11.95 EACH

RECTANGULAR BOXES

SIZE – 100(L) x 50(W) x 25(D)mm
Cat. HB6120 – ORANGE Cat. HB6121 – GREY Cat. HB6122 – BLUE Cat. HB6123 – BLACK
PRICE 1 – 9 UNITS ONLY $3.95 EACH; 10 OR MORE $3.45 EACH

SIZE – 112(L) x 62(W) x 31(D)mm
Cat. HB6130 – ORANGE Cat. HB6131 – GREY Cat. HB6132 – BLUE Cat. HB6133 – BLACK
PRICE 1 – 9 UNITS ONLY $4.75 EACH; 10 OR MORE $4.25 EACH

SIZE – 120(L) x 65(W) x 40(D)mm
Cat. HB6140 – ORANGE Cat. HB6141 – GREY Cat. HB6142 – BLUE Cat. HB6143 – BLACK
PRICE 1 – 9 UNITS ONLY $4.95 EACH; 10 OR MORE $4.45 EACH

SIZE – 150(L) x 80(W) x 50(D)mm
Cat. HB6150 – ORANGE Cat. HB6151 – GREY Cat. HB6152 – BLUE Cat. HB6153 – BLACK
PRICE 1 – 9 UNITS ONLY $5.45 EACH; 10 OR MORE $4.95 EACH

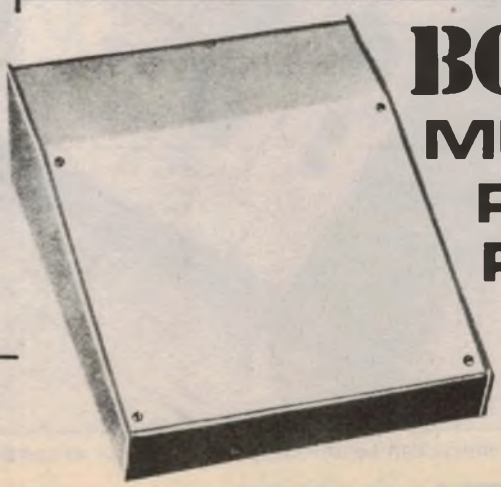
SIZE – 190(L) x 110(W) x 60(D)mm
Cat. HB6160 – ORANGE Cat. HB6161 – GREY Cat. HB6162 – BLUE Cat. HB6163 – BLACK
PRICE 1 – 9 UNITS ONLY $9.95 EACH; 10 OR MORE $9.25 EACH

DIE CAST BOXES

NATURAL GREY FINISH
SIZE: 50 x 50 x 31mm Cat. HB5010 1–9 $3.95 each; 10 or more $3.45 each
SIZE: 190 x 110 x 60mm Cat. HB5016 1–9 $12.95 each; 10 or more $11.95 each

JAYCAR

SEE THE OTHER JAYCAR ADS IN THIS MAGAZINE FOR OUR STORE ADDRESSES AND PHONE NUMBERS....



BOXES MULTI PUR-POSE

Versatile effects unit for creative musicians

What would you say to a versatile "Effects Unit" that can create phasing, flanging, echo, reverb and vibrato effects for around $75? This unit does all that and is easy to build.

by COLIN DAWSON

At the heart of our new Effects Unit is a bucket brigade device (BBD) which functions as an analog delay line. Each of the various sound effects can be selected individually or in combination for some really offbeat effects. Whether you're a professional musician or an aspiring amateur, this unit will add a whole new dimension to your music.

Three input sockets, each corresponding to a different input signal level, are featured on the new design. These might, for example, be set up to accommodate an electret microphone, an electric guitar and a line input. You don't have to use the exact set-up that we used, however – there is plenty of scope for customising the Effects Unit.

Sound effects

For those readers not familiar with the subtleties of modern music, the advantages of an effects unit might not be immediately apparent. If you find yourself scratching your head in bewilderment at the mention of "phasers" and "flangers", the following description of the most popular effects will be of assistance.

Let's begin with the echo effects. An echo is a well known naturally occurring phenomenon and, in electronic form, is fundamental to most of the effects in this project. Our circuit has two categories of echo effect which we have labelled "single" (phaser) and "reverb" (flanger). These effects are selected by a three-position slide switch (off, single, reverb).

Each of the various effects can be selected individually or in combination.

Single echo: When single echo is selected, the original signal is presented to the output of the unit together with a delayed version of this signal. The amount of delay will be somewhere between 1ms and 25ms and is adjustable by means of a delay control. It's worth pointing out, however, that a single echo is not a very powerful effect. It is only at the maximum delay setting that the echo becomes really apparent as a separate event.

Phasing: Phasing is achieved by mixing the original signal with an echo of relatively short delay. The amount of phase shift which occurs through the delay line will depend on the frequency of the signal. For some frequencies, this will be 180°. In this case, mixing the delayed signal with the original will cause almost total cancellation. At other frequencies, where little phase shift has occurred, additive mixing will result.

The response curve for this effect will consist of a series of peaks and troughs. Thus, the circuit behaves as a "comb filter". The result is a metallic sound that can be made stronger by slowly sweeping the notches of the comb filter up and down the audio band (in our design, by applying a small amount of vibrato).

Reverb: If a certain amount of delayed signal is fed back to the input of the delay stage, it is possible to achieve multiple, decaying echos. This is known as reverberation and, by virtue of an adjustable depth control, can produce some varied and extraordinary sounds.

With a short echo delay and maximum

reverb depth, *flanging* is achieved. This is a more profound version of phasing and makes the music sound as though it is travelling down a long piece of drain-pipe. Increasing the echo delay produces the classical "reverb" sound until finally the original sound is virtually unrecognisable amidst the mass of echoes.

At slightly less than maximum reverberation depth, a human voice will sound very much like a Cylon voice, losing all its individual tonal quality and becoming very metallic.

When the echo switch (S1) is set to "off", only the delayed signal appears at the output. In other words, the signal is still routed through the delay line. The reason for this is that it is necessary to be able to vary the signal delay to achieve the vibrato effect.

Vibrato: If the amount of delay applied to a signal is varied continuously, the frequency of the output signal will appear to vary proportionately. In fact, we can achieve a frequency modulated output. This effect is known as vibrato and is commonly used by vocalists (without any electronic assistance!).

Vibrato is usually set at between 2 and 7Hz (ie, the tone is modulated at this frequency). For this reason, our effects unit can be switched (S2) to either 2Hz or 7Hz vibrato. The amount of vibrato is adjustable by means of a depth control which determines the amount by which the signal frequency is shifted either side of normal!

Only a small depth setting is necessary to simulate natural vibrato. At moderate depth settings, a guitar will sound quite "Hawaiian" while at maximum depth both guitar and voice will become virtually unrecognisable.

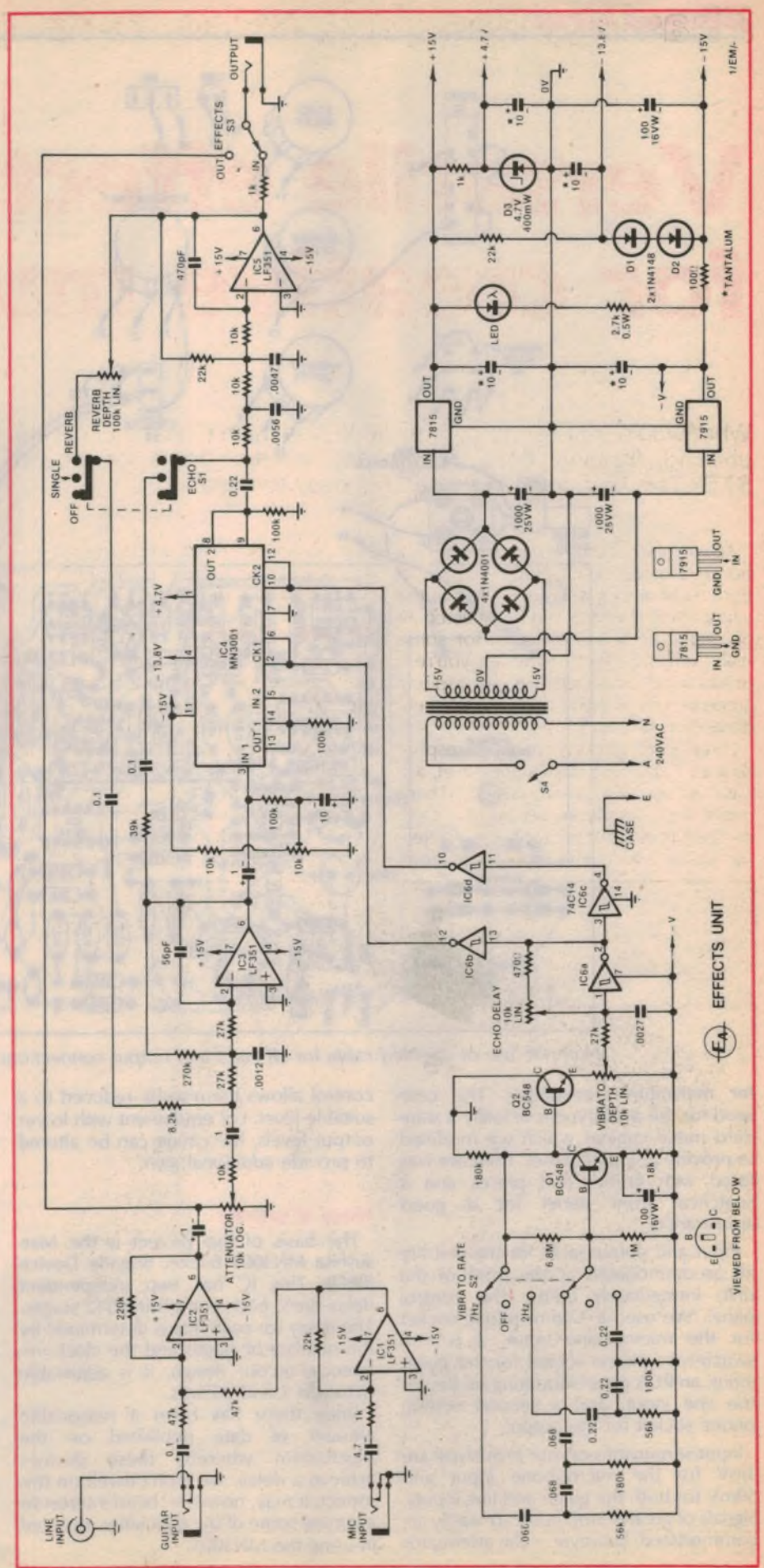
The only other controls on the front panel are an input attenuation control, an effects on/off switch (S3), and a power on/off switch (S4). As its name implies, the effects switch simply switches the Effects Unit in and out of circuit. In the off position, the input signal bypasses the delay line and is fed directly to the output.

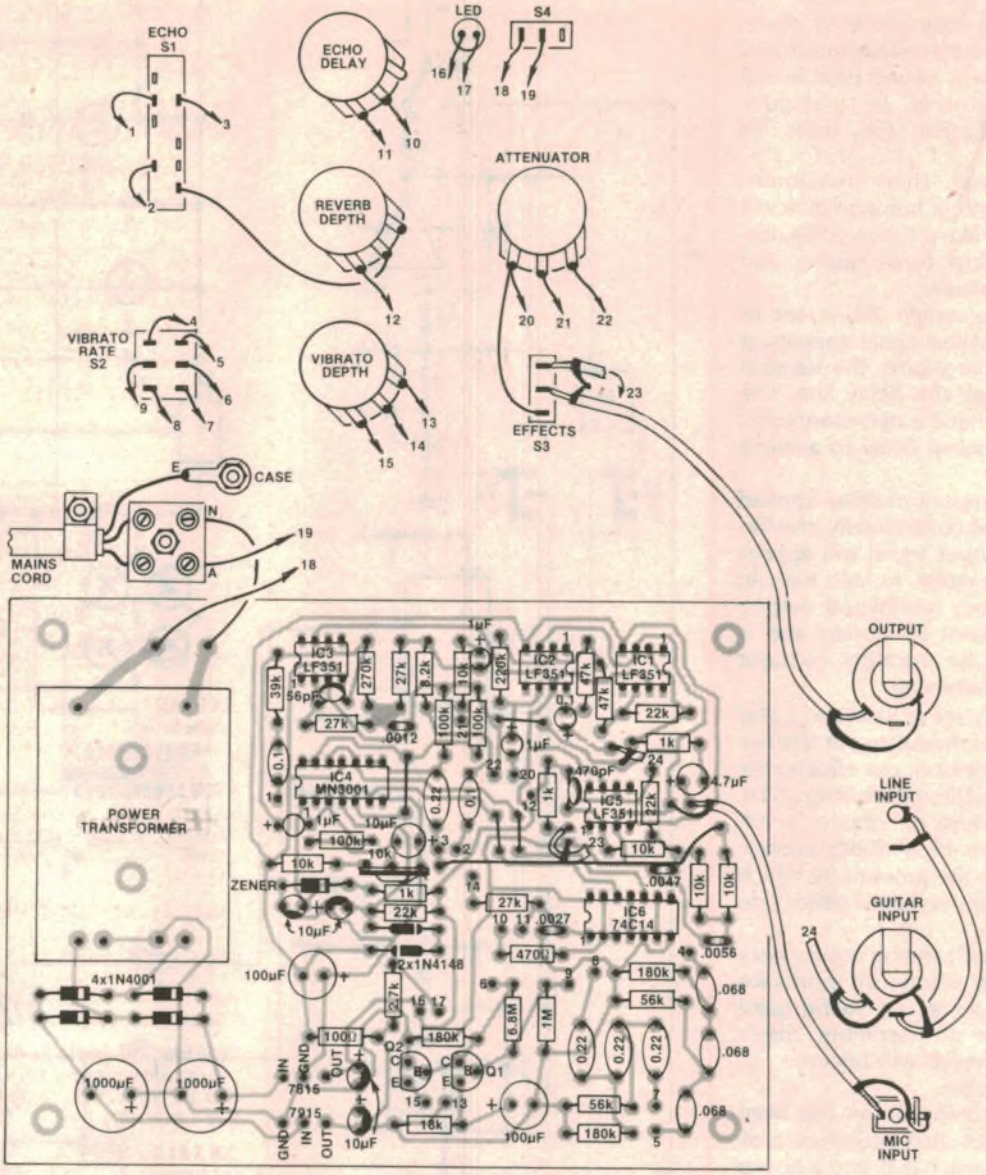
Although we chose to mount the effects on/off switch on the front panel, this function could be easily operated by remote control. A foot-operated switch would be ideal for this purpose.

That outlines the basic features of the Effects Unit. However, by combining effects, it is possible to produce many additional sounds to those described above. Obviously any attempt to give an accurate description of these sounds is bordering on the futile – the only way to get a worthwhile appreciation is to build the Effects Unit and have a listen!

Presentation

All control facilities for our new Effects Unit are laid out on a sloping front panel





Note the use of shielded cable for all input and output connections.

for maximum accessibility. The case used for the prototype is actually a standard metal cabinet which we modified to provide a sloping panel. This case was fitted with timber end pieces and a Scotchcal front panel for a good appearance.

Input and output jacks for the unit are all accommodated at the front of the unit, immediately below the control panel. We used a 3.5mm phone socket for the microphone input, a 6.5mm switch-type phone socket for the guitar input, an RCA panel-mounting socket for the line input, and a second 6.5mm phone socket for the output.

Input sensitivities on our prototype are 1mV for the microphone input and 50mV for both the guitar and line inputs. Signals of greater amplitude are easily accommodated, however – the attenuator control allows them to be reduced to a suitable level. For equipment with lower output levels, the circuit can be altered to provide additional gain.

How it works

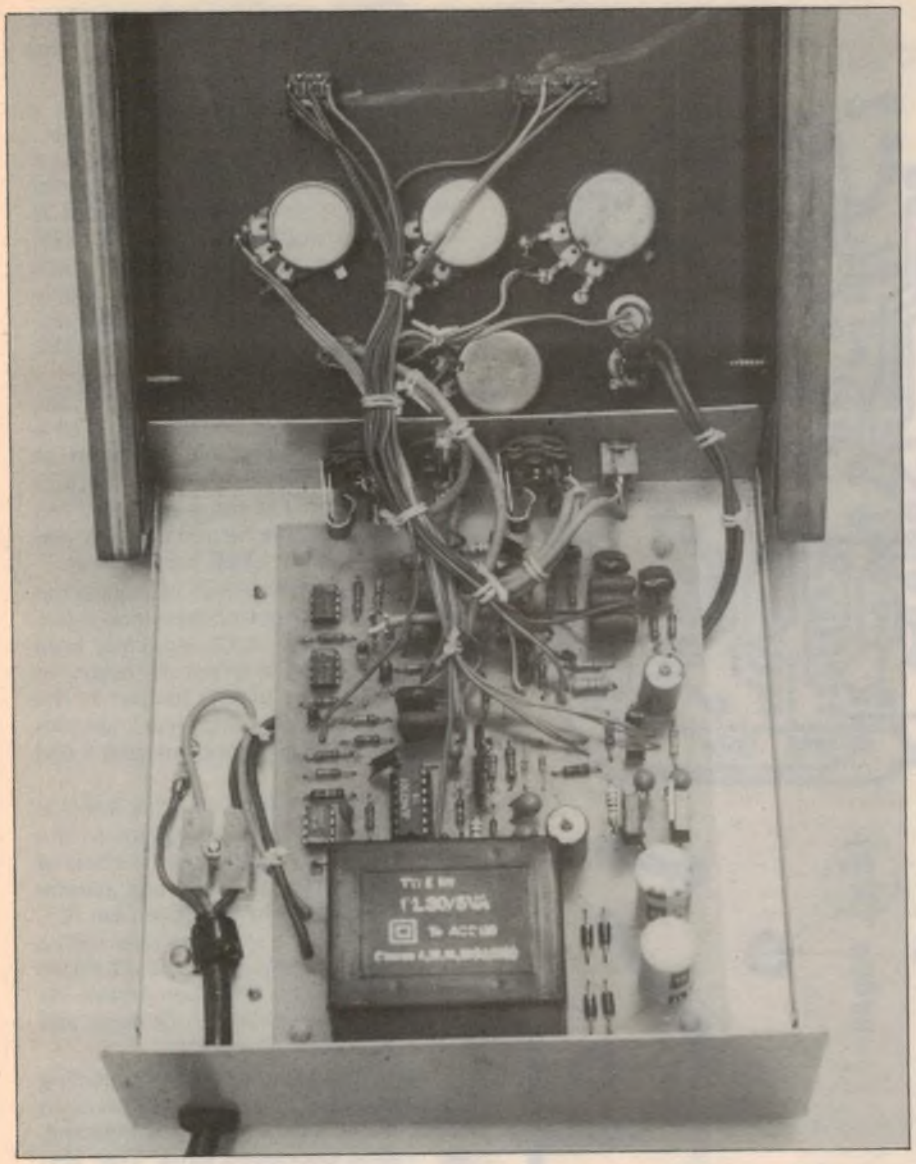
The basis of this project is the Matsushita MN3001 Bucket Brigade Device (BBD). This IC has two independent delay lines, each comprising 512 stages. The delay for each line is determined by the number of stages and the clock frequency. In our design, it is adjustable between 1 and 25.6ms.

Since there has been a reasonable amount of data published on the mechanism whereby these devices achieve a delay, we won't dwell on this aspect. It may, however, be of interest to examine some of the difficulties involved in using the MN3001.

In order to pass an analog signal from input to output, each delay line requires two clock signals. These signals must be in antiphase (ie, one high while the other is low and vice versa). The output of each delay line is the analog signal plus a significant amount of clock noise!

This characteristic dictates that the clock must operate at a supersonic frequency – ie, higher than 20kHz. Because the delay for each line is 512 divided by twice the clock frequency, this immediately limits the maximum delay to 12.8ms per delay line.

The clock frequency determines not only the delay but also the frequency response of the BBD. The highest frequency which can be passed through the delay line is generally regarded as being one-third that of the clock frequency or, for a higher level of distortion, one half



View inside the completed prototype. Keep all mains wiring neat and tidy, and sleeve the connections to the power switch (S4) to avoid electric shock.

of the clock frequency. Therefore, the clock frequency selected, is a compromise between delay period and frequency response. In the interests of low distortion, we opted for a maximum frequency which is one-third of the clock (ie, about 7kHz).

One further limitation of an analog delay line is the loss of signal through it. This is in the vicinity of 8.5dB per line. In our design, with the two lines connected in series, this amounts to 17dB. This loss must be made good with gain elsewhere in the circuit.

The three inputs on the Effects Unit are arranged such that the microphone input will be mixed with either the guitar or line level inputs. The guitar input, however, has priority over the line level input so that when both are connected, only the guitar signal will be used.

The most sensitive of the three inputs is the microphone input which is connected to IC1. This is a FET input op amp such as the TL071 or LF351. ICs 2, 3 and 5 are also of this type.

IC1 is configured as an inverting amplifier with an input impedance of 1kΩ and a gain of 22. This will suit electret microphones as typically supplied with portable cassette recorders. The 22kΩ feedback resistor determines the gain and altering its value will have a proportional effect on gain.

Assuming that the microphone has an output of almost 1mV, this will correspond to 20mV at the output of IC1. A 47kΩ resistor feeds this signal to the inverting input (pin 2) of IC2.

Pin 2 of IC2 is also connected to the guitar input socket (via a series 47kΩ resistor and 0.1μF capacitor). This

THE ZX SPECIALISTS
The Professionals who care!

COMPUTERS

SINCLAIR ZX 81. . . . . $149.95 (add $7. for p&p)
SPECTRUM 16K Version. $315 (add $7. for p&p)

HARDWARE

16K SPECIAL RAM PACK, (cased) $69.50 (incl p&p)
Suitable for ZX 80/81.

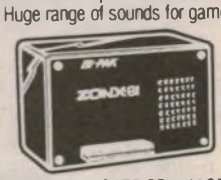
32K D RAM PACK (cased). . . . . $125.00 (incl p&p)
Suitable for ZX 81. No extra PSU required. Plugs into expansion port behind printer.

X ROM CARD. . . . . $69.95 (incl p&p)
Fits inside our 16K Ram Pack. Has built-in printer interface to use a printer other than ZX Printer and contains EPROM Burner for Basic and Machine code programs.

PROGRAMMABLE CHARACTER GENERATOR. . . . . $95.00 (incl p&p)
(Fully assembled) Suitable for ZX 81/80 fitted with 8K ROM. Create own character sets, high resolution graphics etc. FREE supporting software of Demmo, 2 Games and instructions.

VIDEO UPGRADE UNIT for ZX 80. . $38.50 (incl p&p)
(Fully assembled) Upgrade to fully animated graphics of ZX 81. Will now run in SLOW MODE. Requires 8K ROM—not included.

ZON X-81 SOUND UNIT. . . . . $69.50 (add $4. p&p)
Self contained unit, plugs in, no extra power required, works with 16K RAM and printer. Uses 3 channel sound chips. Huge range of sounds for games and music.



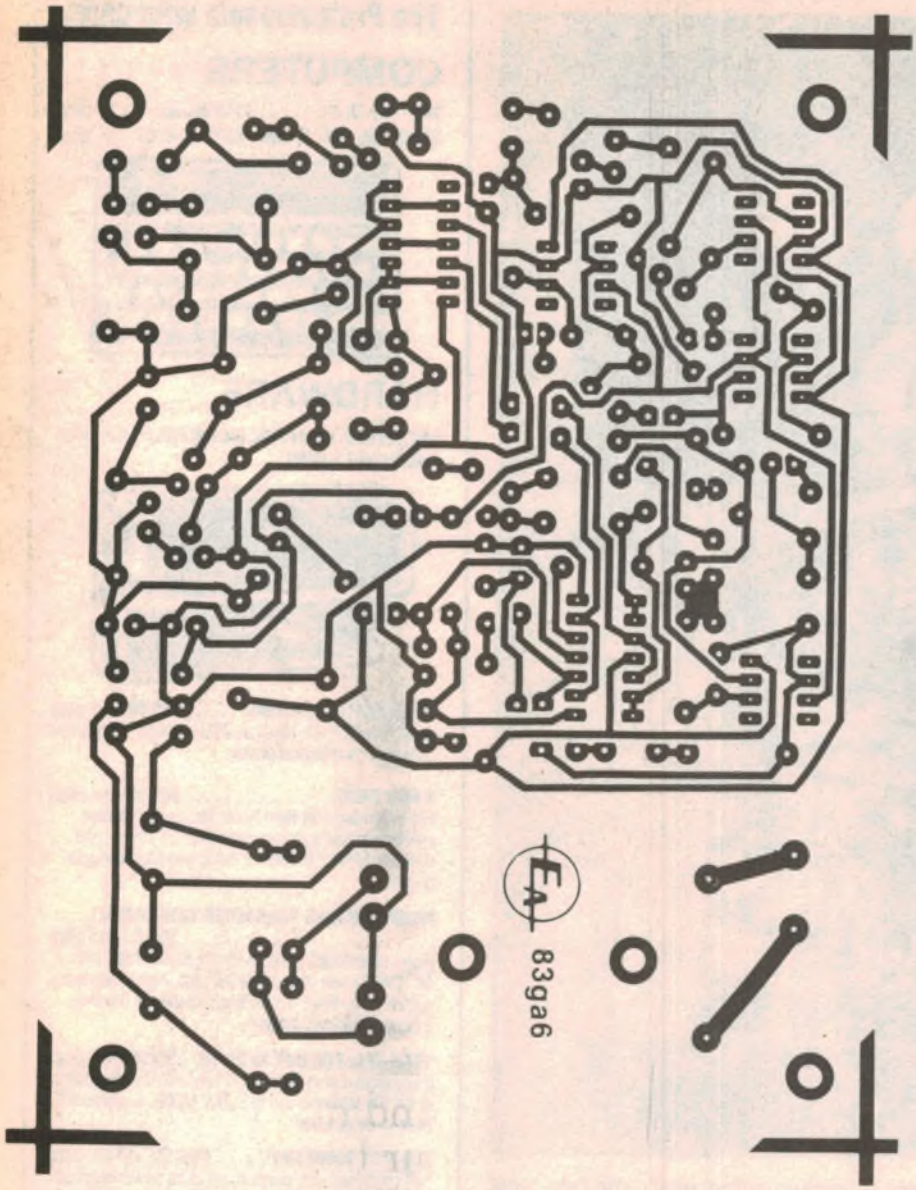
SINCLAIR PRINTER. . . . $175.00 (add $7. for p&p)
ZX Printer Paper. $5.50 per roll (add $1.50 for p&p)
8K ROM for ZX 80. . . . . $75.00 (for ROM, Manual and Keyboard overlay)

COMING SOON. . . . . KITS FOR ZX 80/81.

Payment by cheque, money order or Bankcard.
For further information send a large S.A.E. to:

VENDALE
VENDALE PTY. LTD.,
Dept. A7. Box 456, Glen Waverley,
Vic. 3150. Australia. Ph: (03) 232 0444.

VEN 8801



Above is an actual-size reproduction of the PCB artwork. Ready-etched boards (and front panels) are available from the usual retailers.

particular socket must be a switching type so that signal is supplied from the RCA line level input socket unless a guitar jack is inserted. IC2 has a gain of five so that its output will typically be in the vicinity of 100-200mV for microphone and guitar signals and 500mV for line input signals.

The output of IC2 is subsequently fed via the attenuator control and then to active filter IC3. This is a low pass filter with a −3dB point at 7kHz (one-third of the minimum clock frequency). The roll off above 7kHz is 12dB per octave.

The active filter has a gain of 10 which gives us a nominal signal level of up to 2V RMS for the microphone and guitar signals and 5V RMS for line signals. The MN3001 (IC4) can accept input signals at a maximum of 2V RMS – higher levels will cause a substantial increase in distortion, with clipping occurring at 2.5V!

Since the level of clock noise present at the output of the MN3001 is fairly constant, it is desirable to maintain the 2V input signal level in order to achieve the optimum signal to (clock) noise ratio. The purpose of the attenuator control now becomes apparent – it enables the optimum signal level to be achieved with different input sources. It is not a volume control.

The delay line

The output of IC3 is coupled via a 1μF capacitor to the input of delay line 1 (pin 3 of IC4). A 10kΩ resistor and a 10kΩ trimpot connected in series across the −15V rail set the bias on pin 3 to around −3.7V. In practice, the exact bias level is determined by listening to the output and adjusting the trimpot for the cleanest signal.

The two clock signals for delay line 1 are connected to pins 2 and 12 respectively. These are derived from IC6, a 74C14 CMOS hex Schmitt trigger. One of the Schmitt trigers (IC6a) is connected as an oscillator while IC6c inverts the clock output to provide the antiphase clock signal. IC6b and IC6d are simply employed as buffers. The clock frequency is adjustable by means of the 10kΩ echo delay potentiometer.

Due to the internal circuitry of the MN3001, the output of each delay line is presented in complementary form at two pins. For delay line 1, these two pins are 13 and 14. For our purposes these two pins need only be tied together and to ground with a 100kΩ load resistor.

The output of delay line 1 is connected directly to the input of delay line 2 (pin 5). Because there is DC coupling from output to input, it is not necessary to provide separate biasing for pin 5. The two clock inputs for delay line 2 are pins 6 and 10, and the outputs are pins 8 and 9.

Note that the output of delay line 2 is coupled via an 0.22μF capacitor to the echo switch, S1. Ignore the function of the switch for the moment and assume that the signal is fed to active filter IC5. This filter is also a low pass type with a −3dB point at 7kHz and a roll off above this frequency of 18dB per octave. Its purpose is to eliminate clock noise and harmonics higher than 7kHz.

That outlines the method of obtaining the delayed signal or echo. However, in order for the echo to have any meaning, the original undelayed signal must also be present. This is obtained from the output of IC3 and is fed via the echo switch for mixing with the output of delay line 2.

Reverberation

For reverberation to occur, it is necessary to have a system of multiple echoes. This brings us to the second function of the echo switch – to provide a feedback path. When reverb is selected, the output of IC5 is coupled back to the input of IC3 where it is mixed with the incoming signal. In this way, it is possible to provide continuing echoes even after the original sound has ceased.

Due to losses through the delay line, the echoes will be decaying, although the time taken for them to vanish will depend on the amount of signal coupled back to IC3. The reverb depth control is provided for this purpose – it can adjust the reverb depth from negligible to the point where sounds take about one se-

The DICK SMITH/EA Electronic Roulette Wheel

A Casino in your loungeroom!

Wow! All the fun and excitement of Las Vegas. . .Wrest Point. . .even Forbes St.
Now you can have a completely random electronic roulette wheel — without the bias of commercial units!

- Our exclusive black printed circuit board with magnificent red silk-screened 'wheel' really looks superb - and it's really easy to build.
- Exclusive playing 'mat' with casino table layout and full instructions on how to play roulette).
- Complete kit including all components (except battery!), base board and assembly instructions - ideal for beginners.
- Great school project to demonstrate logic & integrated circuits - and you could win a fortune at recess!

Beware of other kits which don't offer you the incredible advantages of this superb Dick Smith Kit.

Cat No. K 3389

AMAZING VALUE

$29.50 'INCLUDING EXCLUSIVE PLAYING MAT'

and don't forget our breath tester!

Beware boys in blue and booze buses bailing belligerent Brabhams blowing bad breath into bags before banning. Check out our breath tester kit - it could be the answer to your broblems.

ONLY

$29.95

Cat No. K 3391

DICK SMITH Electronics

A499/JCP

bankcard welcome here

HFC

See page 98 for full address details

Special offer!
INTRODUCTORY PRICE!

40 WATT
KYOCERA
SOLAR PANEL

As featured in ABC programme "Towards 2000"

APPLICATIONS INCLUDE

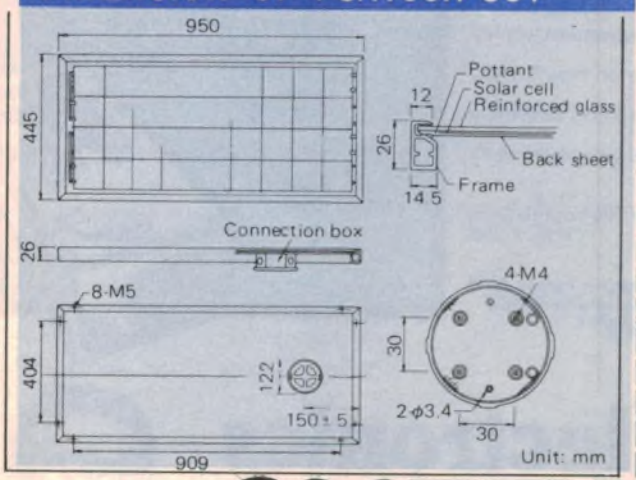
Communications
VHF/UHF relay stations, indoor broadcasting systems for schools, radar installations, meteorological observation telemeters (water, rain and snow levels), transceivers, CATV.

Agriculture
Irrigation pumps, pumps for drop cultures, hydroponic cultures and livestock watering, insect light traps and insect prevention lamps for fruit orchards, greenhouse control and watering systems, electric fences.

Domestic
Power sources for mountain cabins and bungalows, remote homes not connected to main power.

Medicine
Medical clinics in remote areas, refrigeration for medical and pharmaceutical goods.

DIMENSION OF PSA100H-361



SPECIFICATIONS

Model No. PSA100H-361
Maximum output power 40W
Optimum operating voltage 16.2V
Optimum operating current 2.47A
Open circuit voltage 19.6V
Short circuit current 2.70A
Weight 6.0kg

COMPLETE & MAIL THIS ORDER FORM TODAY!

To: Amtex Electronics, Suite 104, 11 Spring St., Chatswood, NSW 2067.

Please send me ..... panels at $495 each: $.....
rail freight at $10 each: $.....
TOTAL: $.....

I enclose cheque/postal order for $.....
OR please charge my Bankcard No.

4 9 6 [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

expiry date: .....

Signature .....
Telephone order: order call (02) 411 1323

NAME: .....

ADDRESS .....

..... STATE ..... POSTCODE .....

NEAREST RAILWAY STATION: .....

TG4502

AMTEX ELECTRONICS
A DIVISION OF TELCON AUSTRALIA PTY. LIMITED

PARTS LIST

1 printed circuit board, code 83ga6, 144 x 107mm
1 metal case, 160mm(W) × 70mm(H) × 184mm(D)
1 Scotchcal label, 122 x 155mm
1 30V centre-tapped PC mounting transformer, Ferguson PL30/5VA or Arlec AL7VA/30
1 3-pin mains plug and cord
1 mains cord clamp
1 rubber grommet
1 2-way insulated terminal block
1 solder lug
4 6mm plastic PCB supports
4 knobs
1 2-pole, 3-position slide switch
1 2-pole, 3-position miniature toggle switch
2 SPDT miniature toggle switches
1 6.5mm jack socket (switching type)
1 6.5mm jack socket
1 3.5mm jack socket (shorting type)
1 panel-mounting RCA socket
1 14-pin IC socket
2 timber side pieces to suit

SEMICONDUCTORS
2 1N4148 diodes
4 1N4001 diodes
1 LED (red)
1 4.7V/400mW zener diode
1 7815 (3-terminal) +15V regulator
1 7915 (3-terminal) −15V regulator
2 BC548 NPN transistors
1 74C14 CMOS hex Schmitt trigger
1 MN3001 dual BBD
4 LF351 or TL071 FET-input op amps

CAPACITORS
2 1000μF/25V electrolytics
2 100μF/16V electrolytics
4 10μF/25V tantalum
1 10μF/16V tantalum or low-leakage (LL) electrolytic
1 4.7μF/16V tantalum or LL electrolytic
3 1μF/16V tantalum or LL electrolytics
4 0.22μF metallised polyester (greencap)
1 0.1μF/16V tantalum or LL electrolytic
2 0.1μF greencap
3 .068μF greencaps
1 .0056μF greencap
1 .0047μF greencap
1 .0027μF greencap
1 .0012μF greencap
1 470pF ceramic or polystyrene
1 56pF ceramic

RESISTORS (¼W, 5%)
1 × 6.8MΩ, 1 × 1MΩ, 1 × 270kΩ, 1 × 220kΩ, 3 × 180kΩ, 3 × 100kΩ, 2 × 56kΩ, 2 x 47kΩ, 1 x 39kΩ, 3 x 27kΩ, 3 x 22kΩ, 1 x 18kΩ, 5 x 10kΩ, 1 x 8.2kΩ, 1 x 2.7kΩ (½W), 3 x 1kΩ, 1 x 470Ω, 1 x 100Ω, 1 x 100kΩ linear potentiometer, 2 x 10kΩ linear potentiometers, 1 x 10kΩ log potentiometer, 1 x 10kΩ vertical trimpot (10mm).

MISCELLANEOUS
Hook-up wire, rainbow cable, shielded cable, machine screws and nuts, solder, etc.

cond to decay (if the depth were any greater than this, instability would result and the echos would not decay at all).

Vibrato

When vibrato is selected, a sine wave is applied to the input of IC6a. This modulates the clock frequency, causing the amount of delay to be correspondingly modulated. The frequency of any signal passing through the delay line will thus be phase modulated – hence the vibrato effect.

It is important that this modulation be imposed in the form of a sine wave to achieve a natural sounding vibrato. In this circuit, sine waves are derived from a simple phase shift oscillator consisting of transistor Q1. By switching in different RC feedback networks, sine waves at two different frequencies (2Hz and 7Hz) are obtained.

Emitter follower Q2 buffers the output from Q1 and feeds the signal to pin 1 of IC6a via a 10kΩ potentiometer and a 27kΩ series resistor. The 10kΩ potentiometer is used to adjust the vibrato depth.

To use vibrato without any other effects, the echo switch should be set to off. This will allow only the delayed signal to be passed to the output – ie, there will be no original signal present and hence no phase induced effects.

The power supply is conventional and consists of a 30V centre-tapped transformer driving a bridge rectifier, with filtering provided by two 1000μF 25VW electrolytic capacitors. Regulated ±15V supplies are derived using positive and negative 3-terminal regulators, while zener diode D3 provides the +4.7V rail. The remaining −13.8V rail is derived using diodes D1 and D2.

Decoupling of the regulator outputs is provided by two 10μF tantalum capacitors, while a LED connected in series with a 2.7kΩ resistor across the ±15V rails provides power on/off indication.

Construction

The printed circuit board (PCB) used for this project is coded 83ga6 and measures 144 x 107mm. Before soldering any components on it, check that the larger devices will actually fit into their intended mounting holes. If any holes need to be re-drilled, now is the time to do it.

The only components which are not polarised (ie, can be fitted to the PCB either way round) are the resistors, metallised polyester capacitors (greencaps), and ceramic capacitors. All other components must be inserted with the correct polarity. Take the usual precautions when soldering the CMOS 74C14 (ie, earth the soldering iron barrel and solder the supply connections first.) We suggest that you use a socket for the MN3001 device – at $16 each they're far too expensive to risk.

We recommend the use of PC stakes to facilitate external wiring connections, but not for connections to the transformer primary.

With assembly of the PCB finished, attention can be turned to the metalwork. It is essential to use a metal case for this project to provide correct earthing for the mains power supply. The shielding afforded by a metal case will also make the project far less susceptible to interference from spurious RF signals.

Our "non-sloping" front-panel case was modified to a sloping-panel design with the assistance of a pair of tin-snips and a hacksaw. This is admittedly a tedious task, but it is worth the effort of doing a neat job.

The job of moditying the case involves trimming the height of the front of the base to 38mm. The lid of the case, which also forms the two sides, is then modified to suit the base. This is done by measuring down 38mm from the top/front corner of the lid on each side, and scribing a line from this point to the bottom rear corner. The two side pieces beneath the scribed lines are then cut away using a hacksaw.

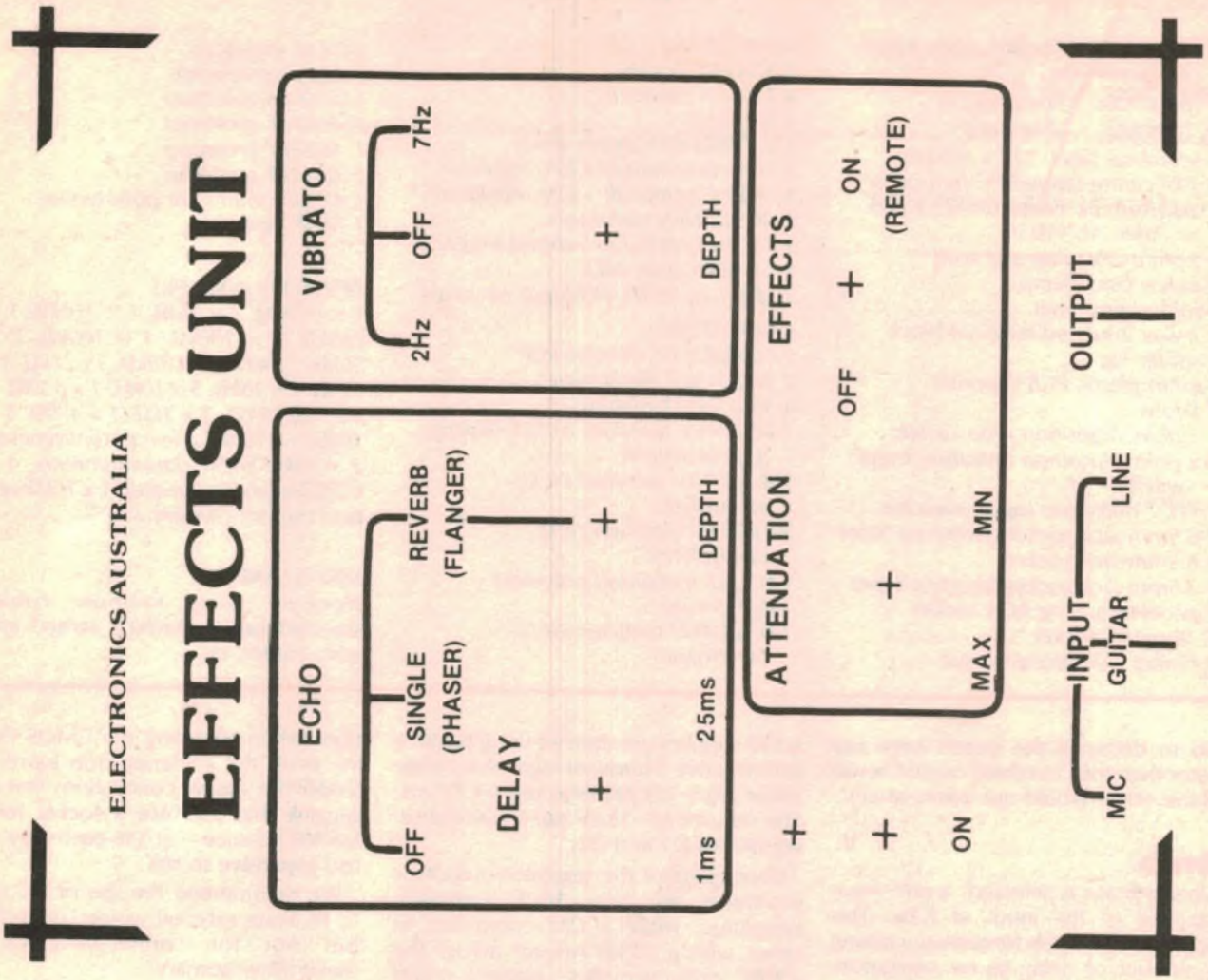
Once this is done, you will also find it necessary to trim the rear edges of the two sides so that they line up with the back of the case. In addition, new moun-

We estimate that the current cost of components for this project is approximately

$75

This includes sales tax.

FRONT PANEL ARTWORK



Here is an actual-size reproduction of the front panel artwork.

ting holes have to be drilled in the sides for the case mounting screws.

If you are fitting the timber end pieces, use the box sides as a template for marking them out. Don't forget that each piece will need two holes for the mounting screws. The timber is now ready for any stain or varnish that you may wish to apply.

Before affixing the Scotchcal label, it is a good idea to spray it with a clear lacquer (eg, Estapol) to prevent scratches. When dry, it can be applied to the front panel and used as a drilling template. You can now install the various front panel controls, the LED, and other items of hardware into the case. The PCB is mounted on the base using four 6mm plastic stand-offs.

The internal wiring can now be completed according to the wiring diagram. Rainbow cable is suitable for most of the wiring connections, but be sure to use shielded cable where indicated. The mains wiring to on/off switch S4 and to the transformer primary must be run using 250VAC-rated hook-up wire.

Take care with the mains wiring. The mains cable enters through a grommeted hole on the rear panel and must be anchored securely with a cord clamp. The active (brown) and neutral (blue) leads are connected to an insulated terminal block, while the earth lead (green/yelow) goes to a solder lug bolted to the chassis. It is a good idea to sleeve the connections to switch S4 to avoid the possibility of electric shock.

With construction now completed, go back over your work and carefully check for possible wiring errors. In particular, check that the ICs and transistors are correctly oriented and that the mains wiring is correct.

Testing, testing!

Before plugging in the MN3001, it is a good idea to check supply voltages first. Assuming that everything is correct, you can proceed with the test procedure.

To test the Effects Unit, plug in a guitar or a microphone and connect the unit to an amplifier and loudspeaker. Set the amplifier volume to a low level, select "Effects Off" and check that the guitar is amplified as normal.

Next, set all controls to "Off" or minimum depth and set the attenuation control to maximum. Select "Effects On" and gradually reduce the attentuation until the signal becomes audible. Provided this occurs without an excessive amount of noise being present, the delay line circuitry is functioning normally.

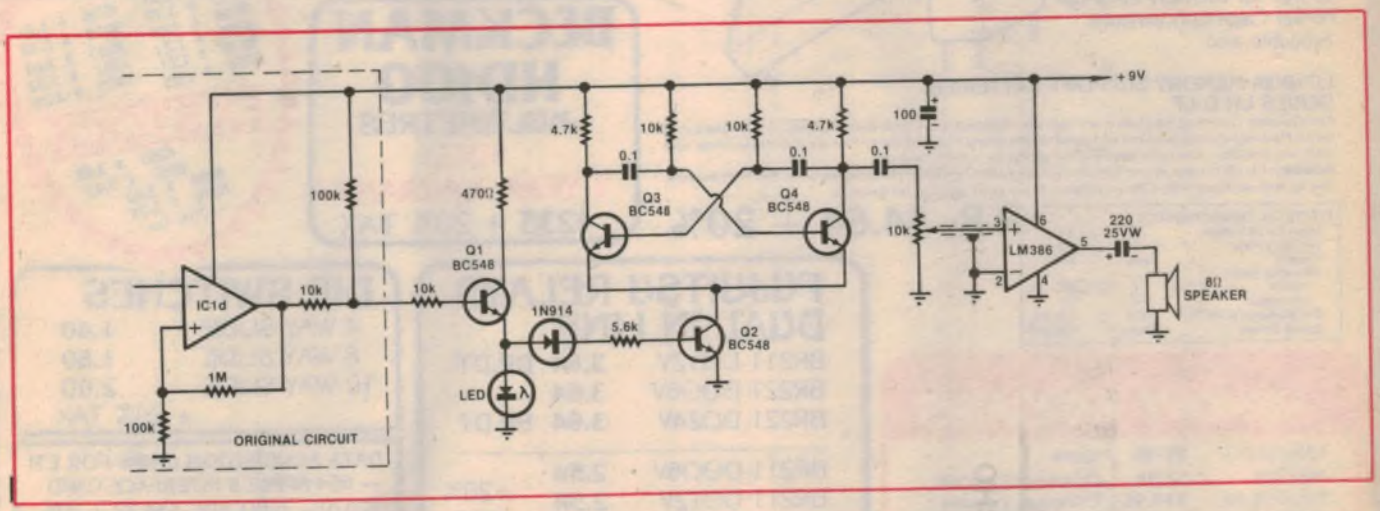
The next step is to set the bias voltage on pin 3 of the MN3001 for the cleanest signal. This is accomplished with the 10kΩ trimpot on the PCB. Make only small adjustments and wait a few seconds before deciding on the result – the 10μF tantalum capacitor connected to the wiper of the trimpot will delay any changes. The "Echo" and "Vibrato" switches should be set to "Off" and the "Delay" control set to minimum during this adjustment procedure.

Finally, you can check that each of the various effects function correctly, simply by trying the Effects Unit out. That's it – ditch the soldering iron, don the guitar and go for it!

Circuit & Design Ideas

Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. As a consequence, we cannot accept responsibility, enter into correspondence or provide constructional details.

Audio indictor for the Heart Rate Monitor



The portable Heart Rate Monitor described in the July 1972 issue is not only suitable for use with humans – it can also be used with animals! By adding this simple audio indicator circuit, the unit becomes a valuable aid during veterinary surgery. In particular, it provides constant monitoring of heartbeat while the animal is under anaesthetic and, because the output is audible, the vet does not have to interrupt the operation to check this vital parameter.

The circuit uses four NPN transistors and an LM386 audio amplifier IC. Transistor Q1 is turned on and off by the output of IC1d and drives a LED to provide visual indication of a heartbeat. Q1 also controls transistor Q2 via a diode and a 5.6kΩ resistor. When Q1 is on, Q2 also turns on to supply power to Q3 and Q4.

Q3 and Q4 form an astable multivibrator which generates an audible tone each time Q2 is turned on (ie, when a heartbeat is detected). The output of the multivibrator is taken from the collector of Q4 and AC-coupled to the LM386 via a 0.1μF capacitor. The 10kΩ potentiometer serves as a volume control.

Thus a brief audio tone is emitted by the loudspeaker each time a heartbeat is detected. The circuit is now in regular use in a veterinary clinic and saves considerable time during operations.

B. Baker,
Mascot, NSW.

Updating the Pools/Lotto Selector

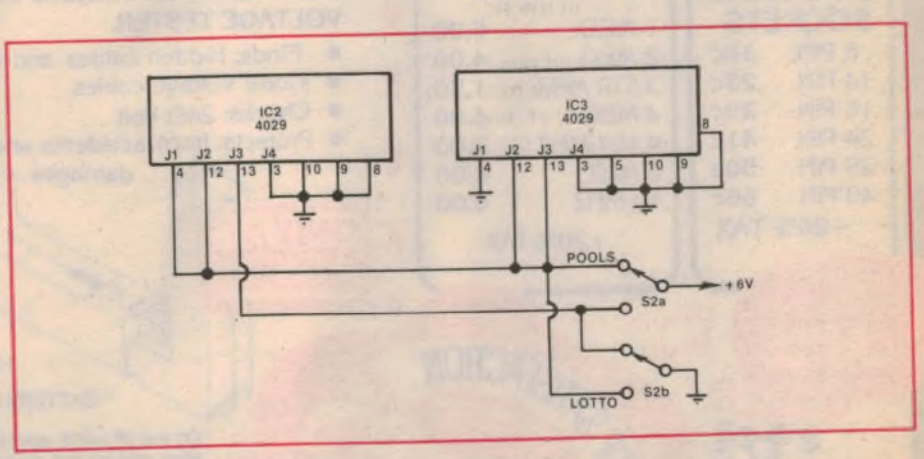
The change of system by the Australian Soccer Pools has rendered the Pools/Lotto Selector (EA July 1981) partially obsolete, though not unusable. (The original system provided for numbers between 1 and 40 for Lotto, and 1 and 55 for Pools. The Pools figure has now been reduced to 36.)

An immediate solution to the problem is to use only the Lotto section of the Selector, and to ignore numbers, 37 to 40. For the purists, however, a more elegant solution is to modify the Pools section to match the new figure. This can be done by substituting a DPDT switch for the original Lotto/Pools switch, and modifying some wiring.

The modification steps are as follows:

(1) Replace the Pools/Lotto switch (S2) with a DPDT type.

(2) Connect the moving arm of S1 to the moving arm of S2a.



(3) Connect the moving arm of S2b to 0V.

(4) Isolate pins 12 and 13 of IC2 and IC3 by cutting printed board tracks in six places.

(5) Re-connect pin 16 of IC2 to +6V.

(6) Re-connect pin 3 of IC2 to 0V.

(7) Remove the link connecting pin 4 of IC2 to pin 4 of IC3.

(8) Connect pins 12 and 13 of IC3, and pins 4 and 12 of IC2 all together, then to the Pools side of S2b and the Lotto side of S2a.

The Selector will now count down from 36 when in the Pools mode, and from 40 when in the Lotto mode.

B. Palfreyman,
South Arm, Tas.

Check Our Super Special Prices!

LITHIUM MEMORY SUPPORT BATTERIES

MEMOGUARD LM & LF Series. Horizontal or Vertical mounting. The ideal power source for memory back up! Nickel Cadmium versions available also.

LITHIUM MEMORY SUPPORT BATTERIES SERIES LH & LF

Construction: Case is of the Dual-in-line type with standard spacing for direct insertion to a printed circuit board. Markings are engraved and non-erasable and clearly indicate polarity. Pins are plated to facilitate wave soldering. Insulated stand-offs ensure good access for solvent cleaning.
Reliability: Excellent capacity retention and voltage stability, excellent performance under thermal variations, shocks and vibrations with a life expectancy of ten years at room temperature.

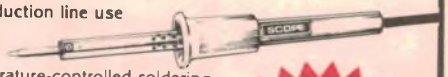
ELECTRICAL CHARACTERISTICS		
Open Circuit Voltage	V	3.5
Average Voltage	V	3.0
Capacity	mAh	200
Operating Temp		
Normal	C	60
Intermittent	C	70
Self discharge at 20 C	%/yr	2 to 3%
Energy Density	Wh/dm³	400/500

R.R. $4.64 + 20%

SCOPE COMMODORE MODEL PH20 370°C

Now a Production Quality 20W Iron that air cools your fingers. . . * 240VAC

- Designed for continuous production line use
- for students
- serious hobbyists.



A professional quality non-temperature-controlled soldering tool. Earthed tip and barrel for component safety.
*Idling temperature subject to variations in line voltage and ambient conditions.

$16.95 +TAX

80 SERIES CHIPS

8085	$ 4.00		
8086	$17.51		
8155	$ 3.77	8226	$ 1.21
8156	$ 3.69	8228	$ 2.39
8212	$ 1.21	8243	$ 2.01
8216	$ 1.21	8251	$ 3.32
8224	$ 1.35	8255	$ 2.20

EX STOCK

8253	$ 3.69
8257	$ 3.43
8259	$ 3.43
8279	$ 2.77

+ 20% Tax

BECKMAN HD100

MULTIMETRES
FULL
1 YEAR WARRANTY
$235 + 20% TAX

FUJUITSU RELAYS DUAL IN LINE

BR211 DO12V	3.64	DP.DT
BR221 DOO6V	3.64	
BR221 DO24V	3.64	SP.DT
BR211 DOO6V	2.54	
BR211 DO12V	2.54	+20%
BR211 DO24V	2.54	TAX

DIP SWITCHES

4 WAY SLIDE	1.40
8 WAY SLIDE	1.60
10 WAY SLIDE	2.00

+ 20% TAX

DATA ACQUISITION CHIPS FOR ETI — 654 APPLE II INTERFACE CARD
AD570 — 8 BIT ADC **$34.32** + 20%
AD7524 — 8 BIT DAC **$8.40** + 20%

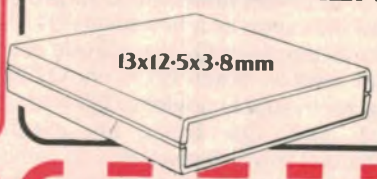
MEMORY BARGAINS

HM6116P-3	$5.99	250ns
MB2716	$2.95	450ns 16K EPROM
MB2764-30	$10.96	300ns 64K EPROM
MB8118	$3.95	120ns 16384 X 1 RAM
MM2708Q	$2.80	450ns 8K EPROM
MB8114 NLC	$4.00	300ns CERAMIC
HN462532G	$7.00	450ns 32K EPROM
S6834	$13.30	512 x 8 EPROM
S6810	$4.70	128 x 10 RAM 450 NS
MC68000-L8	$99.95	8 MHZ C P U

+20% TAX

Great Value!

INSTRUMENT CASE. MODEL IC-1



KIT COMPRISING
- 2 blank styrene panels
- 4 bump on rubber feet
- all screws required for PCB mounting

$5.25 +20% TAX

CAMBION I/C SOLDER SOCKETS

8 PIN	18c
14 PIN	25c
16 PIN	29c
24 PIN	41c
28 PIN	50c
40 PIN	66c

+20% TAX

CRYSTALS

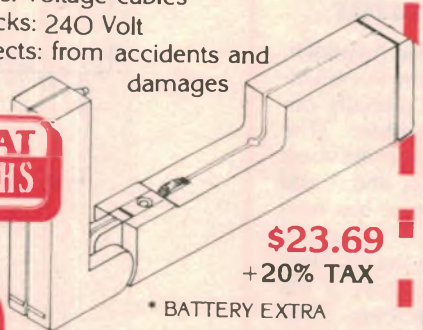
1 MEG	6.00
2 MEG	4.00
3.579 MHZ	1.50
4 MEG	4.00
4.194 MHZ	3.00
8 MHZ	4.00
10 MHZ	4.00

+20% TAX

MULTI-COMBI ELECTRONIC METAL AND CABLE SEARCHING TOOL + VOLTAGE TESTER.

- Finds: Hidden cables and metals
- Finds: Voltage cables
- Checks: 240 Volt
- Protects: from accidents and damages

ONLY AT MAGRATHS



$23.69 +20% TAX

* BATTERY EXTRA

On and off switch operates automatically when opening and closing.
Regulator adjusts the sensitivity of both searching functions.
Indicator control lamp red — for voltage cables yellow — for metal.

HARD TO GET CHIPS!

27C16	10.00
CDP1802 ACE	9.82
685OP	4.00
ISP 8F-025A	17.00
2716-50	2.75
INS 8060N	7.22
RC 4136	.60
TL 074	1.80
TL 084	1.50
NE 57IN	3.00
IIC90	12.75
MC10116P	1.00
TIP 31C	.50
TIP 32C	.50
DIB 04 1A 400V DUAL IN LINE BRIDGE RECT.	.50

+ TAX

SUPER BARGAINS AT MAGRATHS

Phone or Mail.

SEAL OF SATISFACTION
MAGRATHS
WORLD OF ELECTRONICS

bankcard welcome here

MAGRATHS ELECTRONICS
55 A'BECKETT STREET, MELBOURNE, 3000
Tele (03) 347 1122, Telex AA31001
Prices subject to change without notice.

— Mail or phone orders add $2.00 up to 1kg pack post
Special rates for **heavy** items on request

MC MG 484

Quiz game adjudicator

Here's a circuit you can use to play your own quiz games like those on TV. It sounds a buzzer and lights an LED to show which of four switch buttons was pressed first – and it can't be fooled.

The circuit is based on a 4042 quad D latch IC. Initially, the four data inputs D0-D3 are pulled low by 10kΩ resistors and so the latch outputs, Q0-Q3, are also low. As soon as one of the buttons (S1-S4) is pressed, the data input connected to it is pulled high, thus forcing the corresponding latch output high (eg, if S1 is pressed, Q0 goes high). This turns on the corresponding transistor (Q1-Q4) to activate the buzzer and light the appropriate LED.

At the same time, the high data output is decoded by NOR gates IC2a and IC2b, the output of IC2b going high to disable the 4042. The contents of the latch are now effectively "frozen" and the circuit ignores inputs from the remaining switch buttons.

Switch S5 provides the reset function. When S5 is closed, pin 5 of IC2b is pulled high and the pin 1 output goes low to enable the 4042 for the next round.

Power for the circuit can be derived from a 9V battery or from a plugpack supply. If you don't wish to use the buzzer, it should be replaced by a 1kΩ resistor.

P. Foote, Dianella, WA.

Leading zero blanking for Playmaster AM tuner

The digital frequency readout fitted to the new Playmaster wide band AM tuner has one minor disadvantage – it does not suppress the leading zero which occurs when frequencies less than 1000kHz are displayed. This simple circuit overcomes the problem using a single IC.

IC1a and IC1b are CMOS 4066 bilateral switches. IC1a acts simply as a buffer. When the Q1 output of IC8 goes high (ie, when a "1" is displayed), IC1a closes and pins 2 and 3 of the 4066 go high. When the Q1 output is low (ie, the leading digit is "0"), IC1a opens and pins 2 and 3 are pulled low by the 1kΩ resistor.

Capacitor C1 acts as a memory while the 4029 is counting. At the end of the count, the latch enable (pin 5) of IC12 goes low and pin 5 of switch IC1b goes high, thus closing S1b. Capacitor C1 will now either charge or discharge, depending on whether the Q1 output of IC8 is high or low. If the Q1 output is low, capacitor C1 discharges, thus pulling pin 4 of IC12 low to blank the leading display digit.

The 4066 can be installed by mounting it "piggyback" on the 4511 (IC12) as follows: solder pin 4 to pin 4; solder pin 14 of the 4066 to pin 16 of the 4511; bend pin 1 up and connect it via a link to pin 14; bend pins 2 and 3 up and connect them together, with a 1kΩ resistor tying them to an earth point; connect pin 7 of the 4066 to pin 8 of the 4511; connect pin 5 to pin 13 of IC13; solder pins 6 and 12 to the pins directly below them (this simply ties the other switches in the IC package to an input); mount the diode, 10kΩ resistor and capacitor as convenient. The remaining pins on the 4066 can be cut off.

Finally, cut the track on the PCB between pins 3 and 4 of IC12 so that pin 4 is no longer permanently tied high.

Note: Because this circuit simply detects whether the Q1 output of IC8 is high or low, it is suitable for use only in the Playmaster AM tuner and in similar applications where the leading digit is either "1" or "0". It is not suitable if the digital readout is used with a shortwave receiver, since Q1 or IC12 can go low for leading digit readings other than "0".

D. Brown,
Parkville, Vic.

The Serviceman

Success, frustration — and a little laughter

My two main stories are in striking contrast this month. The first one is an almost text book example of a routine job — the kind that pays the bills. The second one is an equally good example of the opposite type — the "stinker" that creates a lot of the bills in the first place!

Following last month's story about a mysterious G2 fault in a General TV set, and a previous story (March 1983) about loss of green which was subsequently fixed by doctoring the green G2 circuit, I have another G2 story. By comparison, it was a quite straightforward job, but I feel it is worthwhile recounting, if only as an example of how simple such faults ought to be.

It concerns a Sharp model 9C 183, although this isn't very important; the circuit configuration is common to most of the Sharp models of the same vintage, and similar to that used in many other brands, including the General set dealt with last month. It started with a phone call from the owner who complained that the set had virtually ceased to function, except that it would produce a brief picture when first switched on, then shut down.

FREE DELIVERY

I knew the customer well enough to suggest that such a fault might be better tackled in the workshop, whereupon he offered to deliver it to me, since he would be driving past the shop later in the day. Naturally, I was happy to accept his offer.

When I finally set it up on the bench and switched it on it behaved much as the customer had said, but with a few extra symptoms which he hadn't noticed. For one thing, the image seemed to appear quite quickly after switch-on and, more importantly, I detected the unmistakable sound of arcing. I switched off quickly, removed the back, and switched on again in an effort to locate it.

And that was the first indication I had that the G2 circuit was involved. Each G2 circuit is fitted with a protective spark gap and the one for the blue gun was turning on a brilliant display of fireworks. So brilliant, in fact, that my first fear was that the tube had suffered an internal short and that, somehow or other, EHT had reached this electrode.

To clarify the situation, I pulled the neck board off the tube and tried again, only to be greeted by exactly the same display. Well, at least that cleared the tube and directed suspicion to the G2 circuit itself.

As I mentioned earlier, this G2 circuit is similar to that of the General set described last month. The voltage is supplied from a tapping on the line output transformer and is applied to a voltage divider network consisting of three or four 330kΩ resistors (varying with the model) in series, three G2 pots in parallel, then a 330kΩ resistor to chassis.

It so happens that I was already familiar with this circuit, due to a fairly common fault with a different set of symptoms. In this case the picture becomes gradually darker, sometimes over several weeks, sometimes more rapidly, until it is no longer watchable. The cause is one of the three or four 330kΩ resistors gradually going high, and lowering the G2 volts.

"Does it bother you if I watch?"

I put the neck board back in place, connected a voltmeter to one of the G2 pins, and tried again. Normally, I would expect to find something like 500V at this point, instead of which it was closer to 1400V, and that was with some meter loading. To clarify the situation I set up a digital voltmeter with a high voltage probe, and this indicated over 2000V. No wonder we had sparks flying!

One possibility was that one or more of the 330kΩ resistors on the high voltage side of pot assembly had been shorted out in some way, such as a sliver of solder or a pinched lead, but a quick glance ruled this out, leaving the 330kΩ at the bottom of the string as the prime suspect.

Unfortunately, the layout is such that this resistor is very hard to see, but a resistance measurement showed open circuit. As a temporary measure I tacked another resistor across it on the back of the board, switched the set on, and everything came up normally.

I had to pull things apart quite drastically to get at the faulty resistor but, when I reached it, it was cooked to a cinder, though I could find no reason why this had happened. I replaced it, put everything back together, and confirmed that the set was working correctly.

The only thing I could find wrong was the need for a grey scale adjustment, and a general touch-up of other adjustments, after which the set performed faultlessly. And, significantly, when I returned it to the customer he was most impressed, claiming that it was performing better than it had for years. Maybe it had needed grey scaling for some time.

Anyway, that was more or less a text book exercise, just to show that not all G2 faults are stinkers.

A REAL STINKER

By comparison, my next story is about a right proper stinker! I have always imagined that the "continuing story" was the sole prerogative of the radio and TV soap opera writers, so it came as something of a shock to realise that my next story has nearly as many episodes

as "Tarzan of the Apes" – or "The Sullivans" in modern parlance.

The story started some six or seven months ago, when I was called in to check up on a National receiver which, according to the owner, ". . . had gone all funny colours." Little did I imagine that what seemed like a perfectly routine fault at the time was going to lead me such a merry dance.

It was nothing more than a purity problem, although the effect was quite severe. My first reaction was to enquire whether it had come on gradually or suddenly. If the effect was gradual it would most likely indicate failure of the de-gauss circuit and, hence, a gradual build up of stray magnetism which would normally be cancelled each time the set was switched on.

A sudden effect, on the other hand, suggests a strong external magnetic field, as from a speaker being parked alongisde the set or, more probably, a vacuum cleaner or other similar appliance being switched off in the immediate vicinity. When this happens the resulting magnetisation is usually too strong to respond to the de-gaussing system.

As it happened the owner was quite adamant; the effect had appeared quite suddenly, the set behaving perfectly when switched off one night, and being faulty when switched on the next night. Although, subsequently, I had reason to doubt the accuracy of this observation, I took it at its face value at the time. I even went so far as to question the owner as to likely causes of the effect, but he could recall nothing. Nevertheless, I felt sure this was what had happened.

So, I simply de-gaussed the tube, switched it on and off a couple times as a check, and went on my way. I confidently believed that would be the last I would hear of it.

MONTHS LATER

In fact, all went well until a couple of months ago. Then the customer was on the phone again complaining about exactly the same effect. More than a little puzzled, I made this the first call of the day, anxious to find out exactly what had gone wrong. Sure enough, there was a purity problem, but it was nothing like as severe as it had been the first time – it was only just noticeable. I imagine that, had the owner not seen the effect before, he may not have been bothered by it.

But that didn't alter the fact that there was a problem, and a rather puzzling one. Had this effect appeared suddenly, as in the previous case, or had its onset been gradual? The owner wasn't sure, but agreed that it was probably gradual. At this point I became convinced that the previous effect had probably been gradual also, its "sudden" appearance being simply the time at which someone realised it was there.

On this basis, there was almost certainly a fault in the de-gauss circuit. Most de-gauss circuits these days are fairly standard, quite simple, and don't give much trouble. They are just a coil with a thermistor in series, designed to produce a relatively strong AC magnetic field at the moment of switch-on, dying away rapidly as the thermistor warms up.

About the only consistent fault is that the thermistors go short circuit, which blows the main fuse. It is easily identified, and easily fixed. The alternative possibility, and the one I now faced, was that the thermistor had gone open circuit; something which I have never encountered in all my years with colour TV sets.

I checked the coil first, but wasn't really surprised when it proved to be intact, and I need hardly add that the thermistor was open circuit. Fortunately I had a spare in the van and it took only a few minutes to fit it. Naturally, I charged only for the thermistor since, in theory at least, I should have found the fault the first time.

NEW THEORY

And once again I went on my way expecting that that was the end of the story. But I was sufficiently intrigued to relate the events to a colleague who, while not directly in the servicing game, is closely allied to it. This produced yet another likely version of what happened.

He recalled reading an article in a technical journal describing a similar sequence of events; the quite sudden purity problem and the subsequent discovery of an open circuit thermistor. The theory advanced was that the thermistor failed at the moment of switch-on and, more particularly, on a mains voltage peak. The result would be inevitable.

In the light of this theory I had to rethink my doubts about the customer's original story. In all probability his version was the correct one; the effect had appeared suddenly the first time and, had I known what I know now, I would have picked the open circuit thermistor in one.

Which brings me to instalment number three – or is it four? Anyway, it didn't end there. The set ran faultlessly for three whole days – then the owner was on the phone with the sad tale that it had failed completely. I lost no time in getting to the house and found a simple explantation for the failure; the main fuses had blown, and quite violently.

It took only moments to confirm my suspicions – it was the thermistor again, only this time it had gone short circuit. While I wasn't particularly happy about

COLOUR TV CHANGE OVER MODULES AND SPARES

HMV EMI C211/212	
Power supply	$38 change over
Horizontal	$45 change over
Vertical	$22 change over
HMV EMI C221	
Power supply	$32 change over
Horizontal	$42 change over
Vertical	$24 change over
PYE T29/T30	
Scan & Signals	$53 change over
Philips & Kries. Early	
Power supplies	$53 change over
P/Supply controls	$18 change over
Sound	$15 change over
Other models available	
RANK	
All deflection boards	$48 change over
SHARP	
Horizontal	$24 change over
26" BLAUPUNKT	
Early version	$28 change over
P/supply & mains unit	$28 change over
Remote receiver	$48 change over
Remote H/Piece	$35 change over
Complete chassis	$80 change over
TYNE	
Convergance	$38 change over
EHT + P/Supply	$48 change over
NATIONAL CP2000, TC86	
Power supply	$30 change over
Vertical	$30 change over
Video	$48 change over
SONY K1830	
Board A	$48 change over
Board D	$36 change over
Board E	$48 change over
Board F	$48 change over
HANIMEX HCT26-700	
Line scan	$53 change over
Field scan	$48 change over
Decoder	$48 change over
GEC 2213 & 2621 & 2612	
PC706 Complete	$53 change over
PC737	$53 change over
PC687	$48 change over
PC470	$38 change over
PC656	$38 change over
PC475	$53 change over
LUXOR	
All P/Supplies	$30 change over

4KA THICK FILMS — ALL $9.00 EA

NEW PARTS

EHT transformers to suit Blaupunkt-Luxor-Nordmende-GEC 22" — All $32 each
Philips & Decca — $36 each
HMVC211/212 — $30 HMVC221 — $24

LARGE RANGE OF OTHERS AVAILABLE.
New remote control handpieces to suit Luxor-Blaupunkt-Nordmende-GEC-ITT/Greatz-Saba-Loewe-etc., all with 2 year warranty $68 each. When ordering parts please specify clearly model and make.

Large range of spares in stock new & second hand
SPECIAL triplers Philips type $10 ea.

Send cheque or money order to:

T.T.V.S.,
159 Queens Parade,
Clifton Hill, Vic. 3068
Ph: (03) 489 1168

Minimum Order $35. P/P $3
Orders over $100 Post Free.

BUY ONE GET ONE FREE!

BONUS CERTIFICATE

Introducing the brand new range of Dick Smith Quality Cassette Tapes.

Not just new packaging – everything is new. A superb new tape formulation giving unbelievable frequency response, unbelievable dynamic range . . . and just look at the low, low prices!

These tapes are SO good we know you'll be absolutely delighted with them in YOUR system. In fact, they're so good we're prepared to make this amazing offer:

Buy any of these new Dick Smith cassettes and we'll give you another of the same type – absolutely free!! That's right – buy one, get one free. And you can take advantage of this offer at your nearest Dick Smith store, or through the Mail Order Centre.

Why make such an amazing offer? We want you to try these superb new tapes for yourself. Then you'll tell your friends, and they'll tell their friends, and.....

Look at these outstanding specifications:

- S/N Ratio (ref level): 57.5dB
- S/N Ratio (max output): 61dB
- 3rd Harmonic Dist: 0.8dB
- Sensitivity: 0.2dB at 315Hz
- Max. output level @ 10kHz: -8.3dB

C90 L.N.
(low noise)
Cat C-3352
10 or more $1.20

C60 L.N.
(low noise)
Cat C-3350
10 or more $1.00

C90 E.D.R.
(Extended Dynamic Range)
Cat C-3354
10 or more $1.90

Here's how you order your tapes:

You can grab your bonus tape at any Dick Smith store, or through the mail order centre. Just fill in the coupon – and for every tape you order, we'll give you another of the same type.

There is no limit to the number of tapes you can order on each coupon, but this offer is strictly limited to the first 1,000 coupons. (one coupon per customer).

Don't miss your chance to get a really great tape at a really low price... and pick up a second tape free!

BRING THIS COUPON INTO ANY DICK SMITH STORE (see page 98 for your nearest branch)

Or send it to the mail order centre. For orders of 10 tapes or more you can even pay by Bankcard!

Yes please! I'll take advantage of this amazing offer:

Here's my order:

( ) C-60 L.N. (C-3350) tapes at $1.50 ea. $ .....
( ) C-90 L.N. (C-3352) tapes at $2.00 ea. $ .....
( ) C-90 E.D.R. (C-3354) tapes at $2.75 ea. $.....
Add P & P if by mail order $2.00

( ) I enclose a cheque/postal order for $ .....

OR please charge to my Bankcard (exp date .....)

CARD NO.
496 | | | | | | | | | | | | | | | |

For every tape ordered opposite, I understand that I will receive another of the same type absolutely FREE OF CHARGE!

NAME: .....

ADDRESS: .....

..... Postcode .....

Signature .....

A500.CT.

what appeared to be one of Murphy's nasty tricks, I didn't attach any special importance to the incident; I simply regarded it as pure bad luck.

But when the same thing happened again a couple of days later I could no longer regard it as coincidence. There had to be a reason, and the only one I could think of right then was the fact that I had not been using the exact thermistor type listed in the manufacturer's data. I had been using a stock item, as used by several other makers, and which had proved totally reliable in the past, on all makes of sets.

So, in the light of what had happened, I ordered the correct type from the distributor's service department and, in the meantime, simply disconnected the de-gauss coil, de-gaussed the tube externally, and warned the owner that he might experience a minor purity problem before I could fit the new thermistor.

The new thermistors duly arrived and I lost no time in fitting one, fervently hoping that this would be the end of story. But not a bit of it — this unit lasted less than 24 hours, again going short circuit.

At this point I realised that I had a real problem. I could no longer blame coincidence, or the wrong brand of thermistor, and that left only the de-gauss coil itself. I wasn't exactly sure what could be wrong with it, but the two most likely possibilities seemed to be either a direct, but intermittent, short across the input lead, or a shorted turn, or turns, within the coil itself.

In any case, it was largely academic. The coil had to be replaced and I immediately ordered one from the service department, only to be informed that they were on back order, and unlikely to be available for several weeks. So, there was nothing I could do in the meantime but wait patiently and keep an eye on the set in case it needed de-gaussing again.

Fortunately, it didn't, and the customer was quite happy to wait as long as the set was working even reasonably well. Eventually, the new coil did arrive and at the first opportunity I called on the customer and fitted it, along with a new thermistor of the correct make and type number. So now there was virtually nothing left to go wrong.

Reasoning thus I switched on. SPLAT! In a split second the fuses had become tubes of blackened glass, so violent was the reaction. I unplugged the de-gauss coil, fitted new fuses, and tried again. The set came on normally.

Feeling just about as foolish as I can possibly imagine, I explained to the owner that things were still not right, and that I would have to make further tests. In the meantime I would leave the set running as it had been before. Happily he accepted the situation with good grace, but I still felt very much like a dog with his tail between his legs as I took my leave.

Back at the shop I fished out the old, supposedly faulty, coil, a spare thermistor — not the right type — hooked them up in series, together with a fuse, and patched the lot across the mains. It took the switch-on surge without a murmer, and ran on the bench for the rest of the day. In fact, I forgot about it and left it on over night. It survived this, and several switch-on surges during the day. In fact I can't make it fail.

And that is where things stand at the time of writing. I can't delay the story any longer — a high powered car with police escort is waiting to make a mad dash to the printery, where they are holding the presses! Well, not really, but they do get a bit twitchy in the office if copy runs late, and it may take a couple of weeks to sort the problem out.

Right now I'm planning to lend the customer a set so that I can bring the monster into the workshop and really get stuck into it. Hopefully, I will be able to finish this "continuing story" next month.

SOMETHING LIGHTER

After a story like that, something in lighter vein is surely called for. Readers may recall that I have a colleague on the NSW south coast who often feeds me an interesting story about fringe area aerial problems, etc, and who also does routine maintenance for the local radio station. And it was in this latter environment that he encountered the incident I am about to relate.

It has nothing to do with service work, but is another example of the cockeyed ideas which non-technical people, particularly the ladies (God bless 'em), come up with when they encounter electronic equipment.

The incident occurred when my colleague was working in the station control room one day, checking out a faulty tape recorder. The program going to air was coming over the monitor speaker but, for the most part, he was giving it little attention. He was vaguely aware that it was an interview of some kind, though whether it was live or recorded he didn't know.

In fact, he later established that it was a live interview from the main studio, where the station's chief announcer was interviewing two people on the subject of microwave ovens. One was a local retailer who was selling a particular brand of oven, and sponsoring demonstrations of it in his local store.

The third person was a lady demonstrator, very well known in her field, and who, among other qualifications, was credited with a degree in home economics. In fact, it was largely her show. So, after the usual introductions, pleasantries, etc, the lady began to extol the virtues of microwave ovens and how they should be used.

Still my colleague paid little attention until the lady came to the subject of cooking times, when something she said suddenly made him prick up his ears and listen more intently. As far as he could recall, she had said something like this:

VOLTS AND RECIPES

"Now ladies, you must realise that these microwave ovens are all made in Japan, and the recipe books are prepared for Japanese use and for the United States market. This is very important to remember because, in both of these countries, the power supply system is 110 volts, and these recipes are based on the 110 volt supply system.

"Now here in Australia, as you are probably all aware, our supply system is 240 volts, and this is very important to keep in mind because, when you are using these microwave ovens with the recipe books supplied with the ovens, you must halve the cooking times given in the manual."

My colleague did a double take on this. Had he heard correctly? Considering that he had not been listening very attentively in the first place, he was quite prepared to believe that he had been mistaken. Surely, no one, not even . . ., well no one would make a mistake like that.

Fortunately, it was easy enough to check. Like most stations, this station runs a logging tape; everything that is broadcast goes on tape and is held for a prescribed number of weeks. This provides a safeguard in the event of advertisers' complaints, or threats of law suits for slander, libel, etc.

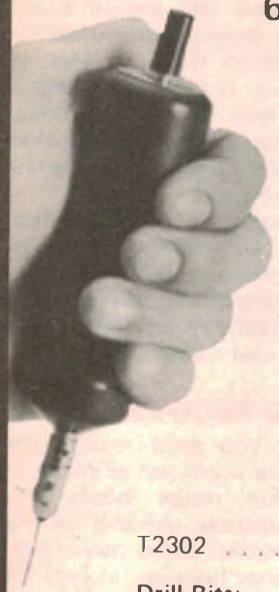
So, at the first opportunity, he ran the logging tape. And sure enough, this was the gist of the lady's advice. Because the microwave ovens are made for the 110V market, cooking times must be halved when they are used on 240V systems. Nor could he resist the temptation to share the joke around. He called in the manager and the chief engineer and, first, related the story and then, when they refused to believe it, ran the logging tape. Needless to say, they all had a good laugh.

The unfortunate aspect of statements like these is that they are so outrageous that it is hard to know where to begin to shoot them down. Did the lady really

Continued on page 144

ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ...

Powerful New 6000 RPM Mini Drill for PC Work



Tons of Torque. Just the shot for PCB work. 12V DC operated from external Power Pack 1.2mm chuck capacity. Supplied c/w 1mm drill bit.

T2302 ..... $12.95

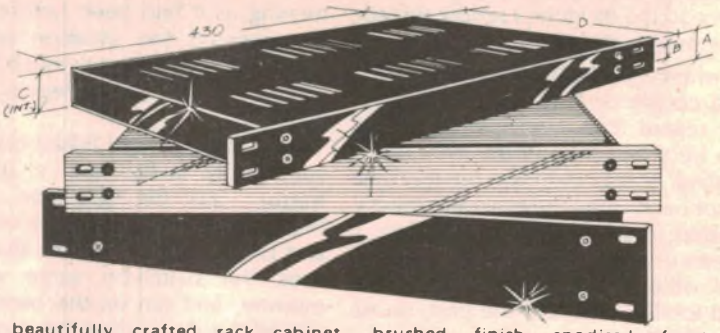
Drill Bits:

T2320 (0.8mm) ... $1.25

T2325 (1.0mm) ... $1.25

YOUR BUDGET PROBABLY ~~WON'T~~ WILL STRETCH TO AFFORD OUR PROFESSIONAL SERIES ALL ALUMINIUM RACK CABINETS

NOW YOUR PREAMPS, AMPS, CONTROL MODULES MONITOR PANELS ETC. CAN LOOK EVERY BIT AS GOOD AS TECHNICS, NAKAMICHI AND OTHER TOP MANUFACTURERS



* These beautifully crafted rack cabinet boxes will give your equipment a real 1st class appearance. * All aluminium construction. * REMOVABLE TOP AND BOTTOM PANELS. * All dimensioning conforms to the International Standard. * Natural or Black finish. * Ventilated lid. * Deluxe brushed finish anodised front panel. * Individually cartoned. * Supplied in Flat Pack Form – Easily assembled in minutes.

Side Elevation:
D = 254mm C (Internal Chassis Height)
B (Mounting Bolt Centres)

Cat. No.	Finish	A	B	C	ea.	5 +
H 0401	Natural	44	34	38	$42.50	$39.95
H 0402	Natural	88	57	82	49.95	47.50
H 0403	Natural	132	89	126	55.00	49.95
H 0411	Black	44	34	38	42.50	39.95
H 0412	Black	88	57	82	49.95	47.50
H 0413	Black	132	89	126	55.00	49.95

Beware of other rack boxes that do not conform to International Rack Sizing.

DIRECT IMPORT ELECTRONIC HARDWARE

FANTASTIC SAVINGS ON BULK 'TRADE' PACKS

TO3 INSULATING KIT

Mica washers and bushes for 4 TO3 semi conductors H 1580 ..... .75

TO3 Trade Pack

100 mica washers + 200 bushes

H 1582 .....$12.50

TO220 INSULATING KIT

Mica washers and bushes for 4 TO220 or other flat Pack Semis. H 1585 ..... .95

TO220 Trade Pack

100 mica washers + 100 bushes

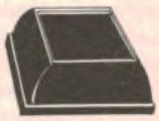
H 1587 .....$9.80

RUBBER FEET

With 3mm Mounting Hole

Standard

Stickon Type



	Size (diam.)	Pack Qty.	Price
H 0914	13mm	8	$ .85
H 0913	13mm	100	7.50
H 0917	16mm	8	.95
H 0916	16mm	100	8.00
H 0940	12mm Stickon	4	.80
H 0942	12mm Stickon	100	9.60
H 0950	20mm Stickon	4	.95
H 0952	20mm Stickon	100	11.50

1/8th inch WHITWORTH

STEEL NUTS AND BOLTS ROUND HEAD ZINC PLATED

	Length	Pack Qty.	Price
H 1000	9mm	25	$ .85
H 1002	9mm	500	4.50
H 1005	12mm	25	.85
H 1007	12mm	500	4.95
H 1009	25mm	25	.95
H 1011	25mm	500	6.95
H 1020	Hex Nut	30	.75
H 1022	Hex Nut	500	5.95
H 1030	S/Proof Washer	50	.95
H 1032	S/Proof Washer	500	6.95
H 1040	Flat Washer	50	.95
H 1042	Flat Washer	500	6.95

Huge Savings with Trade Packs (Contents: 500)

BA NUTS AND BOLTS

Bolts Cheesehead Steel, Nuts Brass

		Pack	Price
H 1045	4BA x 6mm	25	$ .95
H 1047	4BA x 6mm	500	5.95
H 1050	4BA x 12mm	25	.95
H 1052	4BA x 12mm	500	6.95
H 1060	6BA x 12mm	25	.95
H 1062	6BA x 12mm	500	7.50
H 1070	Nut Hex 4BA	25	1.00
H 1072	Nut Hex 4BA	500	12.50
H 1080	Nut Hex 6BA	25	1.00
H 1082	Nut Hex 6BA	500	12.50
H 1090	4BA S/Proof Washer	50	.95
H 1092	4BA S/Proof Washer	500	5.95
H 1095	4BA Flat Washer	50	.95
H 1097	4BA Flat Washer	500	6.95

SELF TAPPING SCREWS

Nickel Plated Steel

From less than 1c each

		Pack	Price
H 1100	No. 4 x 6mm	25	$ .75
H 1102	No. 4 x 6mm	500	4.50
H 1110	No. 4 x 12mm	25	.95
H 1112	No. 4 x 12mm	500	5.50
H 1120	No. 8 x 12mm	25	.95
H 1122	No. 8 x 12mm	500	6.95

From less than 1c each.

SPACERS (STANDOFFS) SUPERB NICKEL PLATED BRASS

UNTAPPED 4 BA or 1/8" CLEARANCE

Cat.	Length		Pack Qty.	Price
H 1305	6mm		8	$ .95
H 1359	6mm		100	8.50
H 1362	9mm		8	.95
H 1365	9mm		100	9.50
H 1372	12mm		6	.95
H 1373	12mm		100	11.00
H 1375	25mm		4	.95
H 1376	25mm		100	15.00

TAPPED 4 BA

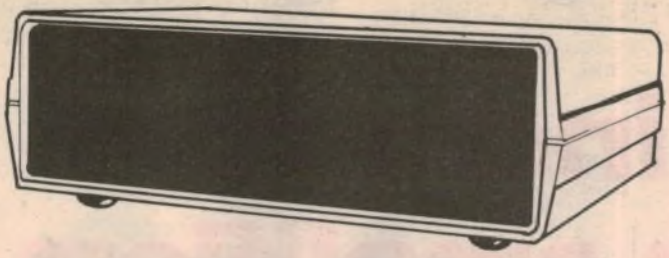
Cat.	Length		Pack Qty.	Price
H 1379	9mm		8	$1.00
H 1380	9mm		100	9.50
H 1383	12mm		8	1.20
H 1384	12mm		100	12.50
H 1387	25mm		4	1.00
H 1388	25mm		100	17.50

BANKCARD JETSERVICE-DELIVERY NEXT DAY BANKCARD JETSERVICE-

ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ...

NEW

DELUXE ABS INSTRUMENT CASE



Case color light grey front-rear panels black

Our superb new instrument case will give your projects the professional appearance they deserve.

* Internal mounting posts enable a wide combination of PCB's, Transformers, etc. to be accommodated (screws supplied).
* PCB guide rails provided internally allow vertical PCB positioning to several locations.
* Removable front and rear panels. Attractive textured finish one side and plain the reverse side. (Enables direct engraving, silk screen printing etc. to plain side.)
* Great for test instruments and other high grade projects.

Overall Size: 200W x 160D x 70mmH

H 0480 ONLY **$13.50** 10 up **$11.50**

OEM'S – Manufacturers – Bulk Users: Your product will look like it's straight out of "Hewlett Packard's" factory with this brilliant low cost case Contact our Wholesale Department for Bulk Prices.

HIGH RESOLUTION MONITOR

NOW WITH SCREEN INVERT FUNCTION AT NO EXTRA COST

One of the hassles of sitting there for countless hours operating your computer is *eye strain* (anyone who has just spent 10 hours solid will agree!!) Well our fantastic new MICRON 12 High Resolution Green Phosphor Monitor has a 'reverse' or invert screen function where by simply rotating the contrast control anti-clockwise the screen information and background are reversed. This is especially valuable in poor lighting conditions.

NO MORE HEADACHES AND BLURRED VISION

MICRON 12

Green Phosphor Monitor Features 12 screen Front controls on off contrast reverse brightness Power 240V 50Hz or 12V DC Input RCA type DC Output Jack 12V 1 1 Amp — power your Micro direct without a power pack Bandwidth 10Hz to 20MHz the resultant definition is truly amazing for a low cost monitor

Guaranteed by ALTRONICS!

Incredible Value.

D 1112 **$199.50**

Adjustable Azimuth DATA CASSETTE

At last a Data Cassette Recorder/Player you can afford. The Micron D 1120 is fully **adjustable azimuth** (absolutely essential in our opinion) and incorporates tailored audio frequency response audio stage together with low distortion.

Now you can save and load software in your Micro with confidence.

Micron D 1120 Data Cassette **ONLY $49.50**

ALTRONICS RESELLERS

Please note that resellers may not have all the items advertised in stock, and as resellers have to bear the cost of freight, prices may be slightly higher than advertised. ALTRONICS reseller prices should however represent a considerable saving over our competitors' prices.

SOUTH AUSTRALIA
CITY
ADN Electronics 212 5505
Photronics 212 3111
SUBURBAN
PROSPECT
Jensen Electronics 269 6144
ELIZABETH GROVE
A.E. Comms 255 2240
CHRISTIES BEACH
Encel Electronics 387 1366
KESWICK
Fortune Electric Wholesalers 293 2033

VICTORIA
CITY
All Electronic Components 662 3506
Electronics 602 3490
SUBURBAN
FOOTSCRAY
Acorn Electronics 689 1911
CHELTENHAM
Talking Electronics 550 2386
HUNTINGDALE
Emona Electronics 543 2123
SOUTH CROYDON
Truscott Electronics 723 3860
COUNTRY
SHEPPARTON
GV Electronics 21 8866
MILDURA
Electronic and Dance Services 23 3380

NEW SOUTH WALES
CITY
Radio Despatch 211 1199
Electronic Agencies 211 2036
Jaycar 264 6688
SUBURBAN
LEWISHAM
PreMix Electronics 560 9770
CONCORD
Electronic Agencies 745 3077
DEE WHY
David Ryan Electronics 982 7500
WAITARA
Applied Technology 487 2711
MATTRAVILLE
Creative Electronics 666 4000
COUNTRY
BROKEN HILL
Crystal TV 4083
COFFS HARBOUR
Coffs Harbour Electronics 52 5644
PENRITH
Acorn Electronics 32 2400
NEWCASTLE
D.G.E. Systems 69 1699
WINDANG
Mailpak Electronics 56 5666
GOSFORD
Tuscan Electronics 24 7246
KURRI KURRI
Kurri Electronics 37 2181

QUEENSLAND
CITY
Dataworld P/L 229 6166
SUBURBAN
SALISBURY
Computerex Wholesale 275 2788
FORTITUDE VALLEY
St. Clair Electronics 52 3543
BIRKDALE
Wholesale Sound Acoustics 293 2502
COUNTRY
CAIRNS
Tropical Microwave Services 51 2404
TOWNSVILLE
Scope 72 2915
ROCKHAMPTON
Purdy Electronics 21 1158
GLADSTONE
Purdy Electronics 72 4321
GYMPIE
TV and Radio Services 82 1631
IPSWICH
P & P Electronics 281 8091
TOOWOOMBA
Hobby Electronics 32 9621
Downs Radio and TV 32 1044
NAMBOUR
Nambour Electronics 41 1604

NT
DARWIN
Radio Parts Darwin 81 3508
Kent Electronics 81 4143
Lasertronics 81 3493
ALICE SPRINGS
Kenner Electronics 52 2167
Acorn Electronics 52 1711

TASMANIA
HOBART
Bob Electronics 34 8232
KINGSTON
Kingston Electronics 29 6802
AVOCA
Emmons TV 84 2166

WEST AUSTRALIA
ALBANY
RP Electronics 41 3691
GERALDTON
Geraldton TV and Radio 21 2777
WYALKATCHEM
D & J Pryor 61 1132
MANDURAH
Kent Electronics 35 3227
KALGOORLIE
Tolmac Electronics 21 5212

ACT
Scientronics 54 8334
Electronic Components 88 4654

RESELLERS WANTED IN ALL AREAS
(including WA)

Phone STEVE WROBLEWSKI (09) 381 7233 for details

NEW 24 HOUR 7 DAYS P/WEEK PHONE ORDER SERVICE FOR BANKCARD HOLDERS

Take advantage of "off peak" low STD phone rates and phone your order to our new recorded 24 hour order service. Give your **name, address with postcode, phone number, bankcard number and expiry date then your order** – and presto your order will be processed and back to you in a flash – Please nominate Jetservice if you want overnight delivery.

$2.50 DELIVERY AUSTRALIA WIDE We process your order the day received and despatch via Australia Post. Allow approx 7 days from day you post order to when you receive goods. Weight limited 10kgs.

$4.50 DELIVERY AUSTRALIA WIDE We process your order day received and despatch via Jetservice for delivery next day.

BANKCARD HOLDERS CAN PHONE ORDER UP TO 8PM (EST) FOR NEXT DAY DELIVERY – SOUNDS INCREDIBLE DOESN'T IT? Alright you cynics just try us! Weight limit 3.3kgs. Jetservice cannot deliver to P.O. box numbers (Australia Post would have a fit).

$10.00 HEAVY HEAVY SERVICE – AUSTRALIA WIDE All orders over 10kgs must travel on the heavy service, that is — road express. Delivery time 7 days average.

ALTRONICS

105 STIRLING ST., PERTH FOR INSTANT SERVICE

(09) 328 1599

All Mail Orders: Box 8280 Stirling St., Perth WA 6000

BANKCARD JETSERVICE-DELIVERY NEXT DAY BANKCARD JETSERVICE-

Overload indicator for power amplifiers

Just how do you tell if an amplifier is being overloaded by a program signal. Even if the overload condition is very slight, it may cause a deterioration in sound quality while being undetectable when displayed on an oscilloscope. The circuit presented here will detect even slight overload conditions and is not affected by load impedance or varying supply voltages.

by LEO SIMPSON

With the advent of direct-cut records and, more recently, the compact disc, programs with very wide dynamic range are becoming more common. Many amplifiers and loudspeaker systems may not be able to reproduce this wide dynamic range without a strong possibility of overload occuring.

The reason that amplifiers and loudspeakers will be more prone to overload is not because people will necessarily be tempted to turn up the volume to enjoy the signal quality, although that is always a strong possibility. No, the reason is that now we have a recording process (ie, the compact disc) which no longer "crushes" the very large signal transients which normally occur from instruments such as pianos, drums or trumpets.

These instruments can easily generate very large signal peaks just in normal playing and without the volume being at a high level. The resulting brief overload of the amplifier may not be really obvious but it will lead to a deterioration in sound quality.

We must emphasise that one need not be listening at a high sound level for these brief overloads to occur.

Having recognised the possibility that the system may be overloading, where is the overload most likely to occur? In the amplifier or the loudspeakers?

It is fair to say that many systems will be prone to overload of both the amplifiers and the loudspeakers. The first step to eliminating this problem, and achieving the best sound quality which these new signal sources have to offer, is to determine if overloading is occurring in the amplifier.

The two factors which are most important are the amplifier supply rails and the load impedance. Now for a given supply voltage a power amplifier may be able to deliver an undistorted sine wave signal of 80 volts peak-to-peak into a resistive load of eight ohms. This corresponds to a power output of 100 watts RMS. To do this, the amplifier would probably require supply rails of at least ±55 volts or a total of 110 volts DC. The exact voltage required would depend on the particular configuration of the output and driver stages and the operating temperatures of the semiconductors.

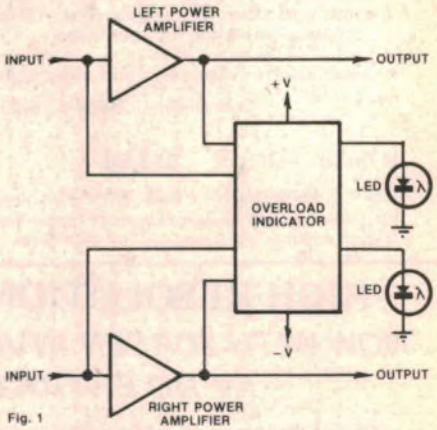


Fig. 1

On this last point, for example, power amplifiers using Mosfets usually can deliver slightly less power as they become hot whereas power amplifiers using bipolar transistors deliver slightly more power before clipping occurs.

Having determined that an amplifier will deliver a certain maximum output voltage to a resistive load (at a given operating temperature), let us now consider what happens if the amplifier supply voltages are reduced by 5% as may easily occur if the mains voltage is low or if the amplifier has just previously delivered a large burst of power. A 10% reduction of the supply rails will lead to almost 20% reduction in available power output.

In addition, most amplifiers are unable to deliver the same output voltage swing to realistic loudspeaker loads as they can into resistive loads. This applies especially if the loudspeaker impedance dips substantially below the nominal value of, say, eight ohms.

The point of the foregoing discussion is

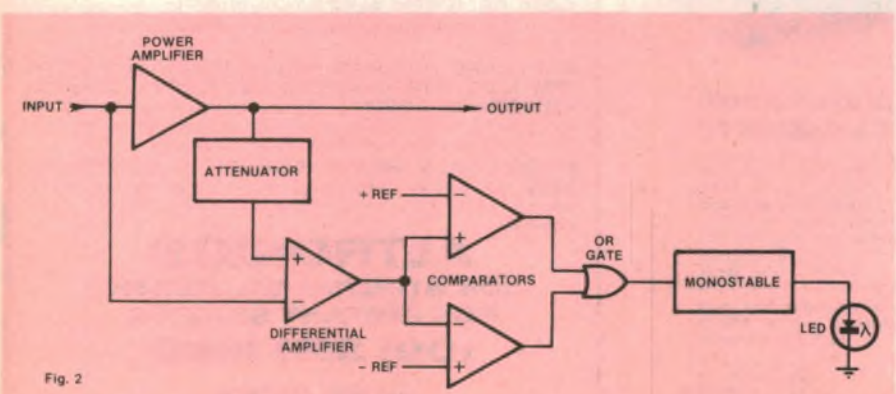
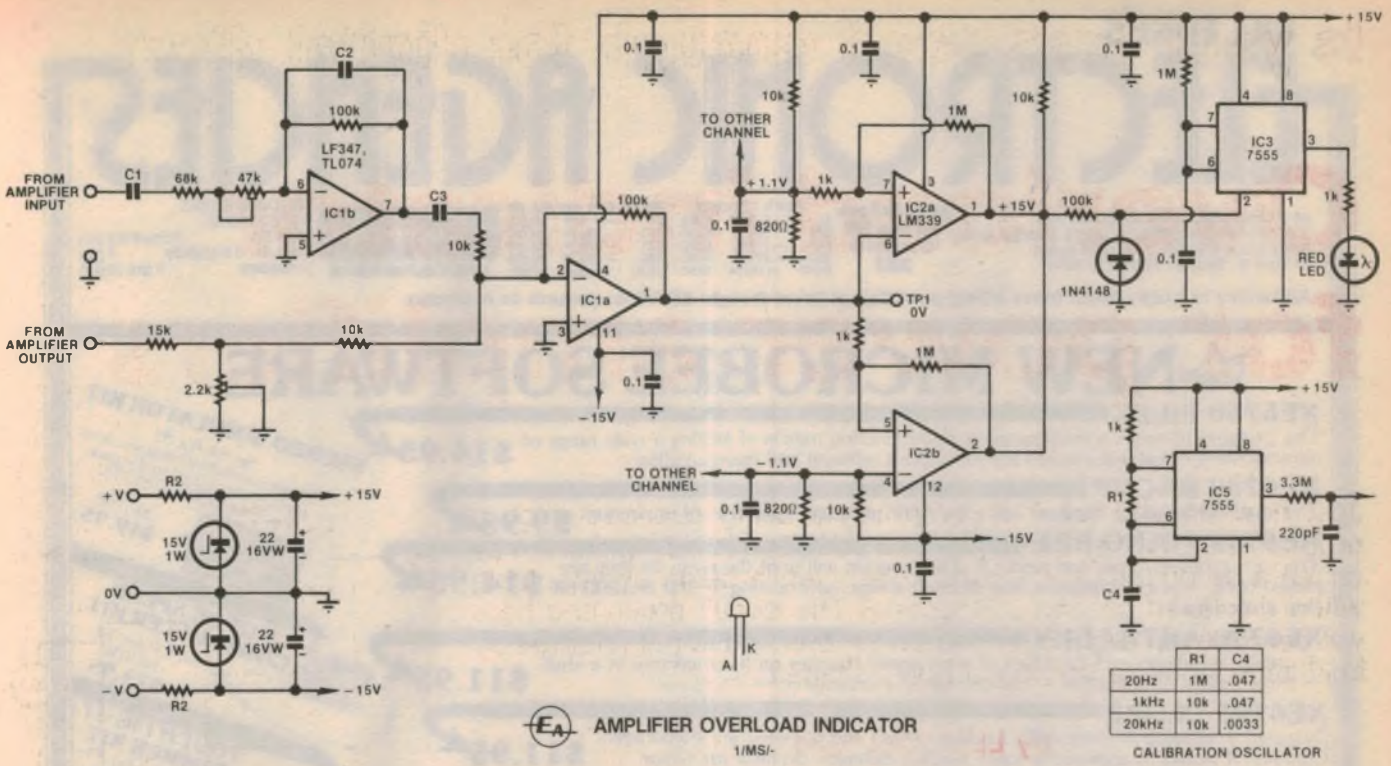


Fig. 2

Fig. 2: basic scheme for the overload indicator (one channel only).



The circuit compares the shape of the signal waveform at the input and output of each power amplifier stage.

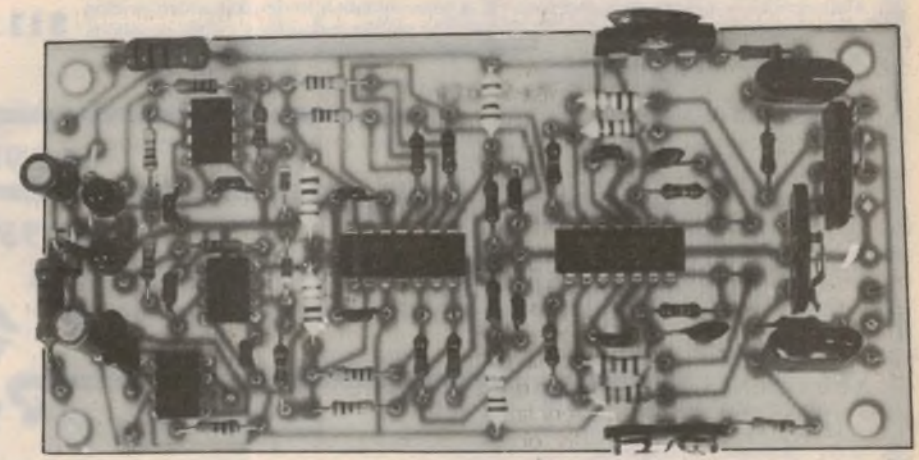
to demonstrate that conventional power meters or overload indicators are unable to accurately indicate if an overload is actually occurring. This is because they depend on the assumption that an amplifier can deliver a certain maximum output voltage, come what may. Well, as the song says, "it ain't necessarily so!"

The overload monitor presented here compares the shape of the signal waveform at the input and output of a power amplifier. If there is a difference amounting to a harmonic distortion equivalent of 0.1% or more, the overload indicator will light. Thus the circuit continuously checks the linearity of the amplifier and will immediately light up in the event of clipping, slew rate limiting or a fault condition such as excessive DC offset at the output.

The circuit includes a memory feature so that even very brief overloads lasting perhaps only 25 microseconds (corresponding to one half-cycle at 20kHz) or less will be clearly indicated by a short flash from a light emitting diode.

The overload indicator would also be of particular use with amplifiers used for stage or studio work. It would then avoid the likelihood of repeatedly driving an amplifier into overload which may damage expensive loudspeakers without any harm to the amplifier itself.

As presented, the overload indicator is a printed circuit board measuring 132 x 63mm which is suitable for incorporation into any solid state stereo (or mono) power amplifier which has balanced supply rails. Fig. 1 shows the general scheme



The PC board is designed to mount inside the amplifier. We installed the LEDs on the board, but they would typically be mounted on the front panel.

of connections from the overload indicator to both channels of a typical stereo power amplifier.

Six connections are required: to the input and output of each power amplifier and to the supply rails. Fig. 2 shows the general concept of how the overload indicator monitors a power amplifier. Only one channel is shown.

Fig. 2 depicts the input and output signal connections from a power amplifier being made to a differential amplifier. The power amplifier's output signal is passed through an attenuator to cancel out the gain of the power amplifier. This means that provided the power amplifier is operating within its linear region (ie, not clipping or otherwise distorting the signal) there will be no output signal from the differential amplifier.

But if the power amplifier is clipping, there will be a substantial difference signal applied to the differential amplifier and it will have a large output signal.

The output of the differential amplifier is coupled to a pair of comparators which sense whether the signal is swinging above or below 0V by more than the comparator reference voltages. If the signal exceeds these limits, the output of one or other of the comparators will go high. The comparator outputs are fed to an OR-gate which has a high output if one or other of the comparator outputs is high. If this happens, the following monostable is triggered and the LED lights.

BILL EDGE'S ELECTRONIC AGENCIES

115-117 Parramatta Rd, Concord 2137
(Corner Parramatta Rd & Lloyd George Ave)
Telephone (02) 745 3077 (two lines)
117 York St, Sydney Phone 29 2098

Mail Orders:
PO Box 185
Concord
2137

NSW & ACT ONLY			VIC, SA, QLD, TAS, WA, NT		
$1	— $ 9.99	$1.50	$1	— $ 9.99	$2.50
$10	— $24.99	$2.50	$10	— $24.99	$4.00
$25	— $49.99	$3.50	$25	— $49.99	$5.00
$50	— $99.99	$4.50	$50	— $99.99	$6.00
$100	or more	$5.50	$100	or more	$7.50

bankcard welcome here

TRADING HOURS
BOTH STORES
Mon-Fri 9 am-5.30 pm
York St Thursday 8 pm
Saturday 9 am-12 pm

All heavy or bulky items (over 20 kg) sent Comet Road Freight $12.00 anywhere in Australia.

NEW MICROBEE SOFTWARE

XE6760 FILEX
This program provides a multi-purpose, multi function means of storing a wide range of name/address orientated records for subsequent retrieval and manipulation. **$14.95**

XE6780 BACUP
This machine language program will copy ANY program regardless of protection **$9.95**

XE6785 PIANO BEE
You can compose music and replay it. The program will print the notes as they are played back. You can compose four different songs, save a song at 300 or 1200 bd load a song back. **$14.95**

XE6790 ARTILLERY
— angles, parabolas and the effect of wind speed changes on the trajectory of a shell.
— three modes of operation — tutorial, game, competition for 2-6 players. **$11.95**

XE6795 CLOZE
Designed to develop reading skills. Looking ahead and guessing are encouraged. Contains 3 stories at approx the same reading difficulty. Suitable for senior primary/junior secondary. **$11.95**

XE6800 ESCAPE
Mathematics — full graphics and sound in a game situation to develop understanding of the order of operations and to develop skill in writing and solving simple equations. **$11.95**

XE6805 TANK BATTLE
A game for two players whose tactics is an important factor **$11.95**

XE6810 TOWNS & CITIES — NSW
Deals with maps and the location of various towns and cities throughout Australia. This one is on towns in NSW. **$11.95**

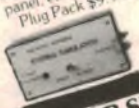
XE6815 TOWNS & CITIES — AUSTRALIA
This program is similar to the above except that it deals with 40 major cities and towns in Australia **$11.95**

XE6820 NUMBER FACTS
— Drill and practice of tables and number facts.
— Options cover all operations plus mixed parameters for addition and subtraction may be set.
— Speed is selectable, suitable for individual or a small group. **$11.95**

XE6825 SECRET NUMBER
A comprehensive program in a challenging format which develops a child's understanding of the properties of a number, eg prime, composite, multiple, square, fibonacci, randome etc. **$11.95**

XE6830 BATTLESHIP
The old game where the Battleships have to be bombed and they are at certain places on the grid. **$11.95**

STEREO SIMULATOR KIT
See EA Apr. 83
All parts supplied including box, front panel, etc, but excluding plug pack. Plug Pack $9.95 Cat ME7721
KE7008 **$19.95**



MOTOR SPEED CONTROLLER KIT
See ETI Apr. 83
KE7006 **$19.95**

TOUCH LIGHT DIMMER KIT
See EA Apr. 83
Complete kit including all hardware.
KE7007 **$19.95**

5A POWER SUPPLY KIT 3-50V
See EA May, '83.
NEW **$149.00.**
KE7011

TEMPERATURE PROBE KIT FOR DIGITAL MULTIMETERS ETI153
A handy temperature probe for any digital multimeter. It can be read directly in °C, °F or Kelvin (for the scientists).
$19.50 KE7010
See ETI June, 1983

BOO BOO'S

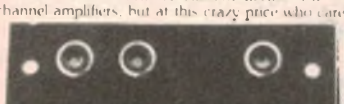
Our Purchasing officer has been doing some naughty things lately. Instead of getting our normal single PC mount fuseholders he bought double ones. Nothing we can do except sell them cheap.
Top quality, bakelite base, accepts standard 3AG fuses.

SE4559

1-49 $0.20¢ ea.
50 up .15¢ ea.

These would normally sell for about 80¢ ea.

And yet another boo boo. We all know the standard single, twin, four way and six way RCA sockets on that nice black bakelite. Well, he bought 3 way ones. Great for TRIRA PHONIC cassette decks, or 3 channel amplifiers, but at this crazy price who cares.



1-49 20¢ 50 up 15¢

These would normally sell for about 75¢ PE0341

MICROBEE MONITORS

XE1186 12" Micron Green Monitor	$199.50
XE1188 12" Kaga Denshi Orange	$325.00
XE1190 12" Kaga Denshi Green	$325.00
XE1192 12" B&W Monitor	$129.50

MICROBEE

XE5000 Microbee 16K Plus	$449.00
XE5100 Microbee 32K Plus	$549.00
XE5200 Microbee 64K Plus	$699.00
XE6505 Editor Assembler	$ 59.50
XE6605 Wordbee	$ 59.50

New Lower Price
Save $30.00

MICROBEE ACCESSORIES

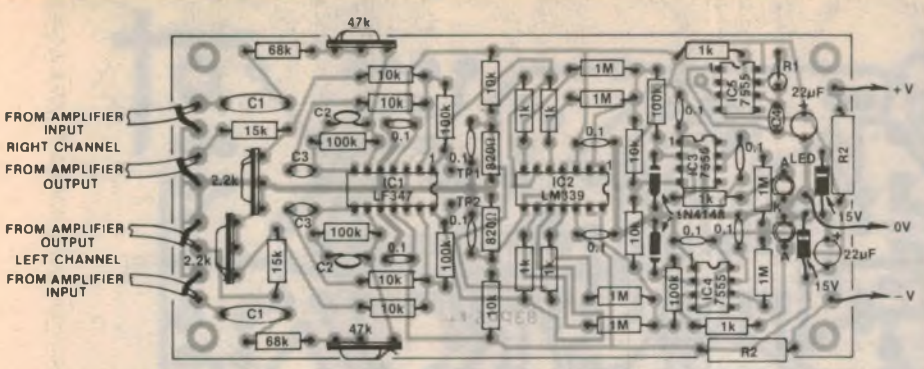
XE8000 Editor Assembler Manual	$6.50
XE8001 Wordbee Manual	$11.50
XE8005 Microbee Basic Manual	$12.50
XE8020 16K Decal	$ 3.50
XE8021 32K Decal	$ 3.50
XE8022 64K Decal	$ 3.50
XE5410 Microbee Plug pack	$17.50
XE5400 Microbee Cassette Recorder	$49.50
XE3530 C10 Blank Cassette	$ 1.10
XE3540 C20 Blank Cassette	$ 1.20
XE3545 C30 Blank Cassette	$ 1.40

HOUSE ALARM KIT. ETI582

This great kit was released by ETI back in 1977. To make it easier for the constructor we have joined the two PCB's together and added a power supply, on the one board.
All components are supplied, including mains transformer, lead, terminal strip, nuts and bolts, but no case. See ETI July/August, 1977.

$59.90 KE7009

Overload Indicator



Parts overlay diagram for the Overload Indicator. Note that the 3.3Mμ resistor and 220pF capacitor on pin 3 of IC5 are not included on the PC board.

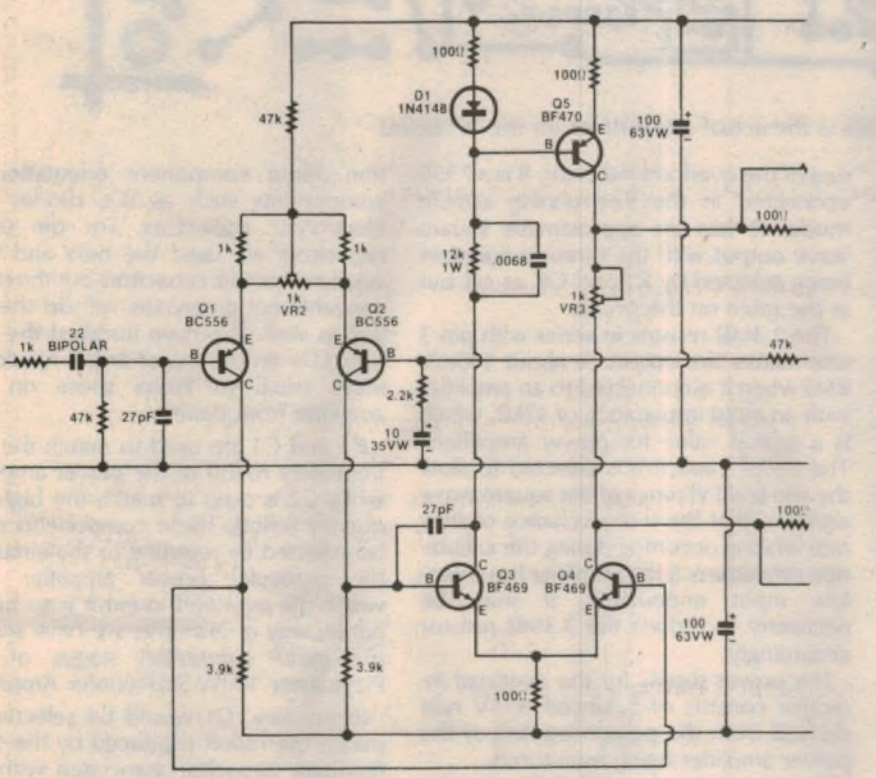


Fig. 3: input differential stages of the Playmaster 100W Sub-woofer Amplifier. See text re selection of C1, C2 and C3 in overload indicator circuit.

The foregoing brief description assumes that the power amplifier being monitored is not an inverting amplifier. As it happens, very few power amplifiers do invert the signal polarity (ie, cause a 180 degree phase reversal between the input and output). With those few power amplifiers which do invert the signal, the monitoring circuit could be modified to take care of this problem, by providing an extra signal inversion.

Fig. 2 won't work

For a number of reasons which will become evident as this article progresses, the simple circuit configuration of Fig. 2 has had to be modified quite extensively to make it work as intended. Refer to the complete circuit diagram now and we will discuss its operation. Again, only one channel is depicted.

Instead of using just one differential amplifier as shown in Fig. 2, we have used IC1a and IC1b. IC1b inverts the signal from the power amplifier input so that it will have out-of phase polarity to the signal from the power amplifier output, which is coupled in via an attenuator consisting of a 15kΩ resistor and 2.2kΩ trimpot.

IC1a functions as a "summing" amplifier with a gain of 10. IC1a sums the inverted power amplifier input signal (via IC1b) and the attenuated power amplifier output signal via 10kΩ resistors. Provided the power amplifier is operating linearly, the output of IC1a is 0V.

PARTS LIST

1 PC board, 132 x 65mm, code 83pp5
18 PC pins
1 TL074, LF347 quad Fet-input op amp IC
1 μA339, LM339 quad comparator IC
3 7555 timer ICs
2 1N4148 diodes
2 15V 1W zener diodes
2 red LEDs

CAPACITORS
2 22μF/16VW PC-mounting electrolytic
10 0.1μF metallised polyester (greencap) or monolithic
1 .047μF metallised polyester or ceramic
1 .0033μF metallised polyester, polystyrene or ceramic
1 220pF ceramic
PLUS: 2 x C1, C2, C3 (see text)

RESISTORS
(5% tolerance, ¼W rating)
1 x 3.3MΩ, 7 x 1MΩ, 6 x 100kΩ, 2 x 68kΩ, 2 x 15kΩ, 9 x 10kΩ, 7 x 1kΩ, 2 x 820Ω, 2 x R2 (see text), 2 x 47kΩ trimpots, 2 x 2.2kΩ trimpots

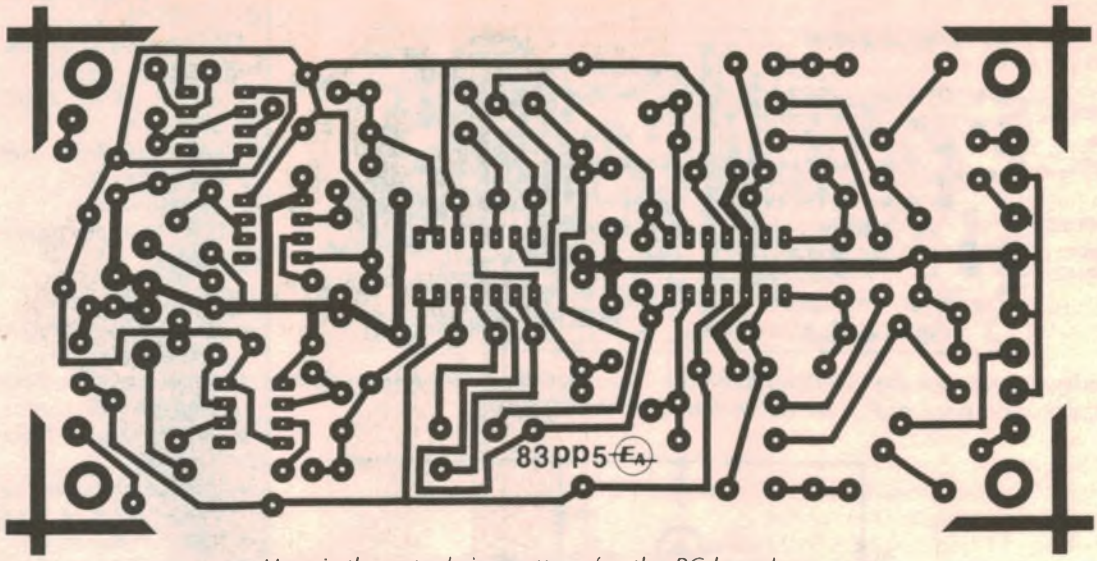
MISCELLANEOUS
Shielded cable, hook-up wire, PC-mounting hardware, solder.

Following IC1a is a pair of comparators, IC2a and 2b, (actually half of a quad comparator, type LM339). These perform the same function as the comparators in Fig. 2 except that the arrangement of the inputs has been changed. The reasons for this change are several.

First, while the signal to the inputs of the comparators may swing above and below 0V, it is desirable that the outputs swing only between 0V and 15V. This is because the 7555 monostable (IC3) at the end of the signal chain requires a single rail supply and requires a trigger signal which drops to 0V.

The LM339 lends itself to this function particularly well because it has so-called open-collector outputs. This means that the two comparator outputs can be tied together and connected to a common 10kΩ load resistor. This is handy because it provides the OR-gate function shown in Fig. 2. It can be regarded as a so-called "wired-OR" gate.

The consequences of the LM339 input and output connections are that, for comparator input signals of less than ±1.1V (the positive and minus thresholds of the two comparators), the tied outputs will be high (ie, +15V). For input signals greater than ±1.1V, the tied output will be low, at −15V. This is rendered compatible with the input of the following 7555 monostable circuit by the 100kΩ resistor and clamping diode.



Here is the actual size pattern for the PC board.

When the common comparator outputs are low, the clamping diode prevents pin 2 of the 7555 (IC3) being damaged by clamping it to −0.6V. When pin 2 is pulled low in this fashion, pin 3 of the 7555 goes high and lights the LED for about 0.1 second, a period determined by the 1MΩ resistor and 0.1μF capacitor connected to pins 6 and 7 of IC3.

In the event of a DC fault or very severe clipping in the power amplifier being monitored, the comparator outputs will be permanently low. In this case, the output of the 7555 (pin 3, IC3) will remain high and the LED will stay alight.

Why use the "summer"?

As noted above, we had to replace the differential amplifier of Fig. 2 with IC1a and 1b. We found this necessary because we were unable to obtain a good "null" when adjusting the attenuator. The reason for this was insufficient common-mode rejection in the differential amplifier, particularly at high frequencies.

By way of explanation, a differential amplifier is supposed to ignore common mode signals or signals which are the same, and only amplify the difference between the signals applied to its inputs.

So by using inverting amplifier IC1b and summing amplifier IC1a, we solve the problem of insufficient common mode rejection. Even so, it is still necessary to ensure that the high frequency and low frequency rolloffs of IC1b match those of the power amplifier being monitored. To this end, we have included C1, C2 and C3. We will describe selection of these components later.

Two aspects remain to be discussed: IC5 and the power supply. IC5 is provided as an on-board oscillator for calibration of the overload indicator. It is a 7555 connected in the free-running astable mode. It has an approximate square wave output with the three frequencies being selected by R1 and C4, as set out in the table on the circuit.

The 3.3MΩ resistor in series with pin 3 attentuates the output to about 100mV RMS when it is connected to an amplifier with an input impedance of 47kΩ, which is a typical value for power amplifiers. The 220pF capacitor is selected to slow the rise and fall times of the square wave signal so that there is no chance of slew rate limiting occurring during the calibration procedure. If the amplifier has a very low input impedance, it may be necessary to reduce the 3.3MΩ resistor accordingly.

The power supply for the overload indicator consists of balanced ±15V rails derived from the power supplies of the power amplifier being monitored.

The two resistors marked R2 must be selected to suit the rail voltages. For amplifier supply rails between 25V and 35V, R2 can be 680Ω/1W. For voltages between 35V and 45V, make R2 1.2kΩ/1W; between 45 and 50V, make it 1.8kΩ; for 50 to 60V, make it 2.2kΩ/1W; for 60 to 65V, 2.7kΩ/1W and for 65 to 70V, 3.3kΩ/1W.

Construction

Assembly of the PC board requires little comment other than the usual caution about component orientation of components such as ICs, diodes and electrolytic capacitors. For the 0.1μF capacitors we used the new and very small monolithic capacitors but the more conventional greencaps will do the job just as well. We have installed the two red LEDs on the board but it would be more usual to install these on the amplifier front panel.

C1 and C3 are used to match the low frequency rolloff of the power amplifier while C2 is used to match the high frequency rolloff. These components must be selected by referring to the circuit of the particular power amplifier with which the overload monitor is to be used. By way of example, we have shown the input differential stages of the Playmaster 100W Sub-woofer Amplifier.

In practice, C1 would be selected to match the rolloff produced by the 10μF feedback capacitor associated with Q2 while C3 would be selected to match the effect of the 22μF bipolar input capacitor.

The selection practice is simply a matter of scaling the capacitor values up or down to match the associated resistors. Taking the easiest one first, C3 should have the same impedance ratio to the associated 10kΩ series resistor as does the 22μF bipolar input capacitor to its associated 47kΩ shunt resistor. By that reasoning, C3 should be 4.7 times 22μF or close enough to 100μF.

In this particular case though, the impedance of a 100μF capacitor at, say, 20Hz, is so low that it will cause negligible phase shift. As a result, C3 may be replaced by a wire link, as shown in the photograph in this article.

C1 is selected by a similar process and is related to the 10μF feedback capacitor in the circuit ot the amplifier referred to

We estimate that the current cost of components for this project is approximately

$20

This includes sales tax.

above. By this process, C1 should have the same ratio to 10μF as 2.2:90. This works out to be 0.24μF. The nearest practical value is .22μF and this can be a metallised polyester type.

C2 is used to match the rolloff at high frequencies produced by input shunt capacitors, feedback capacitors (which would normally be in parallel with the 47kΩ feedback resistor in our example) and output RLC network. Since the total effect of these components is unknown unless you take the trouble of measuring the amplifier, a good starter value for C2 is 10 picofarads. This will be ceramic capacitor.

Note that the 3.3MΩ resistor and 220pF capacitor on pin 3 of IC5 are not mounted on the PC board.

For calibration of the overload indicator you will need access to an AC millivoltmeter (your digital multimeter will do) with good frequency response (to at least 20kHz), or an oscilloscope. For a signal source you can use the on-board oscillator (IC5) or an external sine-wave audio oscillator.

First apply power, with no input connections. Check the voltages shown on the circuit and see that they are close to the specified values. Now make the connections to the input and output of the amplifier. One point that should be made here is that the input cable from the power amplifier's input should not have its shield connected to the amplifier's input earth. This is to prevent a possible earth loop situation.

Set the oscillator to 1kHz and adjust the level so that the amplifier is delivering a signal level which would result in several watts being delivered to the load. Do not have the loudspeakers connected otherwise the noise level will be annoying. Adjust the 47kΩ trimpot for about mid-setting and adjust the 2.2kΩ trimpot for a null signal at TP1, ie, the minimum possible signal.

Now set the oscillator to 20Hz and adjust the 47kΩ trimpot for a null. This will alter the gain at mid-frequencies for IC1b and the nulling at 1kHz will have to be repeated by adjusting the 2.2kΩ trimpot. In turn, this will require a readjustment of the 47kΩ trimpot at 20Hz. Finally, set the oscillator at 20kHz and check for a null at TP1. If the null is not as good as obtained at the two lower frequencies, the value of C2 may have to be changed.

If the power amplifier is stereo, these tests now have to be repeated for the other channel. Then finally, when tests are complete, disable IC5, the oscillator, by removing R1.

Now reconnect your loudspeakers for listening tests. If the LED indicators light during these tests you will have to make sure that your amplifier volume control is set to a lower level in future. Either that, or you have to buy a bigger amplifier.

SHARP

5 KV. OPTOs

RIGHT 1st TIME!

TELECOM APPROVED

WHATEVER THE APPLICATION

SHARP's massive range of opto couplers has a product to suit . . .
High Gain, High Current, High Voltage, Hybrid Mounting, OPTO FET,
ULTRA HIGH SPEED, Single, Double, Triples and Quads, End Stackable or solo

SHARP . . . right, FIRST time

Distributed in Australia by:

daneva australia pty ltd
66 Bay Rd, Sandringham, Vic., 3191.
P.O. Box 114, Sandringham, Vic., 3191.
Telephone: 598-5622. Telex: AA34439.

Sydney: (02) E&M Electronics 51-5880
Adelaide: (08) DC Electronics 223-6946
Perth: (09) Micro Controls 445-2544
Brisbane: (07) Baltec 369-5900

KITS--KITS--KITS--

500MHz Digital Frequency Period Meter

Ref: EA Dec '81 – Feb '82
Jaycar has by far the best kit version of this project in Australia. We now supply 2 x GOLD plated BNC input connectors at no extra cost!
Cat. KA1390 $119 (50MHz Version)
Cat. KA1392 $26 (500MHz option)
(Beware of kits that don't conform to the original design).

ONLY $119

HEART RATE MONITOR

Ref: EA July '82
Brilliant kit which enables you to measure your heartbeat instantly. One of our most popular kits ever. The Jaycar kit comes in a beautiful ABS splashproof case with professional silkscreened panel.
Cat. KA1466 $79

$79

DIGITAL CAPACITANCE METER

$74.50

Ref: EA March '82
Accurately measure capacitance from 1pF – 19.99uF. A must for the serious enthusiast.
Cat. KA1420 $74.50

Digital Thermometer

Ref: EA Feb '82
0 – 100 degrees C with 0.1 degree resolution. Bright, easy to read display. Kit includes two temperature sensors.
Cat. KA1404 $74.50

magnificent! $74.50

TRANSISTOR ASSISTED IGNITION

Ref: EA Jan '83. Latest version of this popular kit. The Jaycar kit has a genuine die cast box – as used in the EA prototype. Beware of others that use flimsy sheet metal.
Cat. KA1506 $35

MAGIDICE

The best electronic dice ever made! Firstly, this is not a kit. It is completely built and tested.
Basically the MAGIDICE is a glistening black cube measuring 75mm on all sides. It has 6 LED's set into the top of the cube under a red filter (the filter LOOKS black as well).
When the switch in the base is turned on, a wave of the hand over the top of the cube causes the circuit to operate. The cube beeps and gives you a guaranteed random dice "throw" in the form of illuminated LED's. There are no buttons to press and you don't even have to touch the cube!
The last number will remain until you note or wave your hand over the unit to "throw" another number. This (patented) product makes an absolutely unique gift and comes attractively presented.
Cat. XC-2006

Please note that a 9V battery snap (supplied) must be fitted to use on local 9V standard cell.

GREAT GIFT
$5 OFF
JUNE ONLY
NOW ONLY
$14.95

BRILLIANT FUN

0–30V 1amp power supply

Ref: ETI December 1982

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

You will never own a more useful piece of gear.

Function Generator

Ref: EA April 1982

$99

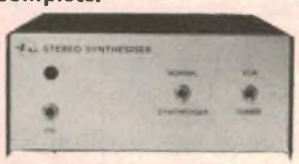
STEREO STEREO STEREO STEREO

Synthesiser

Creates a very realistic stereo sound from mono sources i.e. AM tuners, TV or video units Very easy to build and comes complete.

Ref: EA September 1982

Cat. KA1478



Short Form Version Only Cat. KA1476
$39.50

EA dual tracking P/S

Ref: EA March '82

Cat. KA1410

Extremely versatile power supply: Will give plus & minus 1.3V to 22V at up to 2 amps PLUS A FIXED +5V@0.9A. The supply is completely protected against short circuits, overloads and thermal runaway. A large meter with voltage calibration is supplied as well as IC sockets. A quality kit.

$89.50

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

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

5000 SERIES GRAPHIC EQUALISERS

REF: ETI JAN/MARCH 1981

SPECIFICATIONS:
Signal-to-Noise: –102dB with respect to 1 Volt
Frequency Response: 12Hz – 105kHz to –1dB
Boost/Cut: 14dB (28dB total)
Distortion: 100Hz 0.04%, 1kHz 0.007%, 10kHz 0.006%
Essentially irrespective of cut or boost!
Current consumption (DC): Approx 100mA @ 7.15V (Requires 30V AC CT)
Output short-circuit proof.

AUSTRALIAN (NOT HONG KONG) MADE – SPECIAL BUILT RACK CABINET – QUALITY!!!

Cat. KE4204

$199

BUY 2 AND SAVE $10 – ONLY $389

ALL IC SOCKETS PROVIDED

FUNCTIONS
- MOVING COIL INPUT
- MOVING MAGNET (DYNAMIC CART)
- INPUTS (2 OFF)
- TUNER INPUT
- AUX INPUTS (2 OFF)
- TAPE INPUTS (2 OFF)
- INPUT LEVEL CONTROL
- TAPE OUTPUTS (2 OFF)
- 400Hz CALIBRATION OSCILLATOR
- LED AVERAGE (VU) & PEAK
- LEVEL METERS -48dB TO +9dB
- MODE SWITCH: STEREO BALANCE CONTROL LINE OUT MONITOR OUT MONITOR VOLUME CONTROL

FEATURES
- EXTREMELY CLOSE TRACKING TO RIAA PHONO EQ.
- GOLD PLATED CONNECTORS ON ALL INPUTS
- ENGLISH 'LORLIN' LOW NOISE SELECTOR SWITCHES
- LOW NOISE 1% 50ppm METAL FILM RESISTORS USED
- TINNED FIBREGLASS PCB's
- LOW CAPACITANCE SCREENED CABLE USED THROUGHOUT
- QUALITY I.C. SOCKETS
- SPECIAL REAR PANEL
- MULTICOLOURED RECTANGULAR LEDs USED

FREE! TILTING BAIL WORTH $4.95 included

NEW MAGNUM 200

NEW! – LOW COST 5000 SERIES AMP

ONLY $299

Black Monolith $319

"BLUEPRINT" ONLY $299

KITS-- KITS-- KITS-

LOW COST DIGITAL MULTIMETER KIT

BY POPULAR DEMAND

ONLY $45

Ref: EA March 1983 (This month)
Almost everyday we are asked for a multimeter kit. Up until now we thought that it was just not worth it considering the fine low cost built up units available. The DP2010 changed all that.
This kit, fully imported from the UK uses the famous DFM-05 custom LCD/voltmeter to achieve phenomenal accuracy at very modest cost.
All parts are included to complete the meter including an attractive and colourful front panel.
(a 9V battery is required)

Set of test probes to suit $2.95
Probe to suit Cat. WT5312
ONLY $2.50
Eveready 216 (red)
9V Battery Cat. SB2370
ONLY $1.40

DP2010 kit Cat. KJ-7010
ONLY $45

AC VOLTAGE AND CURRENT RANGES
When S7a selects a.c. functions the output from either the voltage attenuator or current shunts is fed through C1 to remove any d.c. components.

SPECIFICATIONS

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

ROBOTICS

JAYCAR – FIRST IN AUSTRALIA WITH THE VERY LATEST IN THE FIELD OF ROBOTICS

Jaycar is the first major electronics company in Australia to stock useful robots in kit and built up form.

MICRO GRASP

ONLY $499

The Micro Grasp is the first low cost true robot. Basically the unit has an articulated arm jointed at the shoulder, elbow and wrist positions. The entire arm rotates on its base and has a motor driven gripper on the end of the arm. Each of the arm movements is SERVO CONTROLLED i.e. there are precision sensors feeding back information to the interface board where it is compared with the programmed or intended position. Any positional error is automatically and continuously corrected. This servo action is independent of the computer, simplifying greatly the software to drive the robot. All programming is carried out with a small number of common BASIC commands. The interface board is memory mapped occupying 64 bytes at any of the 1024 available locations.
Control of the Micro Grasp as a computer peripheral is accomplished thru the parallel expansion port of most small computers. To keep the cost to an absolute minimum and to increase the learning factor the Micro Grasp is supplied as a self assembled kit. All components down to the last nut and bolt are included, as is the power supply.

MICRO GRASP KIT INCLUDING POWER SUPPLY Cat. XR1000 – SPECIAL INTRODUCTORY PRICE $499.00
UNIVERSAL COMPUTER INTERFACE BOARD (in kit form) Cat. XR1010 ONLY $179.00 (not required for Sinclair ZX81 computer)
23 + 23 way edge connector at $9.95 ZX-81 peripheral/RAM pack splitter board $10.95
CALL IN TO OUR YORK STREET SHOWROOM AND SEE WORKING!!

AS DESCRIBED ETI MAG. APRIL/MAY 1983

EPROM programmer for the MicroBee

Ref: ETI Feb '83

Fantastic little accessory for the popular "Microbee" computer.
The Jaycar kit contains all components including the following SPECIAL features:
- 28 pin IC socket included!
- 3 x 16 pin "PERSONALITY PLUG" HEADERS
- 15 pin PARALLEL CONNECTOR
- IC sockets for all logic devices including personality socket.

ALL THIS FOR ONLY $39.95!
Cat. KE4650

24 pin ZIF socket to suit only $12.95 Cat. PI6522

Sparkrite

The Brandleaders in Auto Electronics

the ultimate in electronic ignition

Each kit is complete down to the last nut & bolt. All fittings included! SX-2000. UK's largest selling electronic ignition! "Reactive Discharge" system – NOT CDI – with great reliability.
Cat. KJ-6650

Sparkrite SX2000

NEW Value

$49
SAVE $10
$59

A Reactive Discharge System combines all features of the SX500 plus
- Reactive Discharge electronics combining all the advantages of both Inductive and Capacitive Discharge for maximum spark performance
- Gives the most thorough combustion of air/fuel ratios especially current lean mixture emission controlled engines
- Voted 'Accessory of the Year' and the best as tested by Popular Motoring Magazine
- Patented clip-to-coil fitting
- Systems Function Light as well as Static Timing Light
- The ultimate brand leading contact-breaker triggered system

TX-2002. Breakerless ignition! Full fitting kit to convert 90% of all cars! All contactless hardware supplied. No drilling or tapping. You can easily convert – and even use your points to work the TX-2002!
Cat. KJ-6652

Sparkrite TX2002

$99
SAVE $16
$115

THE BRAND LEADER

A Reactive Discharge System – with unique auxiliary circuit. Combines all features of the TX1002 plus
- Reactive Discharge electronics combining all the advantages of Inductive and Capacitive Discharge for maximum spark performance
- Gives the most thorough combustion of air/fuel ratios especially current lean mixture emission controlled engines
- Unique 3 way change-over switch incorporating an auxiliary back up circuit 'ELECTRONIC/OFF/AUXILIARY'
- Robust die-cast case, fully resistant to moisture and heat
- The ultimate system – REACTIVE DISCHARGE – CONTACTLESS OR CONTACT TRIGGERED – AUXILLIARY BACK UP CIRCUIT – CLIP-TO COIL FITTING – FOUR CONNECTIONS ONLY – ALL PARTS IN ONE BOX TO FIT OVER 500 APPLICATIONS

TX APPLICATIONS
Special application listing kit required, all parts in one box, to fit more than 500 vehicles.

TX-1002. Slightly lower powered version of the TX-2002. Ideal for most 4 cylinder cars. All fitting pieces included!
Cat. KJ-6651

Sparkrite TX1002

An Inductive Discharge System
- Can be operated utilising 'Hall Effect' triggered head, or existing contact breakers
- Extended dwell inductive Discharge for maximum spark efficiency
- Three position switch
- Static Timing Light
- Systems Function Light
- Patented clip-to-coil fitting
- Robust die-cast case
- Fully waterproof
- Protected from the hostile environment of the engine compartment

SAVE $10 $79 $69

Sparkrite AT-80

Brilliant Computer Programmable Car Security System
This kit, the famous British Sparkrite AT-80 is absolutely unique. It uses a self-adhesive sensor pad that attaches to the inside of your glass windscreen. You have a special key fob (2 are supplied) and you program YOUR SPECIAL CODE in, from the OUTSIDE OF THE CAR to get back in.
This windscreen pad is a REAL deterrent shown!
Cat. KJ-6655

ONLY $89

$99

Jaycar NUMBER 1 FOR KITS

SYDNEY SHOWROOM
125 YORK STREET PHONE: (02) 264 6688
TELEX: 72293

CARLINGFORD SHOWROOM
Cnr. CARLINGFORD & PENNANT HILLS ROAD
PHONE: (02) 872 4444

MAIL ORDERS & CORRESPONDENCE
BOX K 39 HAYMARKET, SYDNEY 2000
POST AND PACKING CHARGES
$5 – $9.99 ($1.50) $10 – $24.99 ($3.20)
$25 – $49.99 ($4.50) $50 – $99.99 ($6.50)
$100 or more ($8.00)

SHOP HOURS CARLINGFORD
Mon – Fri 9am – 5.30pm: Sat – 9am – 12pm: Thurs night 8.30pm
SHOP HOURS SYDNEY
Mon – Fri 8.30am – 5.30pm: Sat – 8.30am – 12pm: Thurs night 8.30pm

Mail Order By BANKCARD Via Your Phone

The first of a series of articles

How to obtain better TV reception: Pt. 1

This article is the first of a series which is intended to enable the reader to diagnose TV and FM reception problems and to become familiar with the various types of antenna.

by LEO SIMPSON

While just about everybody is familiar with the television medium, very few people enjoy the best reception which is possible. Very few people are even aware just how poor their reception is compared to the normally excellent quality of the TV signal being transmitted. Let's face it. Most people don't know and don't care. But that is no reason for you, the informed EA reader, to remain ignorant and inactive.

While we are being provocative let us continue in the same vein. It is painfully obvious, from my personal observations, that most people, including technically informed people such as engineers and high fidelity enthusiasts, do not know how to critically adjust their television receiver for the best picture. I will go further than that. They are not even aware that anything is wrong.

Even after some eight years of colour television transmission, the average domestic TV picture is too bright, too colourful, has either too much or too little contrast and, to compound the mess, is plagued with ghosts. Yet how often have I asked people about their television reception and been told "Oh, our TV reception is perfect!".

Most people seem blissfully unaware that they have a ghost problem even if they know what a ghost looks like. And the reason that they are not aware is usually that their set is not properly adjusted. In my experience there are very few TV antenna installations which are completely ghost-free. But I am getting way ahead of myself. Let us go back to the beginning.

Fine tuning

The first step in critically adjusting your TV receiver for best reception is to set the fine tuning. Unfortunately, the TV set manufacturers have lulled users into thinking that they can neglect this task. This is quite wrong. Even though most sets these days have some sort of automatic fine tuning or AFC (automatic frequency control) they should be critically tuned to begin with.

Many readers will immediately retort that this should not be necessary because the AFC will automatically "pull" the local oscillator to the correct frequency. This is true but the resultant tuning is then usually only "in the ballpark" and is not optimum. And the older the set is, the more likely that the AFC is off-centre.

So the first step in critically adjusting the fine tuning is to switch off the AFC. Now depending on whether your set has a pushbutton or rotary switch tuner, critically fine tune a station. This is best done when the station is broadcasting a test pattern or a first quality program such as a weather report (weather maps are particularly good for this exercise).

Photographs A, B and C show what to aim for. Photo A is taken from a studio monitor and so is an exceptionally good picture but this result can be approached by a well-adjusted domestic receiver in good reception conditions.

Photo B is taken from a typical domestic receiver with the fine tuning adjusted for best picture definition. Note particularly the resolution of the vertical "sinusoidal definition lines". These are not as good as in photo A. Photo C shows the same domestic TV set with the fine tuning adjusted beyond the optimum point so that noise (graininess) and interference (from the sound carrier) is beginning to break into the picture.

The idea is to adjust the fine tuning to the point depicted by photo C and then back off slightly to remove the interference and graininess. At this point

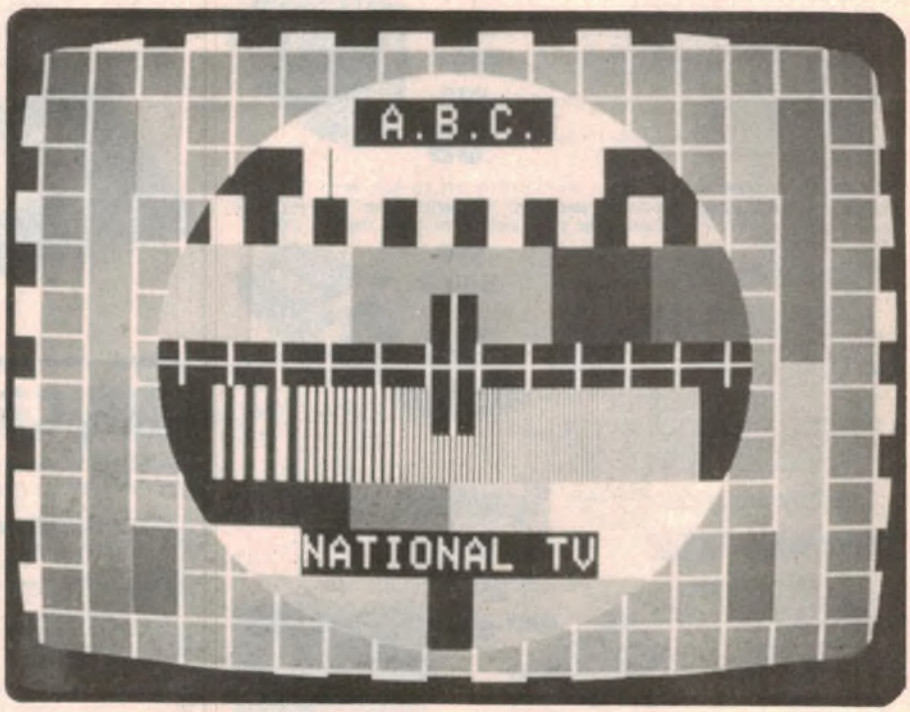


Photo A: Taken from a studio monitor, this shows the standard of reception possible in optimum conditions. Note that any interference effects (Moire patterns) evident in this photo are the result of the printing process.

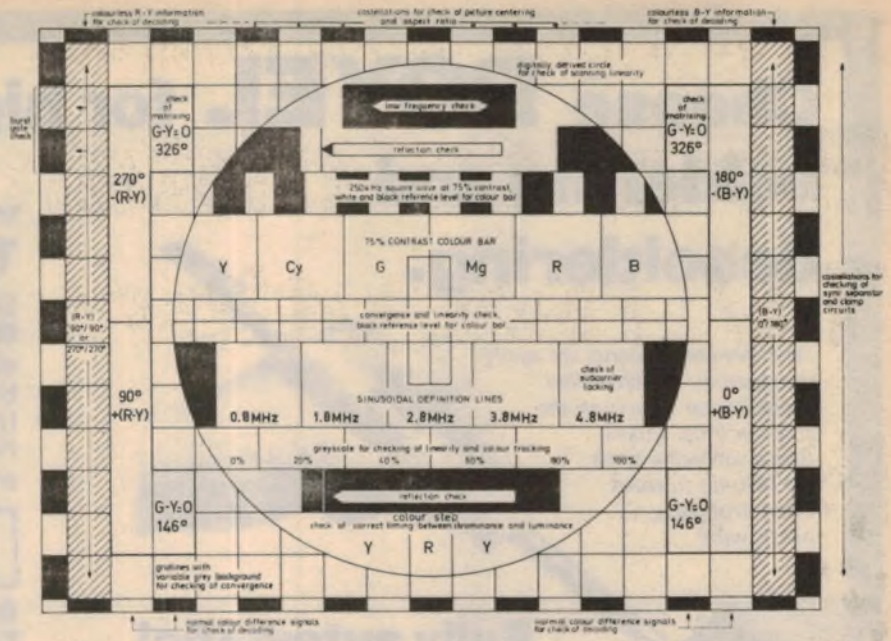
there could be kinks in the station identification letters. If so, you need to back off a little more.

In this discussion I am assuming that your TV signal is essentially noise and interference-free. This is often not the case so the fine tuning procedure is essentially a compromise to obtain best picture definition while not making noise in the picture too obvious.

Now, with the fine tuning adjusted for best possible picture definition, switch the AFC control back in. More often than not this will produce a slight detuning from the optimum setting. If the degree of detuning is more or less the same in the case of each station (eg each station detuned for less picture definition), it should be possible to adjust the AFC circuit for better operation. To do this, you will need to gain access to the inside of the set and you will need to refer to the service manual for the set. Most TV set makers or distributors will sell a manual to you for a modest charge (usually a few dollars) and this is well worth paying.

A few words of caution on making adjustments inside your set. First, you need to know what you are about. Don't fiddle with or touch any coils or presets without being absolutely sure that they are the ones you are supposed to be adjusting. Take note of initial settings of presets and coils, so that if you do accidentally pick on the wrong control to twiddle, you can at least return it to the original setting. Also, be aware that even though most sections of solid state sets do operate with low voltage rails, some sections do generate extremely high and dangerous voltages, notably the horizontal output and EHT sections. Finally, if yours is a late-model set it may well have no mains power transformer.

In this case, the circuitry and chassis metalwork of the set will usually be "floating" at half mains potential (ie, at about 120VAC) and so will be dangerous to work on unless you have access to an isolating transformer.



This is the key to the Philips PM5544 test pattern shown in Photos A, B and C. Those parts of the pattern which are black here should be black on screen and the 100% segment of the grey scale should be white.

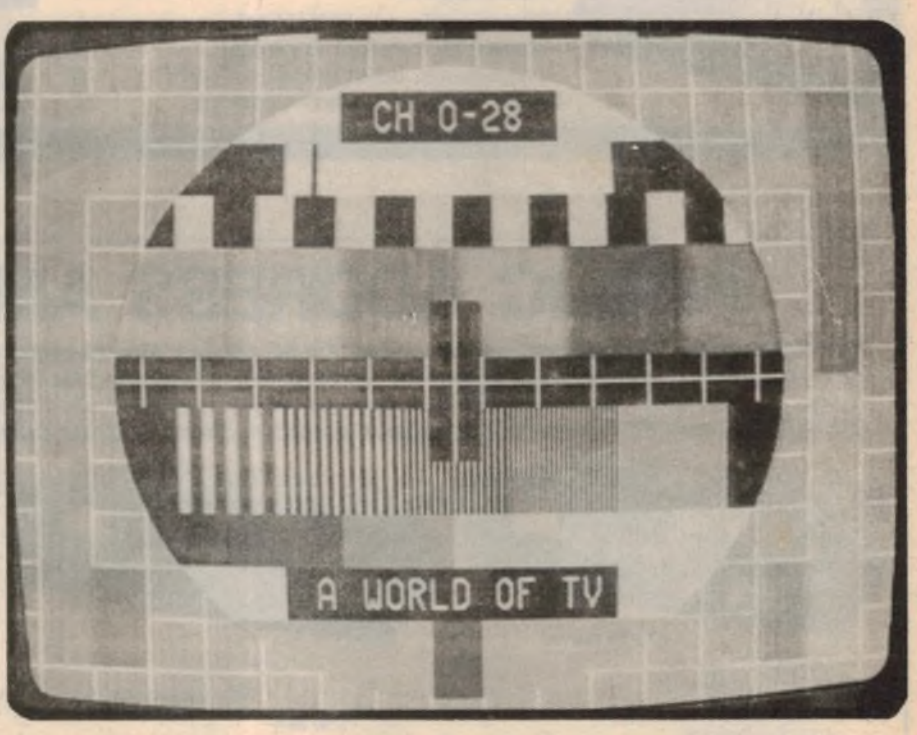


Photo B: taken from a typical domestic TV receiver with fine tuning adjusted for best reception. This picture shows evidence of overscan, less than optimum vertical linearity (distorted circle), and failure to fully resolve the six steps of the grey scale.

Brightness & Contrast

Having talked about the fine tuning and AFC we can move on to the brightness and contrast controls. The controls may superficially be regarded as being self-explanatory but that is not really the case.

For example, the contrast control is not used to obtain the maximum contrast between light and dark areas of the picture. Rather, it is used to obtain the greatest range of greys in the picture ranging right through from black to white.

Similarly, the brightness control may set the overall brightness of the picture but in some ways it is better to regard it as the "blackness" control. The situation is further complicated because the two controls interact with each other. How to adjust for optimum picture?

To adjust the controls correctly, it really helps to have some understanding of how the picture information is put into the amplitude modulated carrier. In Australia we use negative picture modulation and this means that a typical composite video waveform looks like Fig. 1.

If you adjust the vertical hold control on your set you will be able to "roll up" the picture so that you have a stationary horizontal bar on the screen. This horizontal bar represents the vertical blanking period of the video transmission, and is the time between two consecutive picture fields (of which there are 50 per second).

The particular feature of the blanking

Choose ROYEL for high reliability soldering and desoldering.

Sensitive components are easily damaged by uncontrolled soldering tip temperatures and electrical spikes. Royel soldering tools are helping to solve these problems, world wide.

Fully automatic!

NO TRANSFORMER TO BUY!
ONE TIP – ALL TEMPERATURES!

*Also available:
The cost-effective DUOTEMP. Normal temperature to protect components. Boost button for rapid heat-up and heavy-duty soldering.

MAINS VOLTAGE
THERMATIC

Slim. Lightweight. High power. 60 second heat up. Fully electronic AUTOMATIC feed-back temperature control. In-handle temperature selector. For micro-miniature, medium and heavy duty soldering.

CHOICE OF 3 MODELS WITH TIP DIAMETERS OF 3, 5 OR 6.5 mm. EACH IN 6 PROFILES x 6 SIZES.

BUY FROM YOUR ELECTRONIC PARTS SUPPLIER.

ROYEL

T182/A

Royston Electronics

N.S.W. (02) 709 5293 QLD. (07) 277 4311
VIC. (03) 543 5122 S.A. (08) 42 6655
TAS. (002) 34 2233 W.A. (09) 381 5500

PUBLIC ADDRESS AMPLIFIERS

The TPA 100 and TPA 150 professional quality Public Address Amplifiers are designed and built in Australia. They offer the professional installer outstanding performance, features and facilities not found as standard on any other brand. ★ XLR 3-31 connectors ★ Balanced mic inputs with LOW cut filters ★ Booster add on facility ★ 19" Industry Standard Rack Mounting Cabinets + Electronic Chime + Short Circuit and Overload protected.

TPA 100/150 Amplifier

Power Output
TPA 100 100W RMS
TPA 150 150W RMS
Harmonic Distortion
Less than 2% at rated output
Frequency Response
45 to 15000 Hz ± 3 db
Hum and Noise
Fundamental 80 db
Microphone 60 db
Auxiliary 70 db
Tone Controls
Bass ± 13 db at 100 Hz
Treble ± 13 db at 10 KHz
Outputs
4. 8. 50V. 70V. 100V Balanced
Dimensions
430W × 250D × 138H (mm)
Weight
TPA 100 12kg
TPA 150 13.5kg

$375.00 TPA 100
$495.00 TPA 150

PB 150 Booster Amplifier

Power Output
150W RMS
Harmonic Distortion
Less than 2% at rated output
Frequency Response
45 to 15000 Mz
Hum and Noise
80 db
Input Sensitivity
1V At 10 K
Outputs
4. 8. 50V. 70V. 100V Balanced
Dimensions
430W × 250D × 138H (mm)
Weight
13kg

$376.40

TPA 50/70/90 Amplifier

Power Output
TPA 50 25W RMS
TPA 70 50W RMS
TPA 90 70W RMS
Harmonic Distortion
Less than 1.5% at rated output
Frequency Response
50 to 15000 Hz ± 3 db
Hum and Noise
Microphone 60 db
Auxiliary 70 db
Outputs
4. 8. 16. 70V. 100V unbalanced
Dimensions
310W × 230D × 80H (mm)
Weight
TPA 50 3.8kg
TPA 70 4.3kg
TPA 90 5.1kg

$169.18 TPA 50
$201.96 TPA 70
$225.00 TPA 90

All prices are plus 20% sales tax if applicable. Dealer enquiries welcome.

RADIO PARTS GROUP PTY. LTD.
Head Office: 562 Spencer St, West Melbourne 3003. Telephone: (03) 329 7888. Telex 32980.
Southern Depot: 1103 Dandenong Rd, East Malvern 3145. Telephone: (03) 211 8122.

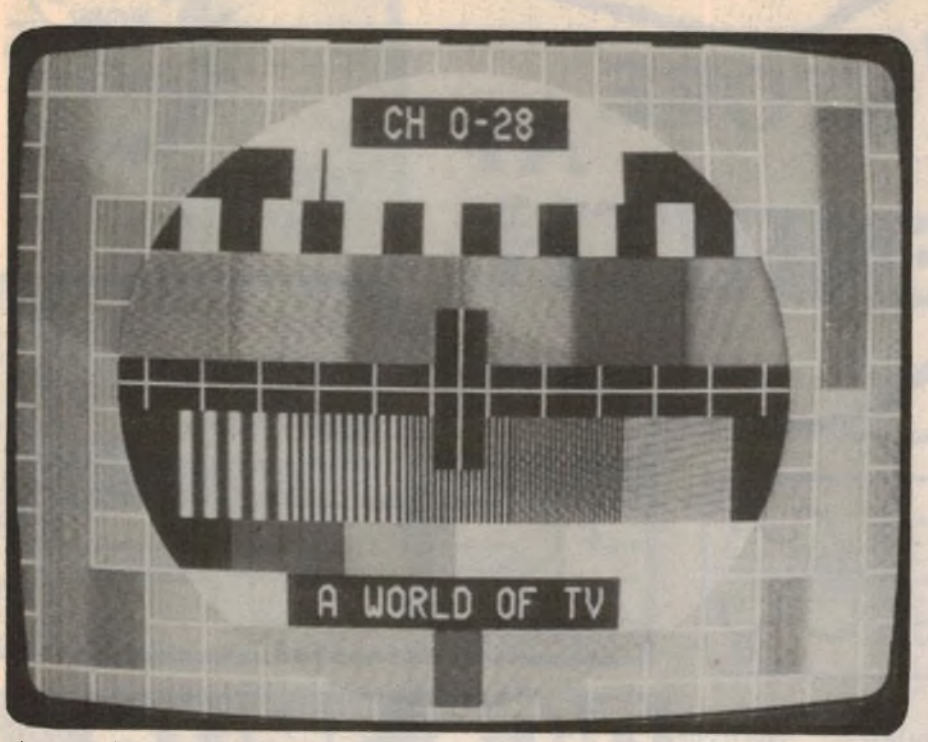
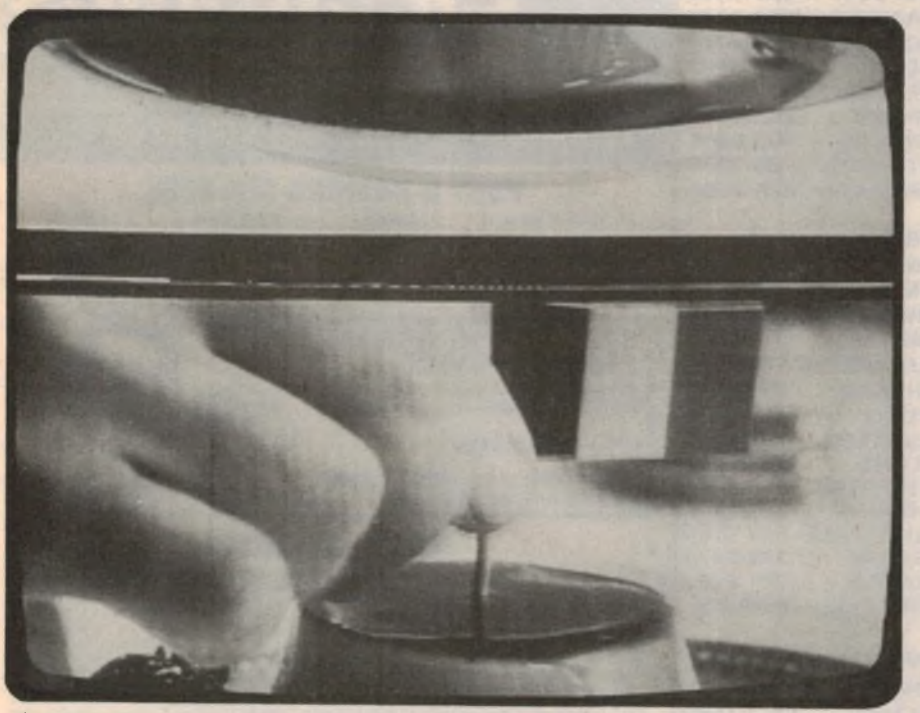


Photo C: this is taken from the same receiver as photo B but the fine tuning has been advanced to the point where noise and interference from the sound carrier is present. The fine tuning should be backed off slightly to remove these effects.



This picture is taken with the vertical hold control adjusted to reveal the horizontal bar which represents the vertical blanking interval. The bar should be black and the vertical sync pulse should not be visible. The white line is a Teletext transmission.

bar is that it should be black, not grey. If the brightness control is advanced too far, the blanking bar will be grey and the vertical sync pulse will be visible as a thinner black horizontal bar embedded in the top half of the blanking bar.

(Also visible in the blanking bar, on most TV transmissions, will be a horizontal white line with small rectangles on it. On some stations, this is their Teletext transmission.)

The brightness control should be adjusted so that the blanking bar is actually black, ie, that horizontal area of the screen should not be emitting any light (apart from that for the Teletext line just mentioned). By adjusting the brightness control in this way, we are setting the "black level" of the video waveform shown in Fig. 1.

Now adjust the contrast control. If the station is transmitting the Philips PM 5544 test pattern featured in this series of photos, adjusting the contrast control is easy. Just adjust it to resolve the six step grey scale.

If no test pattern is present, adjust the contrast control to resolve the maximum detail in the picture. For example, if a bush or tree is shown in the picture, you should adjust for the maximum detail in the leaves. Similarly, if a person is pictured, adjust for maximum detail in the hair.

What this process actually achieves is to adjust the gain of the video stages of the set for optimum signal handling. If the gain is too low, the amplitude of the video signal will be insufficient and the "whites" in the picture will be grey. Alternatively if the gain is too high, the signal will overload the video stages so that whites will be "whiter than white" and blacks will be blacker than black.

In effect, the "light greys" will be pushed into white and the "dark greys" will be pushed into the black. In other words, light greys will be indistinguishable from white and dark greys will be indistinguishable from black. Adjusting for optimum contrast will give the full range of shadings from black to white and thus reveal fine details that would otherwise be lost.

If you have correctly adjusted the contrast control, the 100% white areas of the test pattern (ie, the peak whites) should become no brighter when the contrast control is advanced slightly.

As noted before, the contrast and brightness controls interact with each other so it will usually be necessary to readjust the two controls a few times for best results.

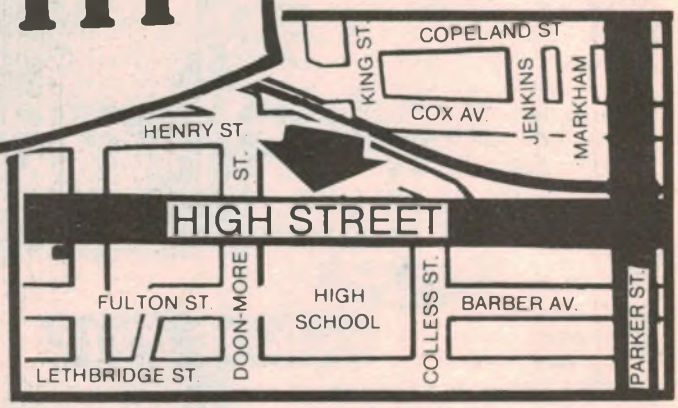
If you are adjusting the brightness and contrast controls without access to a test pattern, the colour control should be turned off, to obtain a black and white picture. If you have a set where the colour cannot be turned right off, you will be stymied at this stage and so you really should use the grey scale on a test pattern for correct adjustment of brightness and contrast.

Similarly, if you have a cheapjack set with a "picture" control instead of separate brightness and contrast controls, you are up a creek with half a paddle. But the foregoing should give the general idea of how it should be adjusted.

NEW STORE AT PENRITH

NOW 38 STORES

WE ARE HERE!



NEW STORE ADDRESS: The Gateway, Shop 1C, Cnr. High & Henry Sts. PENRITH

Dear Customers,

Quite often, the products we advertise are so popular they run out within a few days. Or unforeseen circumstances might hold up shipments so that advertised lines are not in the stores by the time the advert appears. And very occasionally, an error might slip through our checks and appear in the advert (after all, we're human too!). Please don't blame the store manager or staff: they cannot solve a dock strike on the other side of the world, or fix an error that's appeared in print. If you're about to drive across town to pick up an advertised line, why not play it safe and give the store a call first — just in case. Thanks.

STORE LOCATIONS

NSW	145 Parramatta Rd	AUBURN	648 0558
	T55 Terrace Level	BANKST. SQ.	707 4888
	613 Princes Hwy	BLAKEHURST	546 7744
	552 Oxford St	BONDI JCT.	387 1444
	818 George St	BROADWAY	211 3777
	531 Pittwater Rd	BROOKVALE	93 0441
	147 Hume Hwy	CHULLORA	642 8922
	162 Pacific Hwy	GORE HILL	439 5311
	315 Mann St.	GOSFORD	25 0235
	Elizabeth Dr & Bathurst St	LIVERPOOL	600 9888
	396 Lane Cove Rd	NORTH RYDE	88 3855
	George & Smith Sts	PARRAMATTA	689 2188
	The Gateway, Shop 1C, Cnr. High & Henry Sts.	PENRITH	
	6 Bridge St	SYDNEY	27 5051
	125 York St	SYDNEY	290 3377
	Tamworth Acde & Kable Ave	TAMWORTH	66 1961
	173 Maitland Rd	TIGHES HILL	61 1896
	263 Keira St	WOLLONGONG	28 3800
ACT	96 Gladstone St	FYSHWICK	80 4944
VIC	260 Sydney Rd	COBURG	383 4455
	Ross Smith Av & Nepean Hwy	FRANKSTON	783 9144
	205 Melbourne Rd	GEELONG	78 6766
	399 Lonsdale St	MELBOURNE	67 9834
	Bridge Rd & Coronation Blvd	RICHMOND	428 1614
	Springvale & Dandenong Rds	SPRINGVALE	547 0522
QLD	293 Adelaide St	BRISBANE	229 9377
	166 Logan Rd	BURANDA	391 6233
	Gympie Rd & Hamilton St	CHERMSIDE	59 6255
	Cnr. Ingham Rd. & Cowley St. West End.	TOWNSVILLE	72 5722
	Cnr. Bowen & Ruthven Sts.	TOOWOOMBA	38 4300
SA	60 Wright St	ADELAIDE	212 1962
	Main South & Flagstaff Rds	DARLINGTON	298 8977
	435 Main North Rd	ENFIELD	260 6088
WA	Wharf St & Albany Hwy	CANNINGTON	451 8666
	414 William St	PERTH	328 6944
	Hay St(The Centre Way Acde)	PERTH	321 4357
TAS	25 Barrack St	HOBART	31 0800
NZ	98 Carlton Gore Rd, Newmarket	AUCKLAND	504 409

STORE HOURS All Dick Smith stores are open for trading during the normal trading hours for their particular area (either 9-5.30 or 8.30-5). Many stores are also open for late night trading: please ring the store concerned for their particular hours.

DICK SMITH Electronics

MAIL ORDER CENTRE
PO BOX 321, NORTH RYDE NSW 2113
Telephone orders: (02) 888 3200

POST & PACKING CHARGES

ORDER VALUE	CHARGE	ORDER VALUE	CHARGE
$5.00-$9.99	$2.00	$50.00-$99.00	$5.00
$10.00-$24.99	$3.00	$100.00 or more	$6.50
$25.00-$49.99	$4.00		

Charges are for goods sent by post in Australia only — not airmail, overseas or road freight.

SPEEDY PHONE/BANKCARD ORDER SERVICE

Just phone your order and Bankcard details - it's so simple!

(02) 888 2105

ORDER ONLY ON THIS NUMBER
ENQUIRIES: (02) 888 3200

DSE A469M-JCP

MAJOR RESELLERS

These are our major resellers. However, we cannot guarantee they will have advertised items in stock or at the prices advertised.

● **Atherton Qld:** Maarten's Music Centre, 55 Main St. 91-1208 ● **Cairns:** Electronic World Shop 27 K Mart Westcourt Plaza Mulgrave Rd. 51 8555 ● **Ballina NSW:** A Cummings & Co. 91-93 River St. 86 2285 ● **Cairns QLD:** Thompson Instrument Services, 79-81 McLeod St. 51 2404 ● **Coffs Harbour NSW:** Coffs Harbour Electronics, 3 Coffs Plaza, Park Ave. 52 5684 ● **Darwin N.T.:** Kent Electronics, 42 Stuart Hwy. 81 4749 ● **Darwin N.T.:** Ventronics, 24-26 Kavanagh St. ● **Deniliquin NSW:** Deni Electronics, 220 Cressy St. 81 3672 ● **East Maitland NSW:** East Maitland Electronics, Cnr. Laws & High STS. 33 7327 ● **Echuca VIC:** Webster Electronics, 220 Packenham St. ● **Geraldton WA:** KB Electronics & Marine, 361 Main Terrace 21 2176 ● **Gladstone QLD:** Purely Electronics, Shop 2, Cnr. Herbert & Auckland STS. 72 4321 ● **Gosford NSW:** Tomorrow's Electronics & Hi-Fi, 68 William St. 24 7246 ● **Kingston TAS:** Kingston Electronics, Channel Court, 29 6802 ● **Launceston TAS:** Advanced Electronics, 5a The Quadrant, 31 7075 ● **Lismore NSW:** Decro Electric, 3A/6-18 Carrington St. ● **Mackay QLD:** Stevens Electronics, 42 Victoria St. 51 1723 ● **Maryborough QLD:** Keller Electronics, 218 Adelaide St. 21 4559 ● **Mt. Gambier SA:** Hutchesson's Comm. 5 Elizabeth St. 25 6404 ● **Mildura VIC:** McWilliam Electronics, 40 Lemon Ave. 23 6410 ● **Morwell VIC:** Morwell Electronics, 128 George St. 34 6133 ● **Nambour QLD:** Nambour Electronics, Shop 4, Lowan House, Ann St. 41 1604 ● **Orange NSW:** M&W Electronics, 173 Summer St. 62 6491 ● **Penrith NSW:** Acorn Electronics, Shop 12, 541 High St. 36 1466 ● **Port Macquarie NSW:** Hall of Electronics, 73 Horton St. 83 7440 ● **Rockhampton QLD:** Purely Electronics, 15 East St. 21 058 ● **Shepparton VIC:** G.V. Electronics Centre, 189b Corio St. 21 8866 ● **Southport QLD:** Amateurs Paradise, 121 Nerang St. 32 2644 ● **Toowoomba QLD:** Hunt's Electronics, 18 Neil St. 32 9677 ● **Townsville QLD:** Tropical TV, 49 Fulham Rd., Vincent Village, 79 1421 ● **Wagga NSW:** Wagga Wholesale Electronics, 82 Forsyth St. ● **Wodonga VIC:** A&M Electronics, 78a High St. 24 4588 ● **Whyalla SA:** Mellor Enterprises, Shop 2, Forsythe St. 45 4764

How to obtain better TV reception

Adjusting for best colour

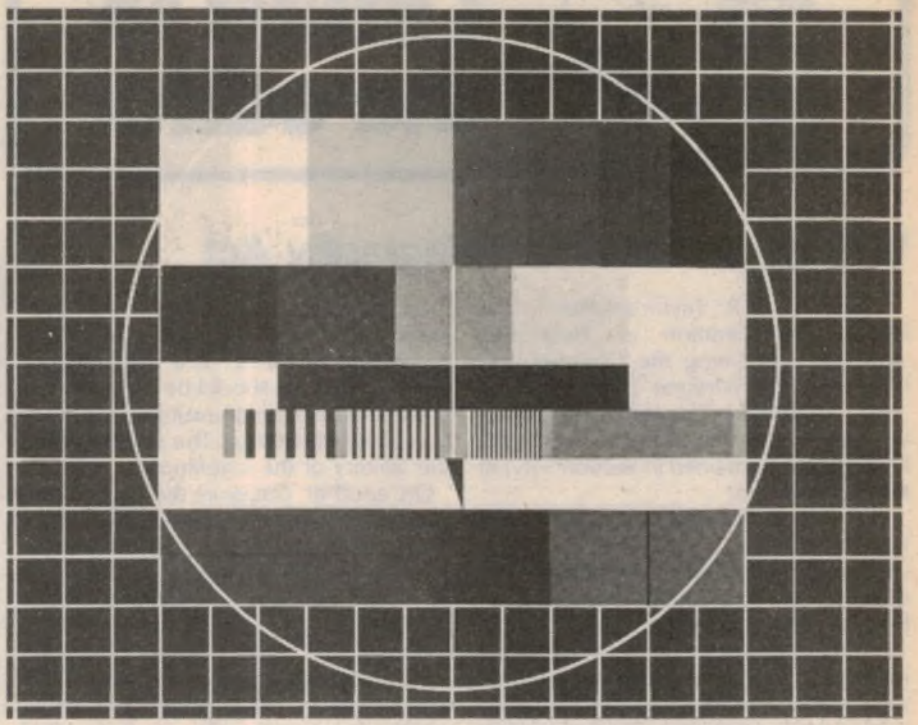
Of all the symptoms of incorrect set adjustment, incorrect colour is perhaps the most obvious. It is also the most prevalent! When adjusting for colour, remember that people's complexions are not an orangey-brown colour, despite the persistence of the "bronzed Anzac" myth.

What we are talking about here is termed "colour saturation" and this is the only aspect of colour that the user has any control of (apart from the "tint" control on some sets). You should adjust the control for realistic flesh tones with typical studio announcers. With the exception of some sports commentators, most people have a fairly pale complexion.

Similarly, Australian sportsfields are not usually an emerald green; they are more a grey-green colour. And if the reds in the picture are shot through with horizontal streaks, that is a sure sign that the colour control is too far advanced. In other words, for correct colour, err on the side of too little rather than too much colour.

Other assumptions

Apart from the assumption of a good quality TV signal already noted, this discussion assumes that the set is basically up to par in terms of convergence, purity, white-point setting (which has to do with the setting of the three picture-tube guns) and picture geometry.



Pictured above is the Fernsech test pattern used by some country TV stations. Below is a shot from an American TV series. US programs should not be used to judge critical tuning of your set.

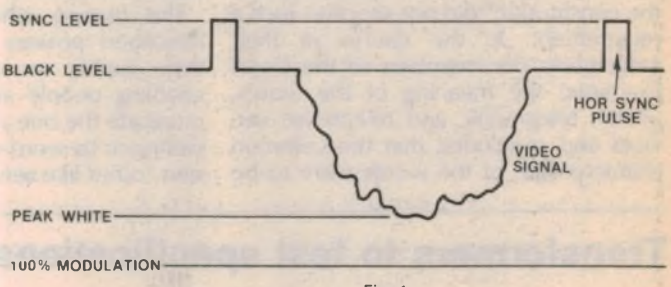


Fig. 1

Sets using vertical slot tubes with "self-converging" yokes are generally pretty good in most of these respects although their white-point setting may not be quite correct and they usually may have some overscan, which is evident in photo B and C.

A slight degree of overscan is usually desirable in order to avoid black margins at the picture borders when the mains voltage drops slightly. Vertical overscan is also desirable to avoid the flickering Teletext line from becoming visible.

Adjustment of these parameters requires access inside the set and reference to the service manual and is beyond the scope of this article.

Next month we will discuss how ghosts are produced and the various effects they can have on reception. We will also tell how you can actually locate the source of a ghost! This will help with the selection and siting of an antenna for best results. With care and patience, even serious multiple ghosting can often be greatly minimised.

Letters to the editor

Validity of Wireless Telegraphy Act

I refer to P. B. Taylor's letter in the March 1983 edition of Electronics Australia concerning the Constitutional validity of the Wireless Telegraphy Act 1905. As stated in the letter, the power of the Commonwealth to pass such legislation is contained in Section 51(v) of the Constitution.

The Section has been the subject of a number of High Court cases and the validity of the Wireless Telegraphy Act depends on the interpretation placed by the Court on the Section.

In 1935, an owner of a broadcasting reception appliance challenged provisions of the Act requiring her to hold a licence for an appliance. The basis of her claim was that "the power granted under the constitution" did not sanction such a requirement. In the course of their judgements the members of the Court examined the meaning of the words, postal, telegraphic and telephonic services and concluded that the common characteristics of the words were to be found in the services which they perform: "they are each of them communication services." If a new form of communications should be discovered it too could be made the subject of legislation as a like service. The Court upheld the validity of the legislation.

On another occasion the High Court decided that what the constitutional provision embraces is the organised communication of messages from a distance as well as the communication of messages by an organised means from a distance. The grant of power contained in the Section is expressed in a form which includes every present and future mode of performing the services called postal, telegraphic and telephonic.

The feature which the services so described possess in common is that they supply an organised means of enabling people at a distance to communicate the one with another either by writing or by word of mouth. The expression "other like services" in the Constitution covers every system or organised process of furnishing of undivided intercommunication, notwithstanding that at the time when the Constitution was adopted it was undiscovered and unthought of.

Accordingly, by virtue of the Section 51(v), the Commonwealth Parliament has power to control communications within Australia and between Australia and other countries. There can be no doubt about the validity of the Wireless Telegraphy Act 1905. The power given to the Minister is to regulate the establishment and maintenance of appliances used for transmitting messages by wireless telegraphy; this power is well within the Section, as interpreted by the High Court.

M. R. Ramsay,
First Assistant Secretary,
Radio Frequency Management Division,
Department of Communications.

Transformers to test specifications

Over the years, I have noticed that you use many "brand" name transformers in your projects and, in particular, I note the use of the "Ferguson" transformer type number PF4361 for the "50V, 5A Lab Power Supply".

This transformer was designed to AS3159, "Approval and Test Specification for Electronic Sound and Vision Equipment". However, when connected in mode "A" as set out in the instruction sheet accompanying each transformer, it also complies with the relevant clauses of AS3126, "Approval and Test Specifications for Extra-Low Voltage Transformers".

Should you consider incorporating the 15 volts auxiliary windings, at some later stage, for additional DC rails, then it would be an advantage to earth the junction of those two windings. These windings would then be a reasonably effective electrostatic shield and, as a consequence, attenuate line noise.

Initially, I made reference to "brand" name transformers, as I realise that many of the kit sets on the market today include units made by the small "one man band" manufacturers. While these transformers may be well made, such organisations rarely, if ever, submit products to statutory authorities for approval. Nor do they have the professional backing of the larger, recognised organisations. The cost of these submissions are generally in excess of $500.00, which is beyond the financial limits of the small company.

It is my considered opinion that the interests of your readers would be best served by ensuring that the kit sets they purchase include the components listed by you and not low cost substitutes. This particularly applies to the transformer which is the component that isolates the rather lethal 240 volts mains from the rest of the circuitry. Obviously, the transformer is not the only factor in determining the safety of the finished project, but its significance should not be overlooked for the saving of a few dollars.

John Richards, Chief Engineer,
Ferguson Transformers Pty Ltd.

Four-be-two lifesaver!

I thought you may be interested to know that I have dreamed up a most useful adaption of your electronic spirit level.

I do a lot of fishing on Georges Basin on the NSW south coast. The trouble is that, when concentrating on flathead nibbles, one tends not to notice the wind getting up a bit.

What I have done was to assemble two four-be-twos at right angles, in the form of a cross, using a clamp to anchor them to the front seat of my aluminium skiff. I replaced the LEDs with a burglar alarm horn.

Far from being a problem, the 45-degree hysteresis which you mention is an advantage as a wave monitor. Most of the time it remains blissfully silent but, when the boat begins to roll by ±45 degrees or, if anchored, to pitch by that same amount, the horn sounds and warns the fisherman (me) that it may be wise to reel in the lines and row back to shore before the water gets too rough!

Orson Swells (Sussex Inlet, NSW).

Alternative outlet for Neosid products

I wish to draw your attention to the "Information Centre" article for the "All-Wave Three" of November, 1982.

This article states that Watkin Wynne is the Australian distributor for Neosid products. Watkin Wynne is indeed an outlet for Neosid, but so too is Aegis Pty Ltd, 141 Christmas St, Fairfield, Victoria.

I would appreciate it if you would advise your readers that Neosid products are available from a Victorian based company.

R.J. LaSalle, Products Engineer,
Aegis Pty Ltd.

EASTERN
COMMUNICATIONS ELECTRONICS & COMPUTERS

FOR ALL YOUR ELECTRONIC NEEDS DROP IN AT EASTERN

HIGH FIDELITY AM

Sounds every bit as good as FM With this absolutely brilliant EA Project

Project 82 AR12 — See December EA

Frankly we felt AM was dead and buried for the serious audio buff — when EA told us their new wide band AM tuner had 16KHz bandwidth and made AM sound like as never before — we were still not convinced. But on hearing the New EA AM Tuner I for one was astonished — AM Broadcasts now sound incredible there is no other word for it.

And the 9KHz whistle filter really works!

The result is clear smooth sound reproduction that will be a joy to every constructor on this fantastic tuner project.

The Altronics Kit includes rack box and every last nut and bolt — even solder.

Full instructions included.

K5200 **$249.00**

LABORATORY MULTIMETER

100K OHMS/VOLT CHECKS TRANSISTORS AND MEASURES CAPACITANCE

Q 1040 Multimeter **$72.50**
Q 1041 Carry Case **$14.50**

From Tokyo Laboratories, Japan

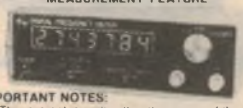
Remember the days when high grade precision laboratory multimeters were available only from UK and then they cost a King's Ransom?! — Well that's history — the new Q 1040 is everything a high quality meter should be **PLUS** it checks transistor HFE and ICO and measures capacitors from 50pf-50UF.

★ 100K OHMS/Volt DC ranges ★ 8.5 UA movement ★ Fuse and diode movement protected ★ Inbuilt oscillator for capacitance measurement **RANGES: DCV** 250MV, 2.5V, 10V, 50V, 250V, 1000V. **ACV** 5V, 10V, 50V, 250V, 1000V (10K/V). **DCA** 10UA, 2.5MA, 25MA, 500MA, 10A. **ACA** 10A **Resistance** x1, x10, x1K, x10K. **Transistors** NPN/PNP. **HFE** 0-1000. **ICO** 0-50UA. **Capacitors** 50PF-3UF, .01 UF-50UF.

DIGITAL FREQUENCY METER

See Electronics Aust Mag Dec 81-Feb'82

500MHZ, 7 DIGIT RESOLUTION PLUS PERIOD MEASUREMENT FEATURE



IMPORTANT NOTES:
(1) This project is well within the scope of the "not so experienced" as virtually all components are contained on a single PCB.
(2) ALTRONICS USE ONLY THE SPECIFIED INTERSCIL LSI — BEWARE OF INFERIOR KITS THAT DO NOT CONFORM TO THE ORIGINAL DESIGN.

★ Screened front panel ★ Bright high efficiency 7 segment display ★ Frequency ranges 0-10MHz, 0-50MHz, 10-50MHz (with optional pre-scaler) ★ 4 gating times — .01, .1, 1, 10 seconds ★ 4 period measuring ranges 1, 10, 100 and 1000 input cycles give 0.1uS resolution ★ High input sensitivity — 10mV to 30MHz, 100mV at 50MHz @ 1M input impedance, 200mV at 500MHz @ 75 ohms input impedance ★ High accuracy — typically better than .005%/count uncalibrated.

Costs a fraction of commercial counters

EXCLUSIVE ALTRONICS KIT FEATURES:

★ IC sockets provide throughout.
★ Low aging 10.000MHz x TAL.
★ Thermalloy heatsink for 5V regulator.
★ Quality Pactec Instrument Case.

K 2500 (50MHz version) **$119.50**
K 2501 Pre-scaler **$26.00**
(add for 500MHz version)

Incredible!

UNIVERSAL MULTIMETER

PORTABLE WITH BENCH STAND

23 ranges at less than $1 per range

★ 20,000 OHMS/Volt DC ★ 10,000 OHMS/Volt AC ★ Mirror backed scale ★ Overload protected ★ Unique carry handle doubles as a bench stand ★ High-impact resistant case ★ Uses 1 AA Penlight battery (incl) ★ Comes complete with battery, test leads and instructions. **RANGES: DC Voltage** 0-.25, 1, 2.5, 10, 25, 100, 250, 1000. **AC Voltages** 0-10, 25, 100, 250, 1000. **Decibles** 20 to +22db. **DC Current** 0-50, 500 UA, 0-5, 50, 500MA. **OHM Meter** 0-6 megohms in 4 ranges, 30 ohms centre scale. Size 135 x 91 x 39.

Q 1002 **$24.50**

COMPLETE RANGE OF ICOM AND KENWOOD ON DISPLAY AT ALL TIMES.

ICOM IC720A $1,060

KENWOOD TS9305 $1,799

ETI'S BRILLIANT NEW DIRECT-CONNECT COMPUTER MODEM

Employs unique "Commutated Filter" design overcoming virtually all the problems involved with conventional modems. Super flexible unit facilitates communications between computers over cables, the telephone network and radio links. Unit connects to a standard RS 232 interface and is capable of both 1200/75 Baud and 300/300 Baud transmission and reception ★ Line switching; answer and dialing facilities on board.

EXCLUSIVES: ★ Plated through, double sided PCB ★ Complete set of IC sockets ★ Kit requires 85 IN914 Diodes for programming these are included ★ Ceralock resonator and matching balanced load capacitor used for long life and high accuracy ★ Telecom approved isolating transformer and Reed relays included.

K 9644 (See ETI Oct 82) **$169.50**

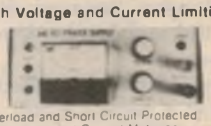
THE SUPERB 5000 SERIES

5000 PWR AMP 100W $319.00

5000 PREAMPLIFIER $299.00

NEW ETI 162 POWER SUPPLY 0-30V at 1 amp

With Voltage and Current Limiting



★ Overload and Short Circuit Protected.
★ Full Voltage and Current Metering.
★ Fully variable voltage and adjustable current limiting.

Exclusive — Fully SEC Certified Mains Transformer supplied

If you're considering buying this kit from your local supplier or one of our competitors — first ring and ask them if the mains transformer is SEC certified to ASC126 — chances are that it won't be.

So why not give us your order? An Altronics Quality Kit speaks for itself and with our overnight Jetservice we guarantee to deliver to your door faster than your local supplier.

K 3205 **$49.50**

The Brilliant New MICRON 12 Green Phosphor Monitor

Features 12 inch Screen, **Front Controls** On/Off, Contrast/Reverse, Brightness, **Power** 240V/50Hz or 12V DC, **Input** RCA Type, **DC Output Jack** 12V/1.1 AMP — power your micro direct without a power pack. **Bandwidth** 10Hz to 20MHz the resultant definition is truly amazing for a low cost monitor.

GUARANTEED BY ALTRONICS! Incredible Value

Cat D1112 **$199.50**

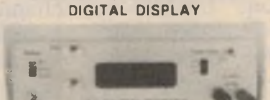
POWERFUL NEW 6000 RPM MINI DRILL FOR PC WORK

Tons of Torque. Just the shot for PCB work. 12V DC operated from external Power Pack. 1.2mm chuck capacity. Supplied c:w 1mm drill bit.

T 2302 **$12.95**

Drill Bits:
T 2320 (0.8mm) **$1.25**
T 2325 (1.0mm) **$1.25**

FUNCTION GENERATOR WITH DIGITAL DISPLAY



EA's new Function Generator covers the frequency range from 15Hz to 170kHz in three ranges with coarse and fine frequency controls. An economical 4-digit display has been incorporated to eliminate dial calibration. Sine wave distortion can be trimmed to around 0.5%.

K 2505 See EA April 1982 **$85.00**

MICRON 30 WATT

This brilliant little 30 watt iron is just the "bee's knees" for the electronics hobbyist, electrician or home handyman. We searched the world for a low cost yet quality iron which met the criteria of ★ light-weight ★ screw in interchangeable tips ★ efficient thermal transfer from element to tip ★ tip temperature maintains within the limits suitable for electronic work and also small household jobs ★ and of course, fully SEC tested and approved.

Comes fitted with T 2435 Tip

Bonus offer Free T 2436 Instrument Tip included this month.

T 2430

REPLACEMENT TIPS $9.50

T 2434 Flat Tip .95
T 2345 Conical Tip .95
T 2436 Instrument Tip .95

DIGITAL CAPACITANCE METER

Electronics Australia Project. Measures 1 PF — 99.99 UF. 240V Mains Powered. Bright LED Display. Easy to build. Complete kit of parts and full instructions.

★★★ **EXCLUSIVE TO ALTRONICS** ★★★

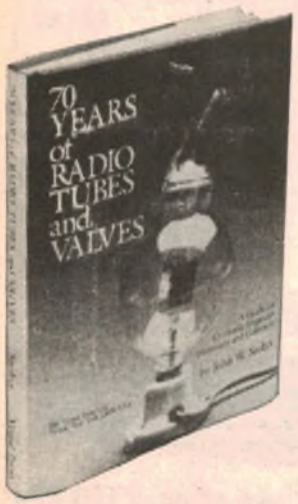
Each kit now includes precision measured capacitors for accurate calibration of each range.

K 2520 **$45.00**

ALTRONICS DISTRIBUTOR: 168 ELGAR ROAD, BOX HILL SOUTH, VIC. PH: (03) 288 3107

Books & Literature

Valves: from the diode to the magnetron



70 YEARS OF RADIO TUBES AND VALVES by John W. Stokes. Published 1982 by the Vestal Press, Vestal New York, USA. Hard covers, 256 pages, 220 x 280mm, freely illustrated. ISBN 0 911572 27 9. Australian price $27.40.

To read this new book by New Zealand electronics veteran, writer and author was indeed a nostalgic experience for this reviewer because, in many many ways, the author's background parallels my own.

Having grown up with wireless during the '20s, I gained work experience in radio factories before joining the Amalgamated Wireless Valve Company in the mid '30s. While there, I was involved, at various times, with valve standards and tolerances, application data and curves, and the compiling of company information about other brands and type numbers.

From that parallel background, I can say that John Stokes has done a thorough job of researching his subject and presenting it in a way that could best be done by someone who, at first hand, has seen it all happen. He explains in the introduction that language problems have largely limited his research to English speaking countries but it certainly hasn't prevented him from giving an excellent overall account of the evolution of the valve from a derivative of the electric light globe to a nuvistor or a magnetron.

What's more, his approach has the distinct advantage that it throws up examples which are likely to be best known to Australian readers.

There are 27 chapters in all, in addition to acknowledgements, preface, terminology list, glossary, index, etc.

The first chapter "In the Beginning" (Edison and Fleming) is followed by "The Grid" (de Forest) and by chapters covering developments during and immediately after World War I.

This is followed by chapters on "Another Grid" (early tetrodes), the challenge of all-mains operation, pentodes, multiple tubes, frequency changers, etc.

As distinct from internal electrode structure, the author also examines the trends, the fashions and the hassles of physical construction: glass envelopes of ever-diminishing size; metal and pseudo-metal envelopes; terminals, side-caps and top-caps; and the endless array of bases and sockets.

Towards the end of the book, he really stirs the memory as he recalls and illustrates many once familiar brands: de Forest Audions and the unforgettable Acturus blue tubes; Crossley, National Union and Ken-Rad, a brand that was displayed so regularly on the cover of our foundation magazine "Wireless Weekly" that it came to be known by some as the Ken-Rad magazine!

And who can forget Tung-Sol, Raytheon and Sylvania – the last-named brand being rated by many one-time radio engineers as uniformly the best!

Chapter 22 covers Canadian and Australian Tube Manufacture, with most of the space given to AWA (pre 1932) and to the Amalgamated Wireless Valve Co. Philips is also mentioned, and the activities of STC, particularly in respect to their wartime contribution.

The book is freely illustrated with valves made available from collections, industry pictures and contemporary advertisements. Looking at some of the advertisements, it is clear that they were not bothered in those days by the Trade Practices Act!

But enough said: those who have a nostalgic interest in the past will find this book fascinating reading. However, the research and presentation is of such a standard that the book will justify use as a reference manual in educational libraries.

The book is available from Technical Book & Magazine Company Pty Ltd, 289-299 Swanston St, Melbourne, Vic, 3000. (W.N.W.)

The 1983 ARRL Handbook

THE RADIO AMATEUR'S HANDBOOK editored by George H. Woodward, W1RN. (60th edition.) Published 1983 by the American Radio Relay League, Connecticut, USA. Soft covers, 704 pages, 210 x 275mm. Illustrated with many circuit diagrams and photographs. ISBN 087259 060 7. Price $19.95.

The ARRL Handbook, as it is popularly called, needs little introduction to the amateur fraternity, most amateurs having cut their teeth on it while studying for their licence and retained it, and subsequent editions, on their shelves for reference as they built, acquired, and modified their equipment.

In broad terms the current edition has followed the previous general style; a little ARRL and amateur history, some basic principles, and a fair amount of practical building instruction ranging from power supplies to antennas, transmitters to test equipment, receivers to slow-scan TV systems.

Three chapters (2, 3, and 4) are devoted to basics: Electrical laws and circuits; Radio design technique and language; and Solid state fundamentals – 125 pages in all. In addition, many of the chapters on construction, such as chapter 8 on Receiving systems, devote a significant amount of space to discussing design fundamentals before getting down to the nuts and bolts.

Other chapters are: (5) AC Power supplies; (6) HF Transmitting; (7) VHF/UHF Transmitting; (8) Receiving systems; (9) VHF/UHF Receiving techniques; (11) Code transmission; (12) Single sideband transmission; (13) FM and repeaters; (14)

Continued on page 105

GET INTO ELECTRONICS FOR $4.95

OVER 30 000 SOLD!

WITH DICK SMITH'S

FUNWAY INTO ELECTRONICS

This is the top selling Fun Way Into Electronics Vol. 1 that has proven that electronics can be fun. For the raw beginner, this book introduces 20 exciting projects that can be built by using a unique 'breadboard' construction system - no soldering, so it's safe. Each project is fully illustrated so that mistakes are virtually impossible. This top-selling book is now into it's fourth printing proving just how popular it has been. Don't miss out! Cat B-2600

ONLY **$4.95**

Vol 1 KITS

Kit to build projects 1-10

You can build any of the first ten projects from 'Fun Way Into Electronics' with this kit. It even includes the base board on which you assemble the circuits! Cat K-2600

$7.25

Kit to build projects 11-20

This kit contains the slightly more specialised components which, together with the components from kit 1, will enable you to make any of the projects in the book. Cat K-2610

$7.90

PARENTS PLEASE NOTE

All Fun Way Into Electronics kits are battery powered so they are completely safe. Also, Fun Way Vol. 1 kits require no soldering.

FUNWAY VOL. 2 20 MORE PROJECTS

After mastering Fun Way Vol. 1 what better way to go than Vol. 2. In Vol. 2 you are introduced to printed circuit boards and soldering. Both are fully explained and illustrated and they give you the choise of making your own boards or buying ready made. The basic laws of electronics, plus chapters on component codes, assembly hints etc are fully explained. ..... Cat. B-2605

$6.95

FUNWAY VOL 2 KITS FROM $2.95

MULTI-PURPOSE LED FLASHER $2.95
A really simple kit that can be used as a warning device, electronic jewellery, etc. Cat K-2621

DING DONG DOORBELL $4.50
Welcome visitors to your home with this integrated circuit doorbell! Cat K-2622

MORSE CODE TRAINER $4.50
This simple oscillator circuit lets you learn Morse code the easy way! Cat K-2623

UNIVERSAL TIMER $5.50
Use it as an egg timer, a darkroom timer, etc: in fact, it's got a lot of applications! Cat K-2624

ELECTRONIC DICE $4.95
Throwing a dice is old hat: do it electronically! Simple circuit has other uses too. Cat K-2625

MONOPHONIC ORGAN $7.95
Easy to build, and easy to play! And it even has 'vibrato' - just like the big ones! Cat K-2626

POCKET TRANSISTOR RADIO $7.95
Simple to build, and it's nice and small. Listening is so much more fun! Cat K-2627

TOUCH SWITCH $5.50
One touch on, next touch off - or 'on while touched'. Dozens of uses in the home. Cat K-2628

MOSQUITO REPELLER $4.95
Do they really work? Research suggests they might. Find out for yourself. Cat-K 2629

SIMPLE AMPLIFIER $6.50
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 $5.50
Highly useful for alarms, night light switches, etc etc. Sensitive and reliable. Cat K-2632

METAL/PIPE LOCATOR $6.50
A simple BFO circuit you can use to find metals, pipes, wiring etc - maybe gold! Cat K-2633

SOUND ACTIVATED SWITCH $6.95
Picks up sound waves and trips a relay. Use as a telephone bell extender, too. Cat K-2634

HOME/CAR BURGLAR ALARM $6.50
Learn how burglar alarms work when you install your own! For home or car. Cat K-2635

ELECTRONIC SIREN $4.95
Great for alarm use - or where any warning is required. Good for kids toys, too! Cat K-2636

LED LEVEL DISPLAY $8.95
This fascinating project shows you the audio level of any amplifier. Cat K-2637

INTERCOM UNIT $8.95
Communicate! Build this intercom and talk between rooms, etc. Cat K-2638

LED COUNTER MODULE $7.95
Learn how digital circuits work by building a counter. Count slot car laps, etc. Cat K-2639

SHORTWAVE RECEIVER $6.95
Listen in to the exciting world of shortwave radio amateurs, foreign countries! Cat K-2640

SCHOOLS, RE-SELLERS, ETC.:
We'll negotiate a special price for bulk quantities on either books or kits, or both!

DICK SMITH ELECTRONICS

SEE PAGE 98 FOR ADDRESS DETAILS

A383/CT

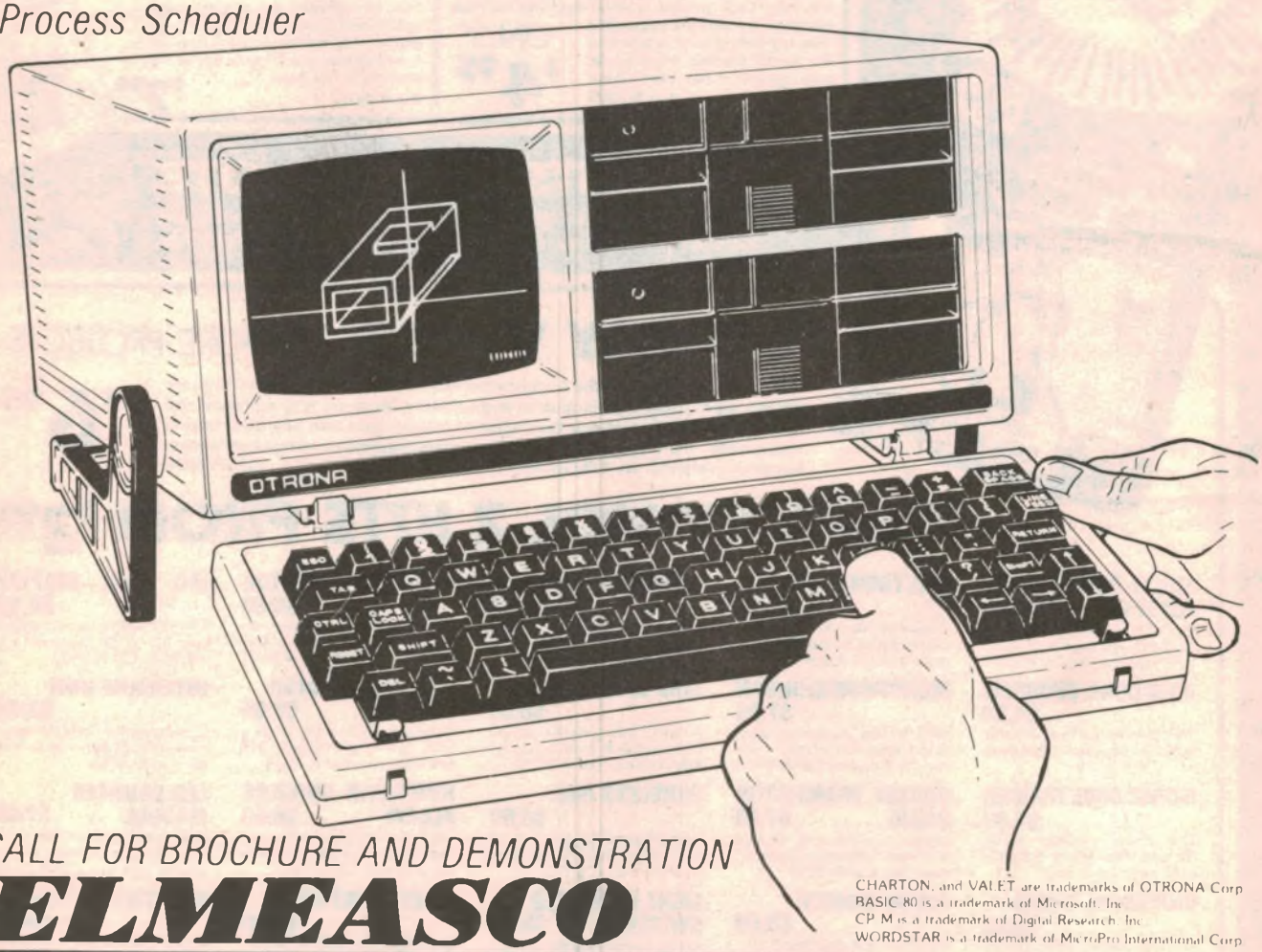
OTRONA ATTACHE™

ALL THE POWER OF A DESK-BOUND MICRO IN A TRUE PORTABLE

• 64k RAM • Dual 384k Disk Drives • Dual Processors • Dual Comms Ports • Battery Operation Optional • Continuous Clock & Calendar

PLUS COMPLETE SOFTWARE PACKAGE

• CPM – the most popular operating system • WORDSTAR-PLUS – enhanced word processing • BASIC-80 – fast easy programming • CHARTON – draws business charts and freeform graphics • VALET – Time and Machine Process Scheduler



CALL FOR BROCHURE AND DEMONSTRATION

ELMEASCO Instruments Pty. Ltd.

CHARTON, and VALET are trademarks of OTRONA Corp
BASIC-80 is a trademark of Microsoft, Inc
CP/M is a trademark of Digital Research, Inc
WORDSTAR is a trademark of MicroPro International Corp

Elmeasco Instruments Pty Ltd – incorporated in N.S.W.

NEW SOUTH WALES
15 Macdonald Street
MORTLAKE
P.O. Box 30 CONCORD
NSW 2137
Tel (02) 736 2888
Telex AA25887

VICTORIA
21-23 Anthony Drive
MT. WAVERLEY
P.O. Box 107 MT. WAVERLEY
VIC 3149
Tel. (03) 233 4044
Telex AA36206

QUEENSLAND
243 Milton Road
MILTON
P.O. Box 2360 BRISBANE
QLD 4001
Tel (07) 369 8688
Telex AA44062

SOUTH AUSTRALIA
99 King William Street
UNLEY
P.O. Box 1240 ADELAIDE
SA 5001
Tel (08) 271 1839

WESTERN AUSTRALIA
20 Barcomb Way
GOSNELLS
P.O. Box 95 GOSNELLS
WA 6110
Tel (09) 398 3362

Specialised communications systems; (15) Interference; (16) Test equipment; (17) Construction practice and data tables; (18) Wave propagation; (19) Transmission lines; (20) HF Antennas; (21) VHF/UHF Antennas; (22) Operating a station; (23) Vacuum tubes and semiconductors (data).

If you are a prospective amateur, this book will certainly provide a useful amount of theory and basic principles to back up what you might learn from more specialised texts, with the added advantage that it will become a valuable constructional reference when you begin building your own equipment or accessories.

And if you are an old timer who hasn't bought a handbook for a few years, and feel that it is time to update, take a look at this edition. You could be agreeably surprised.

Our review copy from Technical Book and Magazine Company Pty Ltd, 289 Swanston St, Melbourne, Vic, 3000 (P.G.W.)

Hardware & software for the Z80

Z80 USERS MANUAL by Joseph J. Carr. Soft covers, 326 pages, 152 x 228mm, illustrated with diagrams. Published by Reston Publishing Co Inc 1980. ISBN 0 8359 9516 X. Price $16.75.

This book is a summary of hardware and software aspects of the Z80 microprocessor. In 17 chapters the author covers processor architecture and pinouts, Z80 support chips, timing and interface control and the Z80 instruction set, including input and output techniques and interrupt servicing.

While valuable to anyone working with the Z80 processor there is nothing that is new in this book and programming examples are conspicuously absent. The book is also showing its age a little, with the discussion of memory centred around older devices such as the 2102 1K x 1-bit chip. There is no mention of the newer dynamic RAM chips such as the 4116 – a pity, because the Z80 is ideally designed for use with these devices.

Be that as it may the book will be useful to the newcomer. It is clearly written and set out and the text is well supported with circuit diagrams and charts. The more experienced hobbyist will probably already have most of this material on their bookshelf in one form or another.

Our review copy came from the Technical Book and Magazine Company Pty Ltd, 289-299 Swanston St, Melbourne, Vic, 3000. (P.V.)

Impact of computer technology

TECHNOLOGICAL CHANGE: IMPACT OF INFORMATION TECHNOLOGY 1982: Australian Government Publishing Service, sponsored by The Department of Science and Technology and the Australian Computer Society Inc. Soft covers, 175 x 250mm, 164pp. ISBN 0644 01974 3. Free of charge.

This book is a collection of papers on various aspects of information technology, the third in a series of publications designed to develop community understanding of the application and effects of information technology. It was distributed free of charge as part of Information Technology Week 1982.

Sections of the book include general approaches to technological change, information technology in business and education, and six papers on Videotex services, both here and overseas.

As with many publications on the subject of information technology most of the papers presented here assume that understanding of technology will remove all cause for concern. While it is true that "ignorance breeds fear" this does not imply that all fear springs from ignorance, and many valid issues concerning the uses of technology cannot be dismissed as misunderstandings.

In his introduction to the papers the Chairman of Information Technology Week 1982, Ashley W. Goldsworthy calls for the establishment of a Technology Planning Council to provide a mechanism for identifying areas of worthwhile development in technology and to advise the government on action that should be taken to benefit Australia in this area.

Such a Council, with representatives from Government, industry, trade unions, professional organisations and teaching and research institutions would go a long way in identifying trends and providing an advisory and research organisation geared to managing the social disruption and dislocation which may well follow from changes presently occurring.

The book is useful as far as it goes, although discussions on issues such as privacy and the effects of "exported" data processing are lacking. It is a useful starting point for discussion however.

Our review copy came from the Information Technology Week Committee, PO Box 65, Belconnen, ACT, 2616. (P.V.)

NEW BOOKS

NEW — NEW — NEW

Latest editions of some of the most popular books on the subject.

The Radio Amateur's Handbook — 1983 Edition. A must for the Radio Amateur and Professional	$19.95
Reference Data for Radio Engineers (New Edition) ITT	$54.95
Radio Handbook — Orr New 22nd Ed	$42.95
World Radio TV Handbook 1983 — The Authoritative Directory of International Radio & Television. Listing all stations, calls, frequencies, programs, etc, for countries	$27.95
HF Antennas For All Locations — L. A. Moxon. A RSGB publication	$15.00
Practical Handbook Of Valve Radio Repair — Chas Miller. A must for the vintage radio enthusiast	$34.00

Computer Books

Intro to Microcomputers — Volume 3: Some Real Support Devices	$21.00
6502 Assembly Language Programming	$26.35
The 8086 Book	$23.80
Intro to Microcomputers — Volume 1: Basic Concepts. 2/e	$17.80
6809 Assembly Language Programming	$26.35
Z8000 Assembly Language Programming	$23.95
Interfacing To S-100/IEEE 696 Microcomputers	$23.25
8089 I/O Processor Handbook	$ 7.15
68000 Microprocessor Handbook	$ 7.15
Osborne CP/M User Guide	$24.75
CRT Controller Handbook	$15.45
Australian Microcomputer Handbook 3rd Edition 1983	$27.00
Basic Microprocessors And The 6800 — Ron Bishop (Motorola)	$33.60
Doing Business With Supercalc — Trost	$19.95
Doing Business With Pascal — Hergert	$28.50
Doing Business With Visicalc — Trost	$19.95
Mastering Visicalc — Hergert	$19.95
Programming With Graphics — Marshall	$12.95
The Spectrum Book Of Games — James	$12.95
The Spectrum Programmer — Gee	$12.95
Introducing Spectrum Machine Code — How to get more speed and power — Sinclair	$16.95
The Custom TRS-80 And Other Mysteries — Kitsz	$37.40
TRS-80 Disk And Other Mysteries — Pennington	$28.10
Machine Language Disk I/O And Other Mysteries — Wagner	$37.40
The Custom Apple And Other Mysteries — Hofacker	$31.15
Basic Faster And Better And Other Mysteries — Rosenfelder	$37.40
TRSDOS 2.3 Decoded And Other Mysteries — Farvour	$37.40
A Guide To Programming In Apple Soft — Presley	$15.00
Your Timex Sinclair 1000 and ZX81 — Hergert	$11.50
SC/Mputer — Build Your Own Microprocessor System — Published by Elektor Volume 1	$13.35
Volume 2	$14.25
Pet Personal Computer Guide	$23.25

Other Titles

Piano Servicing & Tuning & Rebuilding — Arthur Reblitz	$24.90
Audio Servicing Theory & Practice — Wells	$22.15
Australia Radio Frequency Handbook — McDonald	$12.95
Confidential Frequency List — Ferrell	$14.20
Electronic Design With Off-The-Shelf Integrated Circuits — Meiksin & Thackray	$15.50
Videocassette Recorders: Theory & Servicing — McGinty	$21.25
Formant Music Synthesiser — Published by Elektor. Price includes cassette	$15.10
The Complete Handbook Of Video — Everything you need to know about video — from home entertainment to everyday office use — Owen. A really outstanding book beautifully presented and highly recommended	$12.95
The Video Manual — David Cheshire. Profusely illustrated, much colour	$20.00

Just a few of the thousands in stock. Call in or write. Prices subject to fluctuation. Correct at time of going to press

If the book you require is not listed below, it can be ordered from us.

MAIL ORDERS BY RETURN

PLEASE ADD $2.00 per parcel postage (Vic)

$3.00 per parcel Interstate

TECHNICAL BOOK & MAGAZINE CO.

295-299 Swanston St, MELBOURNE 3000. Ph. 663 3951

GREAT NEW PROD

NEW

JAYCAR'S DIRECT IMPORT PRICES

BALANCED MIC TRANSFORMER $18.95

A true Mu-metal shielded unit for balanced applications.
Primary – 200 – 600 ohm CT (Balanced)
Secondary – 10 – 50K Unbalanced
(Can be operated either way round)
9mm bushing mount with flexible wire leads
Frequency response 30 – 15kHz at mic level

STAGGERING VALUE
ONLY $18.95

Cat. MT4710

We also have a 10K:10K line isolating transformer (identical in appearance to above) at
ONLY $17.95
Cat. MT4720

SENNHEISER MUFFS

$5.95

PAIR

Genuine factory made spare foam earpads for the famous HD-414. We now have plenty of stock.
Cat. AA2011 $5.95 pair

HIGH SPEED LOGIC PROBE

QT2210

- DTL/TTL/HTL/CMOS/MOS compatible!!
- Pulse memory
- 10MHz input frequency (tested to 12MHz)
- ± 50V input overload
- Complete with leads.

ONLY $29.95

IEC 320 240V APPLIANCE CONNECTOR

Some day all mains equipment will be fitted with these!

CHASSIS PLUG – Front or rear mount
- Accepts RH, LH, or straight IEC 320 standard line skt.
- Simplifies 240V wiring
- Quick connect/solder terminals

Cat. PP2302 ONLY $2.95

LINE CORD/SOCKET
- 3 wire cord (A,N,E)
- Moulded line socket
- Strain relief grommet
- other end unterminated

Cat. PS4302 $4.95

$4.95

HEAVY DUTY MAINS FILTER

There are an enormous number of Desktop micros now having problems with mains borne interference.
Our MS4002 filter has been invaluable where mains interference is only marginal problem. This unit (illustrated) costs only $14.50 and is supplied with full data.
For much more serious problems, or when a free standing unit (not illustrated) is required the MS4004 is ideal. It will pass 2 amps (conservative) at 240V AC. This unit is a grey painted metal case that plugs into a standard mains socket. On one end of the case is an unswitched 240V outlet. Virtually the only thing that comes out of this socket is mains. All frequencies above 50 Hz are very heavily attenuated. Ideal for problem areas.

Cat. MS4002 $14.50
Cat. MS4004 $99.00

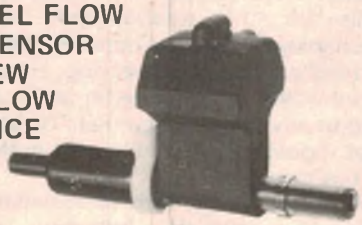
NEW 28 PIN ZIF SOCKET

It's hard to keep up with demand for the popular 24 pin zero insertion force socket however, we have had many requests for a 28 pin version.

24 PIN ZIF SOCKET
Cat. PI6522 $12.95

28 PIN ZIF SOCKET
Cat. PI6523 $17.95

FUEL FLOW SENSOR NEW LOW PRICE



As used in the EA Fuel Consumption Meter. (Ref: EA March 1983)
The original, accurate fuel flow meter. Delivers a TTL compatible pulse in linear proportion to fuel flow. Will measure flow of many low-viscosity liquids apart from fuel.
Cat. XC2020 $45.00
NORMALLY $59.50 SAVE $14.50

SPEEDO CABLE SENSOR BACK IN STOCK

Amazing $29.50

Great for precision electric speedos, car computers etc. Provides TTL compatible pulse directly proportional to speed of vehicle. Simple fitting with instructions provided.
Cat. XC2025 $29.50

9 VOLT BATTERY HOLDER/ CONNECTOR

ONLY $2.95

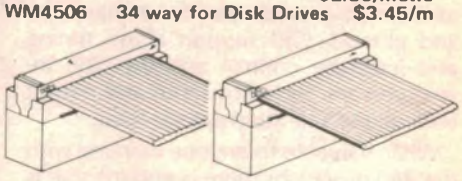
NEW!

The 216 cell 9V battery is a common source of power for many projects. The problem is, however that they are difficult to mount. You usually end up letting the battery bounce around the box tethered to its battery snap. This great unit (pictured) enables you to secure the 9V cell as well as connect to it. Great for any portable equipment!
Cat. PH9232 ONLY $2.95

INSULATION DISPLACEMENT CONNECTORS & RIBBON CABLE

I.D. Insulation displacement. The quick and reliable way of making multiple connections to computer peripheral connectors. Great for Disk Drives, Printers etc. Crimp them yourself and save a fortune.

PI6550	16 pin DIP header	$1.99
PI6555	24 pin DIP header	$2.50
PI6560	PC edge connector 34 way (Suits 5¼" Disk Drives)	$8.50
PI6575	25 pin Cannon 'D' male	$8.95
PI6576	25 pin Cannon 'D' female	$8.95
WM4502	16 way cable	$1.50/metre
WM4504	25 way (for DB25's & 24 way DIP	$2.50/metre
WM4506	34 way for Disk Drives	$3.45/m



EXPERIMENTER BREADBOARDS

from $3.45 VALUE!

Cat. PB8810	WBDN 100 holes	$3.45
Cat. PB8812	WBTN 640 holes	$10.95
Cat. PB8814	WB2N 840 holes	$16.95
Cat. PB8816	WB4N 1680 holes	$29.50
Cat. PB8818	WB6N 2420 holes	$45.00

UCTS– LOW PRICES

MEAN YOU SAVE A BUNDLE!!

NEW

$42.95

FAR CHEAPER THAN DPM SEPARATELY

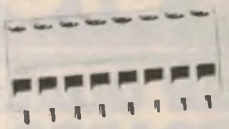
Specification

Function	F.S.D.	Resolution	Accuracy
Voltage (d.c.)	20V	10mV	0.5% ± 1 digit
	200V	100mV	0.5% ± 1 digit
Resistance	2000Ω	100mΩ	0.5% ± 1 digit
	20kΩ	10Ω	0.5% ± 1 digit
R.P.M.	20,000r.p.m.	10r.p.m.	1% ± 3 digits
Dwell	90°	0.1	2% ± 3 digits

minitune

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

Cat. KJ7012 MINITUNE KIT $42.95
TEST LEADS TO SUIT ONLY $2.95



PCB MOUNT SCREW TERMINALS FROM $1.25

NEW

We now stock two (2) types of 4 way and 8 way. Great for the rugged connection of 240V or other heavy duty wiring to PCB's when solderless disconnection may be required at a later date.

4 way Cat. HM3207 PRICE $1.25
8 way Cat. HM3208 PRICE $1.95

EXPERIMENTER'S MAGNET KIT

NEW

ONLY $4.95

Magnets never cease to amaze – yet most of us know very little about them.
With this in mind Jaycar has had a special "Magnet Kit" produced.
The kit contains: 2 very powerful Ceramic magnets, flux concentrator, pole pieces and a short manual written by experts in magnetism.
Magnet experiments are also shown as well as a technique to actually make your magnets stronger!!

Cat. KJ6512 $4.95

Digital Delay Line KIT

400ms VERSION

ONLY $449 COMPLETE

WE DARE YOU TO COMPARE WITH DEARER UNITS!!

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

Cat. KJ6621 $449

Jaycar NUMBER 1 FOR KITS

SYDNEY SHOWROOM
125 YORK STREET PHONE (02) 264 6688
TELEX 72293

CARLINGFORD SHOWROOM
Cnr CARLINGFORD & PENNANT HILLS ROAD
PHONE (02) 872 4444

MAIL ORDERS & CORRESPONDENCE
BOX K 39 HAYMARKET, SYDNEY 2000
POST AND PACKING CHARGES
$5 – $9.99 ($1.50) $10 – $24.99 ($3.20)
$25 – $49.99 ($4.50) $50 – $99.99 ($6.50)
$100 or more ($8.00)

SHOP HOURS CARLINGFORD
Mon – Fri 9am – 5.30pm Sat – 9am – 12pm Thurs night 8.30pm
SHOP HOURS SYDNEY
Mon – Fri 8.30am – 5.30pm Sat – 8.30am – 12pm Thurs night 8.30pm

Mail Order By BANKCARD Via Your Phone

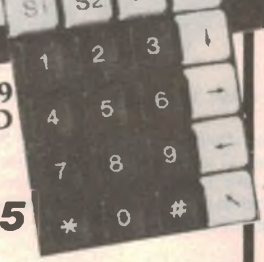
"GET ALONG TO THE SHOP WHERE THE BARGAINS NEVER STOP"

Sheridans – The Component Kings

AT LAST! ULTRA-HIGH QUALITY KEYBOARDS AND NUMERIC KEYPAD

MODEL AK68MF10
FULL QWERTY KEYBOARD
and only **$99.95**

MODEL NK20 MF19
NUMERIC KEYPAD
only **$37.95**



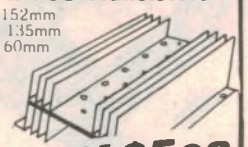
The PREH 'Commander' from West Germany

These superb keyboards provide the standards of performance normally associated with equipment costing many thousands of dollars. Using superior membrane technology, the Commander keyboards provide full travel keying – essentail when the keyboard is in frequent use. Precision West German technology is now available at an amazingly low introductory price.

FULL TECHNICAL DATA ON REQUEST

MINIWATT Heatsinks Pre-drilled for 5 x TO3 Transistors

L 152mm
W 135mm
H 60mm



ONLY $5ea NEVER AGAIN!

PYE-TMC Illuminated Pushbutton Switch with 2 make/break contacts. Choice of red, green or orange bezels (lamp not included)

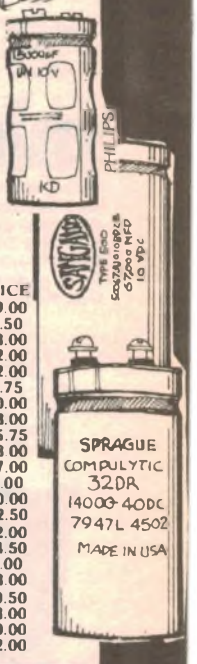
$3.50

ELECTRO SALE

½ PRICE!! *Mounting brackets now free!*

This is probably your last chance to buy these brand new computer grade electros at around half normal cost. We made a scoop purchase of Philips, Sprague and Sangamo electros, but they won't last much longer. Order now to avoid disappointment!!

CAP MFD.	WKG. VOLTS	MAKE	DIA MM	HEIGHT MM	PRICE
500	250	SPRAGUE	35	80	$5.00
590	200	SPRAGUE	35	80	$5.00
1800	50	SNGAMO	35	60	$3.50
2300	60	SPRAGUE	35	80	$4.00
2400	50	SPRAGUE	35	55	$4.00
2400	50	SNGAMO	35	60	$4.00
3000	75	SNGAMO	35	125	$5.00
3300	75	SNGAMO	35	110	$5.50
3700	30	SNGAMO	35	60	$3.50
4300	25	SNGAMO	35	60	$3.75
7000	35	SNGAMO	35	90	$5.00
8000	35	SNGAMO	35	110	$6.00
8200	25	SNGAMO	35	90	$5.75
9100	60	SNGAMO	50	110	$10.00
10000	40	SPRAGUE	50	90	$6.50
13000	60	SPRAGUE	65	110	$10.0
14000	25	SPRAGUE	50	85	$5.50
14000	40	SPRAGUE	50	110	$9.00
15000	3	SNGAMO	35	60	$3.50
20000	25	SNGAMO	45	110	$8.75
22000	6.3	PHILIPS	35	85	$5.00
22000	10	PHILIPS	35	117	$6.00
22000	75	SPRAGUE	75	145	$19.00
26000	10	SNGAMO	35	110	$6.50
30000	25	SNGAMO	65	85	$13.00
30000	25	SPRAGUE	50	110	$12.00
33000	16	SPRAGUE	50	120	$12.00
36000	20	SNGAMO	50	110	$7.75
39000	25	SNGAMO	50	150	$10.00
39000	30	SPRAGUE	50	145	$13.00
44000	35	SNGAMO	75	110	$15.75
47000	10	PHILIPS	50	120	$13.00
47000	25	PHILIPS	65	120	$17.00
55000	3	SNGAMO	35	135	$6.00
65000	35	SNGAMO	75	150	$20.00
67000	10	SNGAMO	50	125	$12.50
76000	25	SNGAMO	75	125	$22.00
88000	10	SPRAGUE	50	145	$14.50
100000	3	SNGAMO	65	85	$7.00
100000	10	PHILIPS	65	115	$13.00
110000	20	SNGAMO	75	150	$20.50
120000	15	SPRAGUE	65	145	$18.00
150000	6.3	PHILIPS	65	113	$10.00
200000	3	SNGAMO	65	135	$12.00



SUPER SPECIALS — SAVE SAVE SAVE

Colourburst Crystals
4 433619MHz **$3.50**

VHF Power Transistor
Type BLV10 ..... **$6.00**

AMPHENOL BNC
Line Plug UG-88/U **$1.95ea**
10 up $1.75

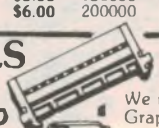
DL-750 Display
(Com Cathode) ..... **90¢**

Edge Connectors 44 way
Double sided right angle
.156" pitch (22 per side) **$3.00**

S100 Edge Connectors
Solder Spill **$4.00**
Wire Wrap **$6.00**

DDK 20WAY Transition
Male PCB Connector
(used on many computer boards) **$1.50ea**
10 or more $1.30ea

MORE SPECIALS



34 way female transition ribbon
cable connector **$2.00**
PO Type 1000 Lever Key Switch
(8 make/break, single throw) **$1.50**

FAIRCHILD DATA BOOKS

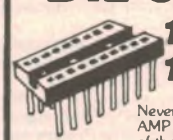
ALL 4 FOR ONLY $30

1981 MOS MEMORY **$2.00**
1982MICROPROCESSOR
PRODUCTS **$9.00**
1982 LINEAR **$13.50**
1982 BI-POLAR
MEMORY **$9.00**

NEWS FLASH

We now have in stock a large range of Bishop Graphics. Riston boards, developers and chemicals for your own PCB design.

"KNOCKDOWN" ON 14 & 16 PIN DIL SOCKETS



10 for $1.00
100 for $9.00

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

SHERIDAN ELECTRONICS

164-166 Redfern St., Redfern NSW 2016. Phone (02)699 6912, (02)699 5922
Mail Orders to Dept EA, PO Box 229 Redfern NSW 2016

Trading Hours:-

Mon-Fri	9am-5.30pm
Thursday	9am-7pm
Saturday	9am-12noon

Mail Charges:

$5.00-$9.99	$3.50
$10.00-$24.99	$4.00
$25.00-$49.99	$6.00
$50.00-$99.99	$7.00
$100.00 or over	$8.00

Note: We regret we cannot give quantity discounts on credit card purchases.

Credit Cards: We accept both BankCard and American Express

MINIMUM ORDER $6.00

bankcard

Shortwave Scene

by Arthur Cushen, MBE

Radio Japan plans new transmitters and relay bases

A Committee set up by the Ministry of Posts & Telecommunications has been looking at the future of Radio Japan and its shortwave services, and is currently promoting the idea of higher power transmitters and new relay facilities.

Radio Japan at present operates 12 transmitters, each of 100kW, and the Committee has recommended that the Yamata transmitting site be upgraded with four transmitters of 300kW, and four of 100kW. The estimated cost is $A50 million, while another $15.1 million per year would be needed to cover operating costs. A BBC Monitoring Service report indicates that the Committee has also suggested that relay facilities should be established in Central America, Africa and South West Asia in addition to the relay now being used in Portugal.

Radio Japan recently rescheduled transmissions to Australia and New Zealand and now broadcasts at 0845-0945UTC on 11875 and 15235kHz. For many years the broadcast was at 0930-1030 and later moved to 1000-1100UTC, but listeners, particularly in New Zealand when daylight time was in operation, found that listening was between 11pm-midnight and this was too late for any substantial audience.

AUSTRALIAN LISTENING POLL

Recently Radio Japan conducted a survey amongst its listeners in Australia to determine the popularity of shortwave broadcasting and requested that respondents list their most popular shortwave station. In some countries Radio Japan was voted No. 1, but the Australian shortwave listener seemed to prefer Radio Nederland, BBC, VOA and Radio Moscow. Australian listeners indicated that they were equally divided in treating their listening as a hobby or as a means of learning about lifestyle and culture in other countries. An interesting aspect of the survey was that Radio Australia was ranked very high in Indonesia, a country which has been long associated with broadcasts in Indonesian from Australia, and the Australian influence in that area seems to be significant. Australian listeners naturally are tuning to Radio Japan for programs such as "Hello Australasia", DX programs and news features.

FALKLAND'S SCHEDULE

The schedule of the Falkland Islands Broadcasting station shows they use two frequencies for their new daily transmission. The first broadcast at 0900-1730UTC is carried on 3958kHz, and the second transmission at 1930-0130 is on 2370kHz. The power of the transmitter is less than 2kW according to a station official telephoned by Steve Rawdon of Wellington, NZ, who reported these details to the New Zealand DX Times. The staff are under contract and include announcers from the BBC and at least one from New Zealand. Regular calls to New Zealand listeners have been heard to around 0930 since soon after the station started to be received in this area and it has been widely reported in Australia, New Zealand and the Solomons.

NEPAL VERIFICATION

Radio Nepal has verified our reception after some reports have been outstanding for 18 months, with a letter and verification card from Miss Mohini Shepherd, who is now handling letters from listeners. In her reply she asked for information about the writer's book "The World In My Ears" to be added to the station's library and also gave details about present schedule and frequencies. The two medium-wave channels 684 and 792kHz have recently been increased in power to 100kW and shortwave broadcasts in English are on 1435-1520UTC on 3230, 5005 and 9590kHz.

The station verified with a card showing the New Hotel Crystal, as well as a schedule and personal letter from Miss Shepherd and the address is: Radio Nepal, PO Box 2908, Kathmandu, Nepal.

DEUTSCHE WELLE

On May 3 Deutsche Welle, the shortwave broadcasting station of the Federal Republic of Germany, celebrated 30 years of operation. The station signal that listeners to the Deutsche Welle heard that day and still hear even now was the theme from the opera "Fidelio" by Ludwig van Beethoven.

When the Deutsche Welle first started transmitting it broadcast three hours of programs in German in five directions every day. On April 3, 1954 the first foreign language programs were broadcast; five minute news bulletins in English and French for the Far East, the Middle East and Africa, and in Spanish and Portuguese (Brazilian) for Latin America, and a ten minute news bulletin in English for North America.

The foreign language program was extended on October 1, 1957 when the successful series "Learn German with Deutsche Welle" was launched. Since February 1975 when transmissions in Bengali began, Deutsche Welle has been broadcasting programs in 34 languages.

The number of transmitters has been rapidly increased since the first 20kW transmitter was installed in 1952 for test purposes. Today there are 27 transmitters in use located in Germany and in Rwanda, Portugal, Malta and Antigua, while additional relay facilities are being established in Sri Lanka.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill NZ. All times are UTC (GMT). Add eight hours for WAST, 10 hours for EAST and 12 hours for NZT.

DO YOU WANT TO BE A RADIO AMATEUR?

The Wireless Institute of Australia, established in 1910 to further the interests of Amateur Radio, conducts a Correspondence Course for the A.O.C.P. and L.A.O.C.P. Examinations conducted by Telecom. Throughout the Course, your papers are checked and commented upon to lead you to a successful conclusion.

For further information, write to

THE COURSE SUPERVISOR
W.I.A. (N.S.W. DIVISION)
P.O. BOX 1066
PARRAMATTA, N.S.W. 2150.

New Products...

Product reviews, releases & services

Nexus Electronics introduces the "mains muffler"

Nexus Electronics has introduced a product which will be a boon to all those troubled by mains-borne interference with computers and peripheral equipment. The "Mains Muffler" is a four outlet distribution board incorporating a two stage filter. Maximum load is a respectable 1000W.

The unit measures 445 x 100 x 40mm and is constructed of heavy duty anodised aluminium and enamelled plate. Keyholes for wall mounting are provided in the base plate at each end of the strip. At the right-hand side is the mains cord, a main switch and an illuminated power-on indicator. The four mains outlets are switched and colour-coded, with two grey outlets recommended for use with printers and disk drives and two black outlets for processors, computers and video display terminals.

The presentation and specifications of the unit are impressive and the product fills two needs – a safe and sure mains distribution strip and a compact, effective interference filter.

A single pi-section filter feeds the first stage outputs, providing attenuation of 40dB at 150kHz, 65dB at 500kHz and 80dB at 10MHz. Between the first and second stage outlets is a dual-T section filter providing 20dB attenuation at 150kHz, 60dB at 500kHz and 70dB at 10MHz. Surge capacity of the unit is specified at 2000A for 20μs.

The Mains Muffler is manufactured in Australia by Sigtronic Industries Pty Ltd and is distributed by Nexus Electronics, 339 Pacific Highway, Crows Nest, NSW 2065. Phone (02) 922 1722. Recommended retail price is $195 including sales tax.

Standby power supply by NEC "Supercap"

The expanding use of digital processing equipment has highlighted the need for a reliable standby power source to maintain volatile memory banks during AC power failures or blackouts.

Until now, standby power has been achieved either by the use of primary cells such as lithium or by rechargeable nickel cadmium batteries but both of these systems have some disadvantages. Primary cells can be risky as there is no way of telling whether the amount of charge available will be enough to handle power cuts of unknown duration. Nicads require controlled charging rates and do not have an indefinite life.

Problems such as these have led to the development of the Supercap by NEC as a new standby power source, capable of providing up to 30 days back-up voltage and current to CMOS RAMS during power failures.

The one farad capacitance and low leakage current of this capacitor is said to make it an efficient, reliable and cost-effective storage device.

The capacitor never needs replacing or maintenance and can be wired into an existing circuit in any orientation (it is non-polarised). It can be charged or discharged at any current rate from microamps to amps, and is a compact 44.5mm diameter x 18.5mm high for direct PCB mounting.

For further information on the NEC "Supercap" contact the Soanar branch office in your state or the head office, Soanar Electronics Pty Ltd, 30 Lexton Rd, Box Hill, Vic 3128. Phone (03) 840 1222.

New components from Fairchild Australia

Fairchild Australia Pty Ltd has released two high speed memory chips designed for use as buffers and high performance memory in computer systems. The 93425 and 93425A are RAM devices organised as 1024 x 1 bit arrays. Access times are specified as 30ns for the 93425 and 25ns for the "A" version.

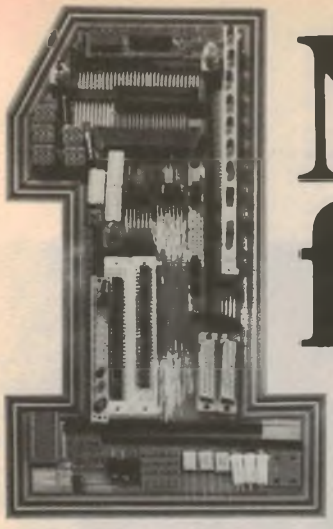
Both chips include full address decoding on chip, separate data in and data out pins and an active low chip select and write enable inputs. They are fully compatible with standard TTL logic, with a drive capability of 16mA and also include a 3-state output for use in bus-oriented systems. Power dissipation is quoted as 0.5mW per memory bit.

Also available from Fairchild is a single chip switching regulator subsystem, the UA78S40. The device consists of a temperature-compensated voltage reference source, an oscillator with selectable duty cycle, an error amplifier, high current, high voltage output switch, a power diode and an uncommitted operational amplifier. External transistors can be added when currents in excess of 1.5A or voltages of more than 40V are required. Applications include step-down, step-up and inverting switching regulators and series pass regulation.

Fairchild has also introduced a 488 x 380 element charge-coupled image sensor for applications requiring high resolution imaging or optical sensing. The new device, the CCD222, is organised as an array of 488 horizontal lines by 380 vertical columns of charge-coupled photodetectors to form an active optical area of 8.8 x 11.4mm.

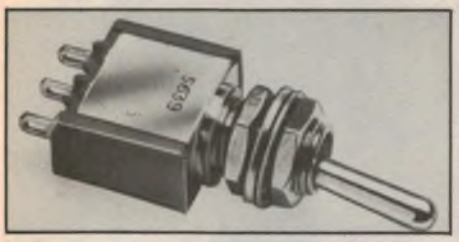
The low noise performance of the CCD structure of the device is said to provide superior performance under low light conditions when the sensor is cooled while performance adequate for most applications can be achieved with the sensor at room temperature or above.

Further information can be obtained from Fairchild Australia Pty Ltd, PO Box 19, Nunawading, Vic 3131. Phone (03) 877 5444, or the NSW office, FAI Insurance Building, 619 Pacific Highway, St Leonards, NSW 2065 (02) 439 5911.



No.1 for any bits.

"ASK ABOUT OTHER ITEMS ON SPECIAL"

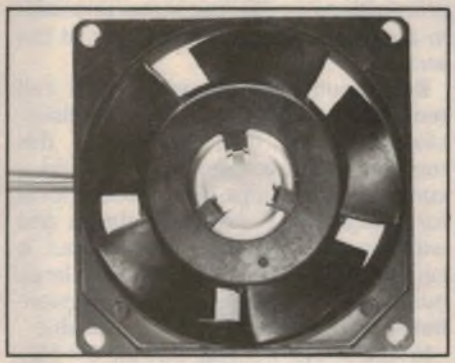


Mini. Toggle Switches

5636A S/P on-off-silver	$0.64 ea
5644A 2 Pole on-on-on silver	$0.97 ea
5644CD 2 Pole on-on-on-gold	$1.16 ea
5646A Dble pole on-on-silver	$0.90 ea
5649CD 2 Pole on-off-on gold	$1.12 ea
5656A 3 Pole on-on silver	$1.50 ea
5659A 3 Pole on-off-on silver	$1.62 ea
5664A Dble pole dble throw	$2.08 ea

Hirose Audio Connectors

HA16JA3P – 3 Pin microphone plug	$1.41 ea
HA16PA3 – 3 Pin microphone socket	$1.87 ea
HA16PR3S – 3 Pin chassis female	$2.05 ea



Axial Flow Cooling Fans

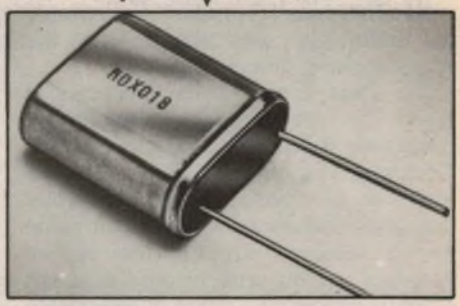
240 Volt – 4"	$11.00 ea
240 Volt – 3"	$11.00 ea

Re-Chargeable Batteries

EP610 1AH Solid gel	$7.34 ea
EP626 2.6AH Solid gel	$10.37 ea
EP1240 4AH Solid gel	$19.12 ea
EP1280 8AH Solid gel	$31.40 ea

D-Series Connectors

ADINIS25S – Solder cup	$2.84 ea
ADINIS25P – Solder cup	$1.92 ea
ADINIS50S – Solder cup	$5.73 ea
ADINIS50P – Solder cup	$3.95 ea
AD3S25S – 25 WY Wirewrap female	$6.10 ea
AD3525P – 25 WY Wirewrap male	$4.21 ea

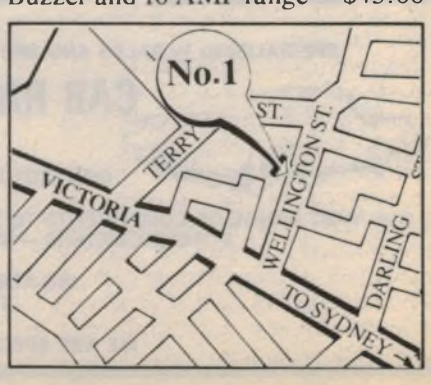


High Frequency Crystals

1 MHZ – HC33 Holder	$4.64 ea
2 MHZ – HC33 Holder	$2.78 ea
2 MHZ – HC18 Holder	$3.53 ea
2.5 MHZ – HC33 Holder	$2.78 ea
3 MHZ – HC33 Holder	$2.78 ea
3.2768 MHZ – HC33 Holder	$2.78 ea
3.2768 MHZ – HC18 Holder	$2.78 ea
3.330 MHZ – HC18 Holder	$2.78 ea
3.579545 MHZ – HC18 Hder	$2.38 ea
4.440 MHZ – HC18 Holder	$1.94 ea
5.9904 MHZ – HC18 Holder	$1.94 ea
6.1444 MHZ – HC18 Holder	$1.94 ea
6.5536 MHZ – HC18 Holder	$1.94 ea
8.8672375 MHZ – HC18 Holder	$1.94 ea
9.8304 MHZ – HC18 Holder	$1.94 ea
10 MHZ – HC18 Holder	$2.16 ea
10.73865 MHZ – HC18 Hder	$2.16 ea
15 MHZ – HC18 Holder	$2.16 ea
18 MHZ – HC18 Holder	$2.38 ea

Soar Digital Multimeters

Buzzer and 10 AMP range $45.00 ea



These prices while stocks last

The Ampec Trade Shop

No. 1 Wellington Street,
Rozelle, N.S.W. 2039
PHONE: 818 1166

AMPEC
The absolute in peripheral thinking.

Giant Solar Array uses polycrystalline cells

Just released by Amtex Electronics, this very large solar cell array is presently available as a special introductory offer at $495. At about $12 per watt this is outstanding value. Of particular interest is the shape and process used for the cells.

Sheer size is the major feature of the array which has overall dimensions of 950 x 445mm. This incorporates 36 cells which are connected in series to produce an open circuit voltage of 19.6 volts. The cells themselves are notable for their size and shape, and the manufacturing process.

The solar array is manufactured in Japan by the Kyocera Corporation. Previously known as the Kyoto Ceramic Company Ltd, this company is at the forefront of development of ceramics and semiconductors. Kyocera is notable for its research work in the use of ceramics in auto engines and also has recently produced a range of top quality audio equipment, including a Compact Disc player. It has also recently signed a merger agreement with the Yashica Corporation.

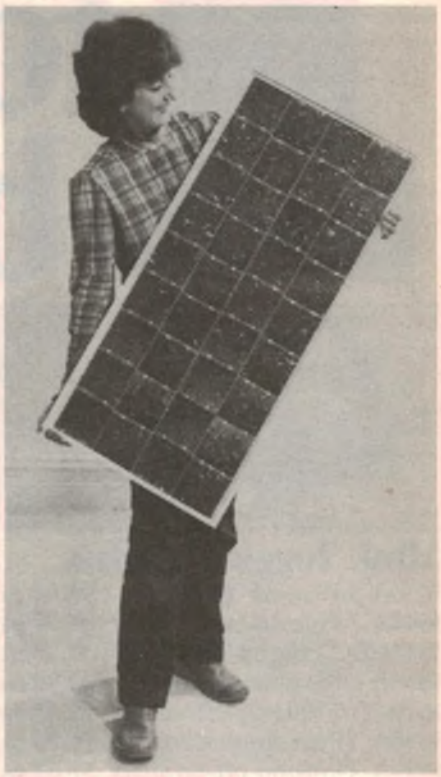
Kyocera began production of solar cells in 1975 and is now mass producing 75mm wide silicon ribbon crystals for solar cells. Cells produced in this way have very high reliability but the newer polycrystalline cells used in this new larger array are even more promising because of their high efficiency.

Each cell in the array is 100mm square which means that there is virtually no wasted area in the whole array. The array itself is framed with precision mitred aluminium extrusion which holds a sheet of tempered glass and a backing plate. The whole assembly is completely sealed with a silicone compound. Output terminations are via four screw terminals in a circular housing on the rear of the array.

Rated output is 40 watts for a cell temperature of 28 degrees Celsius. Under typical load conditions this translates to a voltage of 16.2V and a current of 2.47 amps. This makes it ideal for charging 12V storage batteries and with the relatively high power output, it can be a viable power source for a large number of applications where conventional power sources are not available.

In fact, arrays of similar size are used by Kyocera as the basis of solar powered street lamps in remote locations in Japan (as has been reported some time ago by the TV series "Towards 2000"). Such a street lamp system incorporates a storage battery with up to 30 days capacity, an inverter to drive the flurorescent lamps, and a light sensing and timer circuit.

At the introductory price of around $12 per peak watt, this new array represents a price breakthrough and should be of particular interest to public utilities, companies or individuals requiring a reliable and automatic power source for remote locations.



This photo gives some idea of the size of the new solar array which weighs 6kg.

For further deatils of the special introductory offer from Amtex Elecctronics, see page 74 of this issue.

IAN J. TRUSCOTT'S

CORNER BAYSWATER AND EASTFIELD ROADS,
CROYDON, VICTORIA, 3136.

(03) 723 3860

ELECTRONIC WORLD

SPECIALISING IN SALES AND SERVICE TO —

CAR RADIOS

C.B.

AND **MARINE**

CONTACT US FOR ALL YOUR 27MHZ AND 477MHZ REQUIREMENTS

OUR VAST RANGE OF COMPONENTS TO SUIT THE ELECTRONIC ENTHUSIAST INCLUDES: RESISTORS — CAPACITORS — IC's — POTENTIOMETERS —HEAT SINKS — CABINETS — PLUGS AND SOCKETS OF MOST KINDS.

WE ALSO STOCK A RANGE OF TEST AND ASSEMBLY GEAR
TO HELP THE HOBBY TYPE ELECTRONIC BUFF

WE ARE SPECIALISTS IN TV, STEREO AND MOST ELECTRICAL REPAIRS.

CAUTION! CAUTION!

DON'T TAKE CHANCES WITH BACKYARDERS

You Could be sorry!

Buying amateur radio equipment?
If you don't deal with the factory authorised distributors, you could be buying trouble!
Everyone knows of the 'backyarder' – the wheeler dealer who can offer you a discount on just about anything. Amateur radio has them just as much as any other field.
But there's a difference: most backyarders sell the 'genuine' article, complete with manufacturer's guarantee, etc, at a discount. Amateur backyarders? That's a different story!
Chances are, what you order won't even be in stock. And when it does finally arrive, you'll get a piece of equipment never even intended for Australia. It could have different bands, the wrong power supply, wrong plugs . . . even Japanese instruction manuals!
And as for service back up . . .
And spare parts back up . . .
Etc. etc. etc.

When you deal with the factory authorised Yaesu distributors, you know you're getting the genuine article.

You know that if it is advertised, we have stock (assuming it hasn't sold out because of popularity!)

You know that if something goes wrong, there is full service back-up available.

You know that we have an enormous inventory of spare parts that are held in stock.

And you know that we'll still be here tomorrow to help you out. (Think of the number of 'backyarders' of yesterday who aren't around now!) Trust Yaesu. Trust Dick Smith for your Yaesu.

All Yaesu products from Dick Smith Electronics are fully guaranteed for 12 months with full back-up.

The brilliant FRG 7700/SW

Cat D-2841

For the professional monitor or serious SWL! If you want the best, you want the Yaesu FRG 7700 SW. Complete shortwave coverage with ease of operation the others only dream about. Just look at these features:

- 2MHz – 30MHz continuous
- ALL Mode – including FM (great for working with converters!)
- Digital frequency readout, with digital clock
- Timer for turning receiver on/off plus control of external equipment (such as a tape recorder).

Ask for a copy of our brochure showing you what the FRG 7700 SW can do for you.

All this for only **$519**

FRG 7700 HF 150kHz – 30MHz version also available. Cat D-2840 **$549.50**

FT 707 SERIES

SAVE NEAR $100.00

The FT 707 is a full HF band (including WARC) multi-mode transceiver not much bigger than an average 2 metre mobile! And you get digital display as well. LED S/power meter, push button operation . . . all the things the amateur needs for safe and yet reliable mobile operation. But it's more than that. Team it up with a power supply and it's a superb base station, too. Cat D-2869

WAS $795.00 NOW ONLY **$699.00**

FT 102 HF Transceiver

SAVE $176

A fantastic new, super high performance HF transceiver has arrived. The FT-102 has all the amateur bands PLUS the new WARC bands. Special high voltage JFET RF amplifier provides exceptional dynamic range – well beyond 100dB. Adjustable Noise Blanker even works on 'the Woodpecker'. Three 6146B final tubes provide remarkable emission purity – plus big power 240W. Has IF Width and IF Shift and the best notch and audio peak filter you've ever heard. You must see this one to believe it! Cat D-2880

WAS $1225 NOW ONLY **$1049**

INCLUDES FREE MICROPHONE!

Accessories to suit:

VHF CONVERTER

$144.50

There's a lot more to listening pleasure than just the HF bands! Listen in to the exciting world of VHF radio: all the services, amateurs etc, etc. 50-59, 118-130, 140-150kHz. Cat D-2844

ANTENNA COUPLER

$89.95

The FRG 7700 works with many types of antennas, but best with a low impedance one. This coupler ensures optimum performance always. Cat D-2843

ACTIVE ANTENNA

$89.50

Don't want to string up an antenna outside? Use the active antenna – powerful preamplifier plus a whip antenna will pull in stations you didn't think possible. Cat D-2845

OPTIONAL MEMORY UNIT

Gives you single button re-call of any of 12 chosen frequencies. Simple connection, instructions included. Cat D-2842

$129.50 WAS $149.50

Antenna to Suit

If you're typical of most amateurs, you live in the suburbs where space is at a premium. You need an effective antenna, but there are usually objections to putting up a beam. You need our V5JR vertical. Virtually unnoticable in your backyard, you'll be able to pursue your hobby without worry!
Cat D-4305

5 BAND VERTICAL ONLY **$99.95**

Antenna Rotator

Dick Smith brings you top value in an antenna rotator, and this one has fully approved power supply. Features include:

- Ruggedly made rotator with massive disc brake.
- Control box with beam direction indicator.

Cat D-5000

Approved Supply (D-5002) $27.50 **$169**

DICK SMITH ELECTRONICS

See page 98 for full address details

A496.CT.

7 DAY SATISFACTION GUARANTEE

HAVE A LOOK AT THIS!

SPECIAL OFFER TO EA READERS

3½-digit LCD multimeter

from PARAMETERS

Model 7040

- High accuracy achieved with laser-trimmed resistor networks
- 0.1% accuracy on DC voltage ranges

Features:

- **28 ranges**
- **Pushbutton operation**
- **DC volts from 200mV to 1kV**
- **AC volts from 200mV to 750V**
- **AC/DC current to 10A**
- **Full overload protection**
- **2000HR battery life**
- **Resistance from 200Ω to 20MΩ**
- **Auto polarity**
- **Low battery indicator**
- **Finger guards on probes & shrouded plugs for safety.**

$99 tax paid

$87.75 tax excl

Price includes postage & packing

Don't miss this great opportunity to purchase a top-quality multimeter with excellent specifications. The LCD readout has exceptional clarity and is readable at extreme viewing angles. We have used this unit in our laboratory and we think it's a bargain!

HOW TO ORDER YOUR MULTIMETER

This offer is made by Parameters Pty Ltd. "Electronics Australia" is acting as a clearing house for all orders. All mail orders will be despatched by certified post. Please allow up to four weeks for delivery.

Fill out the coupon at right. Cheques or postal orders should be made out to Parameters Pty Ltd. If not paying sales tax, please quote sales tax number or enclose a sales tax declaration on your letterhead. Send completed coupon to:

EA/PARAMETERS
MULTIMETER OFFER
c/- "Electronics Australia"
PO Box 163,
Chippendale, NSW 2008

To Electronics Australia, PO Box 163, Chippendale 2008

Please send me ..... Parameters 7040 multimeter(s) at $99.00 each incl tax or $87.75 excl tax (includes post and packing).

NAME .....

ADDRESS .....

..... **POSTCODE** .....

☐ **I enclose cheque/postal order to the value of $.....**

☐ **Please charge my Bankcard $.....**

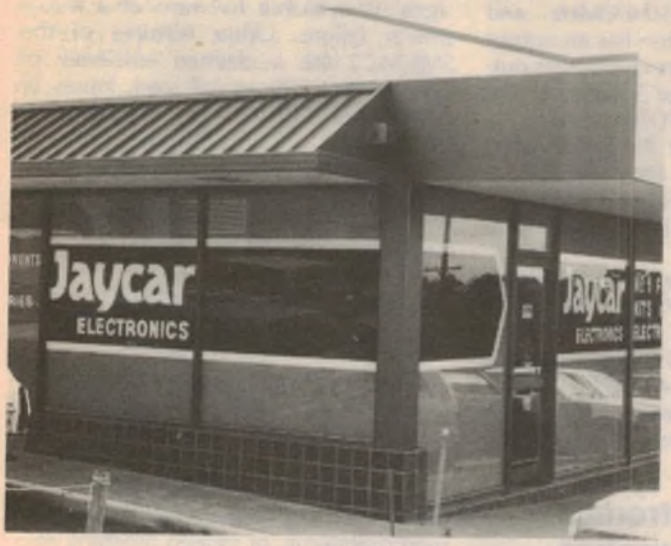
Bankcard Number 496.....

Expiry Date ..... Cardholder Signature.....

Sales Tax No..... **(if applicable)**

If you are using Bankcard, be sure to include your full address (not a PO Box)

Jaycar's Carlingford store



Jaycar Electronics now have a second store, in Carlingford, a north-western suburb of Sydney.

"One of our main problems is that many people are still not aware that we have this new showroom," says Gary Johnson, managing director of the company. "Our research indicated that the Carlingford area was one of the few major areas left in Sydney that did not have an outlet catering to the needs of electronics enthusiasts."

The new Jaycar store is conveniently located on the corner of Carlingford and Pennant Hills Roads and is only 10 minutes by car from either Parramatta or Hornsby. All Jaycar items are stocked at the store and many kit projects can be demonstrated. The phone number of the new store is (02) 872 4444.

Handheld computer terminal

Telxon Australia has released a new hand-held multi-function computer designed for business and industrial applications such as inventory control, retailing, and warehouse operations. The new unit, the Telxon 790 provides expansion on the functions of the popular Telxon 787 "tele-transaction" computer introduced last year.

Weighing around 800g including batteries the hand-held computers can record, edit, compute, store, and transmit business data from a remote source to a central computing system and a large number of hardware and software options is available to further expand these capabilities.

A feature of both computers is a 32 character keyboard with a removable upper casing to allow the user to customise the keys for specific requirements. Information, including prompts to the operator and the results of calculations are displayed on a two line 32 character LCD display panel on the 790 model, while the 787 has a single line 16 character LED display.

The Model 790 also provides I/O ports for the connection of peripheral equipment including send only and send/receive acoustic couplers, direct computer and terminal interfaces, printers, a larger keyboard or bar-code scanners.

Memory capacity ranges from 32,000 to 64,000 four bit characters with optional expansion to 256 or 512,000 characters in any mix of RAM, ROM or EPROM.

For further information contact Telxon Australia Pty Ltd, 93 Phillip Street, Parramatta, NSW 2150. Phone (02) 922 2555.

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

The Medfly home computer is compatible with the largest library of software available today. What this opens up to you and your family is simply amazing. For your children — education packages on Algebra, Spelling, Mathematics, Vocabulary — making your Medfly virtually a home coach or tutor.

For personal and business use — get access to Time Management, Business Systems, Accounting Packages and Financial Broadsheets. For family entertainment — you'll be able to share the fun of Action Games, Strategy Games and Adventure Games, which you can plug straight in to your home TV screen.

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

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

MEDFLY

putting the value buzz into home computing

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

ALL OTHER STATES:

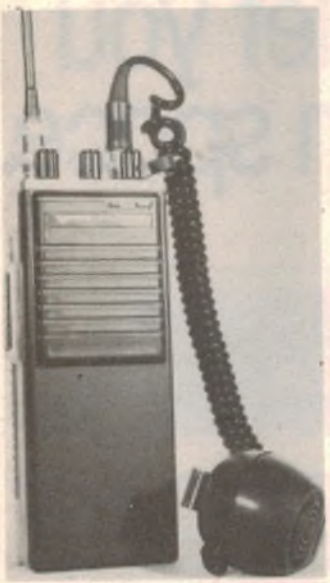
DATA UNIVERSE
2/190 George Street PARRAMATTA. PH: (02) 689 2599

DU 487

New Products

UHF/VHF transceivers from Vicom International

Victom International Pty Ltd advise that they have recently released a new series of hand-held UHF and VHF transceivers intended for commercial applications. The transceivers have been approved by the Department of Communications, they include an SEC approved battery charger, and offer very rugged construction.



They can be supplied to operate in a choice of bands, and with a choice of output. For example, the UHF models cover the bands 450-470MHz and 470-500MHz. One version has an output of 1 watt only. The other version has outputs of either 1 watt or 3 watts, in the same unit. This is the SU101 series.

The VHF models on the other hand cover 148-174MHz, and provide a choice of outputs of either 1 watt or 5 watts in the same unit. This is the SV1000 series.

For more information contact Vicom International Pty Ltd, PO Box 366, South Melbourne, Vic 3205, (03) 62 6931, or their NSW branch, 339 Pacific Highway, Crows Nest, 2065 (02) 436 2766. In New Zealand contact the branch office at 84 White Lines East, Lower Hutt. Phone 69 7625.

Scientific Electronics switchmode supplies

An Australian company, Scientific Electronics, has introduced a three output switch mode power supply unit designed for microprocessor-based systems.

Designated the SM65AC2, the power supply provides continuous output voltages of +5.2V at 8A, +12V at 2.5A and −12V at 1A. Other outputs are available according to customer specifications and the power supply unit comes with a five year guarantee.

All outputs are short circuit protected and the +5V and +12V outputs have overvoltage protection. A shut-down signal is available to warn of a mains power failure. Other features of the SM65AC2 are a claimed efficiency of greater than 70% at full load, inputs of 240VAC or 110VAC, line regulation of better than 0.5% on all outputs and output ripple of less than 2% peak to peak.

For further information contact Scientific Electronics, 6 Holloway Drive, Bayswater, Vic (03) 762 5777.

Selleys "Super Clip" for the workshop

Selleys has introduced a new product which should find a thousand uses around the home or workshop. The "Super Clip" is a self-adhesive multi-purpose plastic clip designed for retaining hard to find items, clamping cables, memorandums, or indeed anything else that needs a strong, positive-action reusable clip.

The clip can solve the problem of never having something to write with close to the telephone, as its self-adhesive base will stick firmly to the side of the phone to secure a pen or pencil. In the kitchen, bathroom or workshop the clip can hold utensils, razors or small tools, or be used to train trailing plants or for clamping stereo cables and electrical cords to walls.

In the car the items which are frequently used can be clipped to the dashboard or sun visor so that they are always ready to hand.

The clip opening and closing action of the new product has been tested by Selleys for over 200,000 operations without failure. The self-adhesive backing works best on smooth, clean surfaces and attains its maximum strength within 12 hours of application.

Super Clip retails for a recommended price of around $1.75 for a pack of four clips. One of the clips is exposed at the top of the pack so customers can try before they buy — a nice feature.

Dick Smith Electronics LCD multimeter

Dick Smith Electronics has introduced an LCD multimeter which includes a capacitance measuring facility. In addition to standard multimeter functions the unit provides five ranges of capacitance checking, a diode test position and a setting for transistor checks.

The multimeter (Cat number Q-1460) comes complete with test leads, a carrying case and instruction manual for $129 and is available from Dick Smith Electronics stores throughout Australia.

MAIL ORDER

MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER

ACTIVE ELECTRONICS
4 KING STREET SANDRINGHAM VICTORIA
PHONE (03) 67 1137

SCR & TRIACS

SC151D	1 85
C103B	39
C106B	64
C106D	64
C122D	1 43
C122E	1 77

TRANSISTORS

AC126	66
AC127	45
AC128	86
AC187	58
AC188	98
AD149	1 39
AD161	1 54
AD162	1 55
AF127	98
BC107	29
BC108	27
BC109	29
BC177	30
BC178	31
BC179	31
BC212	20
BC318	11
BC327	11
BC328	11
BC338	11
BC546	11
BC547	11
BC548	11
BC549	11
BC550	11
BC556	17
BC557	11
BC558	11
BC559	11
BC637	35
BC639	30
BC640	30
BCY70	40
BCY71	44
BD135	33
BD136	39
BD137	40
BD138	40
BD139	32
BD140	32
BD233	40
BD235	42
BD236	42
BD237	44
BD238	44
BD262	75
BD263	75
BD437	46
BD647	1 98
BD677	62
BD681	52
BD682	52
BDV64B	3 08
BDV65B	3 08
BDY96 (BUX 80)	3 10
BDY97 (BUX 80)	3 10
BF115	57
BF167	57
BF173	57
BF180	72
BF184	66
BF198	22
BF199	22
BF337	50
BF458	51
BF459	51
BF469	70
BF470	73
BF494	27
BFY50	53
BFY90	72
BU126	1 87
BU208	2 15
BU326	1 92
BUX80	3 18
MFE131	1 21
MJ413	3 40
MJ802	3 75
MJ1001	2 50
MJ15003	3 63
MJ15004	3 63
MJ2955	1 04
MJ4032	8 30
MJ4035	7 60
MJ4502	4 07
MJE340	75
MJE350	82
MJE521	1 21
MJE700	51
MJE800	51
MJE2955	1 92
MJE3055	1 76
MPF121	1 37
MPF131	1 21
MPSA05	13
MPSA06	16
MPSA12	17
MPSA12	80
MPSA14	20
MPSA42	18
MPSA56	18
MPSA92	27
MPF102	48
MPF103	68
MPF105	68
MRF237	3 85
MRF454	29 00
MRF475	4 20
MRF646	35 00
MRF901	2 86
TIP31A	46
TIP31B	50
TIP31C	55
TIP32A	46
TIP32B	50
TIP32C	55
TIP41A	66
TIP41C	71
TIP42A	74
TIP42C	83
TIP111	66
TIP112	66
TIP116	77
TIP117	83
TIP120	66
TIP122	72
TIP125	77
TIP127	88
TIP2955	1 21
TIP3055	1 21
2N301	3 19
2N697	42
2N918	42
2N2219	42
2N2222A	42
2N2369	17
2N2484	41
2N2646	61
2N2647	1 21
2N2894	36
2N2904	45
2N2905	44
2N2906	39
2N2907	42
2N3019	46
2N3053	46
2N3054	1 60
2N3055	86
2N3302	39
2N3440	61
2N3441	2 15
2N3442	2 31
2N3563	14
2N3564	14
2N3565	14
2N3566	14
2N3567	14
2N3568	14
2N3569	14
2N3638	14
2N3640	14
2N3641	14
2N3642	14
2N3643	14
2N3644	14
2N3646	14
2N3702	27
2N3704	18
2N3771	2 86
2N3772	3 52
2N3773	3 63
2N3792	2 42
2N3819	53
2N3866	83
2N3904	14
2N3906	14
2N4032	46
2N4033	53
2N4036	49
2N4121	18
2N4236	1 21
2N4237	1 10
2N4248	13
2N4249	13
2N4250	13
2N4258	22
2N4355	17
2N4356	17
2N4360	50
2N4401	13
2N4402	13
2N4403	13
2N4416	1 22
2N4427	79
2N4919	2 05
2N5088	14
2N5089	17
2N5179	1 16
2N5190	66
2N5191	66
2N5192	61
2N5193	61
2N5194	2 42
2N5195	65
2N5210	14
2N5245	70
2N5303	3 63
2N5401	16
2N5457	51
2N5458	42
2N5459	47
2N5461	53
2N5462	99
2N5485	49
2N5486	55
2N5590	9 46
2N5591	15 40
2N5641	15 40
2N5656	1 65
2N5770	14
2N5777	77
2N5830	14
2N5831	16
2N5873	1 21
2N5874	1 38
2N5944	13 20
2N5945	18 15
2N5946	20 35
2N5961	17
2N6027	46
2N6084	22 00
2N6124	58
2N6126	66
2N6130	1 32
2N6133	1 43
2N6274	21 90
3N201	1 43
2SJ49	6 11
2SK134	6 11
7400	22
7401	22
7402	21
7403	21
7404	21
7405	27
7406	29
7407	29
7408	25
7409	26
7410	21
7411	22
7412	27
7413	29
7414	31
7416	31
7417	31
7420	22
7421	27
7423	31
7425	27
7426	31
7427	31
7430	21
7432	27
7437	29
7438	27
7440	27
7442	39
7443	2 20
7444	1 05
7445	50
7446	53
7447	53
7448	1 05
7450	21
7451	22
7453	22
7454	22
7460	27
7470	38
7472	33
7473	33
7474	31
7475	42
7476	27
7480	88
7482	1 27
7483	53
7485	53
7486	27
7489	2 97
7490	33
7491	47
7492	41
7493	40
7494	1 21
7495	44
7496	53
7497	83
74107	31
74109	47
74121	31
74122	42
74123	38
74125	35
74126	42
74132	40
74141	1 16
74145	39
74147	1 65
74148	1 10
74150	1 06
74151	40
74153	39
74154	1 07
74155	43
74156	74
74157	38
74160	94
74161	61
74162	1 06
74163	51
74164	51
74165	55
74166	66
74167	2 09
74174	50
74175	40
74176	99
74177	85
74180	35
74182	94
74184	3 30
74190	53
74191	66
74192	51
74193	53
74194	55
74195	46
74196	94
74197	55
74198	1 21
74199	1 43
74221	1 43
74251	1 21
74279	44
74283	66
74290	55
74293	83
74298	66
74365	75
74366	75
74367	75
74368	76
9300	44
9301	2 10
9302	99
9304	45
9307	1 21
9308	1 38
9309	46
9310	61
9311	1 21
9312	42
9313	4 95
9314	61
9316	61
9317	4 29
9318	99
9319	2 09
9320	4 40
9321	61
9322	40
9324	55
9328	1 10
9334	72
9338	88
9340	3 85
9342	5 39
9368	88
9374	3 25
9386	2 15
75107	88
75154	83
75450	77
75451	43
75452	43
75453	43
75461	49
75462	49
75491	53
75492	53
8121	1 32
0130	4 62
8131	3 30
8303	1 43
8304	4 18
8820	1 54
8833	2 86
8836	1 32
1488	55
1489	55
81LS95	1 76
81LS96	1 76
81LS97	1 76
81LS98	1 76
8126	1 65
8T28	1 43
8T96	1 65
8T97	1 65
8080	5 95
8085	4 62
8086	65 00
8088	23 10
8155	4 24
8156	5 06
8185	31 90
8202	1 65
8203	52 00
8206	97 00
8212	1 65
8214	1 54
8216	1 43
8224	1 93
8226	1 45
8228	2 92
8231	218 00
8237	35 20
8238	6 16
8243	2 86
8251	3 85
8253	4 22
8255	2 97
8257	5 00
8259	3 90
8271	84 00
8272	24 20
8273	49 50
8274	33 00
8275	34 00
8276	20 90
8282	2 15
8283	6 93
8284	7 70
8286	6 38
8287	6 38
8288	19 80
8289	68 20
8291	31 90
8292	27 50
8293 10	29 15
8741	45 10
8748	28 60
8749	53 90
8755	28 60
2911	27 50
2912	18 70
2920	99 00
3205 8205	7 37
3242	17 60
3245	10 45
3628	28 60
8008	59 40
8031 3	32 50
8035	5 72
8039	5 94
FD1771	13 75
FD1791	27 50
FD1793	28 60
FD1795	28 60
FD1797	31 90
WD1691	14 85
WD2143	12 10
WD1931	21 50
WD1933	31 90
WD1983	10 75
WD1993	59 00
WD2123	26 40
WD8250	16 50
TR1602	6 50
TR1863	5 80
BR1941	9 90

74F SERIES

74F00	51
74F02	46
74F04	51
74F08	50
74F10	47
74F11	45
74F20	46
74F32	60
74F64	49
74F74	57
74F86	72
74F109	1 04
74F138	1 21
74F139	1 04
74F151	1 05
74F153	95
74F157	95
74F158	77
74F175	1 60
74F181	3 10
74F182	1 56
74F189	4 05
74F190	3 30
74F191	2 42
74F194	77
74F241	2 30
74F243	2 40
74F244	2 40
74F251	1 21
74F253	90
74F257	88
74F258	1 21
74F350	1 98
74F352	1 26
74F353	1 21
74F373	2 00
74F374	1 00
74F399	1 00
74F521	2 97
74F533	2 86
74F534	77

MEMORY

2102	99
2112	6 30
2114	1 65
2708	5 80
2716	3 96
2732	5 80
2764	10 70
4116	1 65
4164	7 10
6116	7 10
58725	6 60
5101	3 30
2532	6 60

OPTO

4N25	66
4N26	60
4N28	50
4N32	60
4N33	79
4N35	59
MCT6	1 21
MCT2	65
FND357	95
FND500	95
FND507	99
FND800	2 85
TIL31A	2 15
TIL81	1 76
BPW50	1 76
COY89	55
MOC3020	1 76
MOC3021	2 15

LEDS

3mm RED	11
3mm YELLOW	16
3mm GREEN	14
5mm RED	10
5mm GREEN	15
5mm YELLOW	15
RED RECT	22
GREEN RECT	22
YELLOW RECT	22
RED CHROME BEZEL	72
YELLOW CHROME BEZEL	72
GREEN CHROME BEZEL	72

VOLTAGE REGS

7805UC	50
7805KC	1 26
7812UC	50
7812KC	1 26
7815UC	50
7815KC	1 32
7818UC	53
7818KC	1 32
7824UC	53
7824KC	1 43
7905UC	61
7905KC	1 32
7912UC	61
7912KC	1 32
7915UC	61
7915KC	1 43
7918UC	61
7924UC	1 43
78L05	32
78L12	32
78L15	32
79L05	99
79L12	55
79L15	55
LM309K	5 27
LM317T	88
LM317K	2 31
LM323K	6 05
LM337T	1 76
LM337K	5 50
LM338K	6 38
LM350T	3 66
LM350K	5 06
LM396K	15 40
78H05KC	5 49
78H12KC	7 15
78HGKC	7 20
78P05KC	9 90
79HGKC	13 20
78S40	1 82
MC1496L	93

SPECIAL FUNCTION

LM4250	1 98
NE5534N	1 37
NE5534AN	1 65
MC3340	1 54
76477	3 95
76488	6 55
8038	5 75
OM350	7 15
XR2206	4 73
XR2207	3 74
XR2208	2 80
XR2209	3 05
XR2211	5 15
XR2216	2 20
XR2240	2 09
XR2242	1 98
XR2243	2 20
XR8038	3 85
ICC7660	4 15
95H90	5 25
11C90	10 40
LM7555	1 32
MC10116L	99
LF13741	59
LF13741H	1 10
DS75451	39
DS75452	39
DS75491	52
DS75492	52
7216A	35 20
7216B	35 20
ADC0800	13 20
ADC0808	13 20
DAC0800	2 86
DAC0808	1 65
SAK140	86
4000	22
4001	22
4002	22
4006	66
4007	22
4008	61
4009	66
4010	53
4011	22
4012	24
4013	39
4014	77
4015	58
4016	39
4017	66
4018	72
4019	39
4020	55
4021	79
4022	58
4023	22
4024	43
4025	27
4026	99
4027	39
4028	73
4029	84
4030	42
4031	2 75
4033	1 65
4034	2 65
4035	77
4040	53
4041	88
4042	53
4043	68
4044	42
4046	88
4047	72
4048	50
4049	32
4050	39
4051	72
4052	88
4053	75
4055	1 98
4060	77
4063	99
4066	33
4068	26
4069	23
4070	22
4071	22
4072	22
4073	22
4075	22
4076	82
4077	26
4078	27
4081	22
4082	22
4085	1 06
4086	40
4089	1 87
4093	40
4094	66
4099	1 08
4104	1 98
4160	72
4161	88
4163	94
4174	66
4175	66
4194	66
4409	4 73
4410	8 58
4411	9 20
4415	5 28
4419	2 97
MC14433	9 30
4435	4 28
4443	2 50
4458	6 30
4469	12 60
4490	3 96
4495	1 65
4500	4 40
4501	28
4502	74
4503	52
4504	84
4507	29
4508	1 04
4510	72
4511	72
4512	62
4513	1 25
4514	1 70
4515	1 98
4516	73
4518	73
4519	60
4520	77
4521	1 62
4522	96
4526	78
4527	78
4528	75
4529	1 00
4530	88
4531	86
4532	1 05
4534	4 95
4536	3 50
4538	84
4539	53
4541	77
4543	73
4544	2 08
4549	3 52
4551	1 37
4553	2 53
4554	1 32
4555	50
4556	60
4558	1 05
4560	2 05
4562	3 79
4566	1 32
4568	2 20
4569	1 43
4572	46
4580	4 60
4581	2 30
4582	82
4583	94
4584	51
4585	73
4597	2 42
4599	3 30
45104	5 20
45106	6 36
45107	5 05

DIODES

1N4148	04
1N4001	05
1N4002	05
1N4004	06
1N4007	08
1N5408	17

74C SERIES

74C00	28
74C02	33
74C04	28
74C08	33
74C10	35
74C14	40
74C20	47
74C30	44
74C32	34
74C42	1 10
74C48	1 65
74C73	61
74C74	55
74C76	80
74C83	1 87
74C85	1 21
74C86	27
74C89	3 70
74C90	1 25
74C93	1 17
74C95	1 37
74C107	99
74C150	3 20
74C151	2 20
74C154	3 69
74C157	2 42
74C160	1 15
74C161	1 04
74C162	1 21
74C163	1 21
74C164	1 70
74C165	1 60
74C173	84
74C174	79
74C175	91
74C192	1 54
74C193	95
74C195	1 56
74C200	10 45
74C221	1 54
74C240	2 31
74C244	1 76
74C373	2 47
74C374	2 42
74C901	61
74C902	61
74C903	75
74C904	72
74C905	9 90
74C906	52
74C907	52
74C908	1 32
74C910	11 00
74C911	9 90
74C912	9 90
74C814	2 03
74C915	1 70
74C917	9 90
74C918	1 65
74C920	4 95
74C921	4 95
74C922	5 28
74C923	4 95
74C925	6 60
74C926	6 15
74C927	5 50
74C928	6 60
74C929	3 85
74C930	3 85
74C932	1 31
74C941	2 09
74C989	7 70

74LS SERIES

74LS00	20
74LS01	27
74LS02	20
74LS03	20
74LS04	22
74LS05	24
74LS08	20
74LS09	23
74LS10	20
74LS11	22
74LS12	21
74LS13	25
74LS14	28
74LS15	22
74LS20	22
74LS21	22
74LS22	23
74LS26	26
74LS27	22
74LS28	31
74LS30	22
74LS32	20
74LS33	29
74LS37	31
74LS38	24
74LS40	23
74LS42	39
74LS47	45
74LS48	42
74LS49	79
74LS51	22
74LS54	26
74LS55	26
74LS73	22
74LS74	26
74LS75	33
74LS76	35
74LS78	40
74LS83	40
74LS85	33
74LS86	23
74LS90	38
74LS92	45
74LS93	33
74LS95	40
74LS96	64
74LS107	35
74LS109	31
74LS112	31
74LS113	38
74LS114	38
74LS122	51
74LS123	40
74LS125	40
74LS126	40
74LS132	33
74LS136	28
74LS138	39
74LS139	42
74LS151	40
74LS152	60
74LS153	42
74LS154	66
74LS155	39
74LS156	42
74LS157	40
74LS158	37
74LS160	55
74LS161	46
74LS162	50
74LS163	50
74LS164	50
74LS165	58
74LS170	66
74LS173	50
74LS174	43
74LS175	39
74LS181	1 65
74LS190	83
74LS191	69
74LS192	50
74LS193	44
74LS194	55
74LS195	48
74LS196	66
74LS197	50
74LS221	55
74LS240	72
74LS241	72
74LS242	72
74LS243	55
74LS244	66
74LS245	54
74LS247	66
74LS248	44
74LS249	72
74LS251	50
74LS253	44
74LS257	44
74LS258	44
74LS259	60
74LS266	29
74LS273	77
74LS279	39
74LS283	44
75LS290	50
74LS293	40
74LS295	60
74LS298	50
74LS352	50
74LS353	53
74LS365	44
74LS366	44
74LS367	44
74LS368	44
74LS373	77
74LS374	77
74LS375	44
74LS377	72
74LS378	50
74LS386	40
74LS390	69
74LS393	55
74LS447	50
74LS629	2 42
74LS640	1 48
74LS670	99

CPU

6502	8 69
6502A	9 36
6507	8 25
6520	2 75
6522	7 70
6522A	9 90
6532	9 90
6545	18 15
6551	13 20
6800	4 10
6802	5 28
6808	3 60
6809	12 10
6810	2 75
6820	2 43
6821	2 42
6840	4 40
6845	9 90
6847	5 95
6850	2 20
6875	9 00
Z80CPU	4 60
Z80ACPU	4 95
Z80BCPU	13 20
Z80P10	4 10
Z80AP10	4 80
Z80CTC	4 40
Z80ACTC	4 80
Z80DMA	14 30
Z80ADMA	16 50
Z80AS10	16 50
Z80S10	14 30
AY 3 8910	8 85
MM5303	4 95
LH0002	7 70
LH0042CH	6 65
LH0070	13 20
LH0071	13 20
TL061	77
TL062	1 43
TL072	1 21
TL074	1 98
TL081	44
TL082	99
TL084	1 65
TA7205P	1 32
UAA170	4 10
UAA180	4 10
LM10CH	5 50
LM301	33
LM301H	94
LM305H	77
LM307CN	50
LM307H	99
LM308	50
LM308H	60
LM309K	1 32
LM310N	2 30
LM310H	2 75
LM311	39
LM311H	86
LM317T	88
LM317K	2 21
LM318	1 50
LM319	1 75
LM324	50
LM325	3 10
LM329DZ	66
LM3352	1 49
LM339	52
LM348	1 05
LM349	1 44
LM350K	6 05
LF351N	40
LF356N	1 05
LF357	95
LM358	55
LM377	2 40
LM378	2 95
LM379 S	3 75
LM380 8 pin	95

MAIL ORDER MAIL ORDER MAIL ORDER

MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER

ACTIVE ELECTRONICS

4 KING STREET SANDRINGHAM VICTORIA

PHONE (03) 67 1137

OUR COMPUTERISED INVENTORY SYSTEM AND LOW OVERHEAD ALLOWS US TO GIVE YOU FAST DELIVERY OF YOUR ORDERS AND LOWEST POSSIBLE PRICES.

* NOW YOU CAN BUY YOURSELF COMPONENTS AT PRICES WELL BELOW THE NORMAL RETAIL PRICES, SO SAVE YOURSELF MONEY. SEND YOUR ORDER TODAY.

POST AND PACKING CHARGES.

$5 TO $9.99 - $1.20 $10 TO $24.99 - $2.40 $25 TO $49.99 - $4.60 $50 TO $99.99 - $5.50

$100 UP - $6.50 UNLESS SHOWN OTHERWISE

ALL COMPONENTS ARE FULL SPEC BY LEADING MANUFACTURERS.

* PRICES CORRECT AT TIME OF PUBLICATION BUT SUBJECT TO CHANGE WITHOUT NOTICE;

BANKCARD VIA YOUR PHONE

MAIL ORDER ONLY
(NO SHOP SALES)

bankcard welcomehere

Bankcard Mail Orders Welcome

Please debit my Bankcard

Bankcard No. . . . . .

Expiry Date . . . . . .

Name . . . . . .

Signature . . . . . .

AE 3/83

LM380 14 pin	84	CA3086	44
LM381	2.20	CA3089	2.31
LM382	1.65	CA3130E	1.21
LM383	2.75	CA3130T	1.22
LM384	2.20	CA3140E	61
LM386	61	CA3140T	99
LM387	1.21	LM3401	77
LM390	2.14	LM3900	66
LM393	47	LM3905	1.21
LM394	3.24	LM3909	1.10
LM396K	14.14	LM3911	2.03
LF398	3.85	LM3914	4.29
NE555	29	LM3915	4.29
NE556	62	LM3916	4.29
NE558	1.66	RL4136	97
NE565	1.02		
NE566	1.58	SCR & TRIACS	
NE567	1.05	SC141D	99
NE571	1.92	SC146D	1.70
LM709 14	44		
UA710CN	50		
LM711	50		
LM723	47		
LM723CH	73		
LM725	5.9		
LM733	68		
UA739	85		
741	28		
UA747	59		
UA748	42		
MC1350	1.37		
MC1445	3.24		
MC1456	1.32		
MC1458	38		
MC1466L	11.00		
MC1488	55		
MC1489	55		
MC1494	6.60		
MC1495	6.05		
MC1496	93		
LM1596	1.87		
LM1830	2.75		
LM2917 8 pin	2.20		
LM2917 14 pin	2.20		
MN3001	15.40		
CA3028	1.70		
CA3059	3.30		
CA3080	90		

ALL PRICES INCLUDE SALES TAX

WE REGRET WE CANNOT SUPPLY TAX EXEMPT

ACTIVE ELECTRONICS

THE QUICK WAY TO LOW PRICES

MICRON 12

Green Phosphor Monitor
Features: 12" screen Front controls: on/off contrast/reverse brightness. Power: 240V 50Hz or 12V DC Input: RCA type DC Output Jack: 12V 1.1 Amp — power your Micro direct without a power pack Bandwidth: 10Hz to 20MHz the resultant definition is truly amazing for a low cost monitor

$185-00

C10 Data Cassette Tape $1.10
C20 Data Cassette Tape $1.20

Adjustable Azimuth DATA CASSETTE

At last a Data Cassette Recorder/Player you can afford. The Micron D 1120 is fully **adjustable azimuth** (absolutely essential in our opinion) and incorporates tailored audio frequency response audio stage together with low distortion.

Now you can save and load software in your Micro with confidence.

$45

MAIL ORDER MAIL ORDER MAIL ORDER

MAIL ORDER MAIL ORDER MAIL ORDER

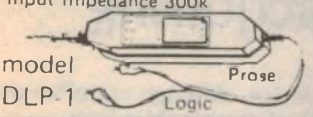
LOGIC PROBE

* Directly powered from circuit under test (5 V)
* Tested to 12.6 MHZ * DTL/TTL — CMOS Threshold selector
* Circuit loading 30 UA approx.
* High-Low — pulse or memory led indication. Impulse mode pulse length is extended to enable visual observation. In memory mode any detected level is continuously displayed until reset.

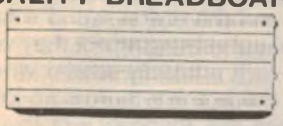
3800A **$26.50**

ACTIVE ELECTRONICS
4 KING STREET SANDRINGHAM VICTORIA
PHONE (03) 67 1137

Max Input 1.5 MHz **$11.50**
Strong Aluminium case
LEDs HI-LOW-PULSE
80cm leads
KEY to LEDs on back of probe
Input Impedance 300k



LOWEST PRICED TOP QUALITY BREADBOARD



2N 200 - 640 Holes

$9.50 each

INSTRUMENT CASE

19 INCH RACK BOX (483 mm W x 132 mm H). Get a professional finish like Namakichi and Technics with your projects.

$38.00 P/P $4.00

WELLER SOLDERING STATION

WITH FREE WIRE STRIPPER

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.

P/P $4.00

ONLY $69.75

CS-1560A II

$540 +$10 FREIGHT

130mm DUAL-TRACE TRIGGERED SWEEP OSCILLOSCOPE

15 MHz

● Bandwidth	DC – 15 MHz
● Sensitivity	10 mV/div
● Sweep Time	0.5 μs/div – 0.5 s/div

● 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 μsec/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: 8.4 kg

POWERFUL NEW 6000 RPM MINI DRILL FOR PC WORK

$11.95

Tons of Torque. Just the shot for PCB work. 12V DC operated from external power pack. 1.2mm chuck capacity. Supplied c/w 1mm drill bit.

DRILL BITS
$1.00 .8mm $1.00 1.0mm

SOLDERING IRON STAND UNIVERSAL TYPE

$5.50

SOLDER SUCKER

Quality de-solder tool with Teflon tip and nozzle sweeper.

$8.75ea

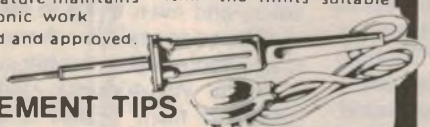
REPLACEMENT TIP **$1.25ea**

MICRON 30 WATT $9.50

* light-weight
* screw in interchangeable tips
* efficient thermal transfer from element to tip
* tip temperature maintains within the limits suitable for electronic work

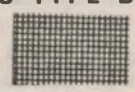
Comes fitted with Tip

S.E.C. tested and approved.



REPLACEMENT TIPS
Flat Tip .95 Conical Tip .95 Instrument Tip .95

VERO TYPE BOARD



H5614 90 x 80mm	$1.45
H5602 150 x 90mm	$3.00
H5116 310 x 100mm	$4.50

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.

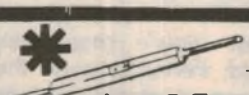
XENON FLASH TUBE

Trigger Transformer $2.20 $80

LIGHT DEPENDENT RESISTORS

69c

WIRE WRAP TOOL WSU-30



$8.85 Wrap-Strip-Unwrap

5" Drive Cases with power supplies

For 1 Drive $55.00
For 2 drives $79

P/P $5.00

REED SWITCH AND COIL

NOW THRASHED TO RIBBONS

SWITCH 40 c
COIL 80 c

COMPUTER COOLING FANS 4½"

$15.75

PUSH BUTTON SWITCHES

Ideal PCB mount PACK OF 4 **$2.10**

Momentery 2 pole Push-on Positive "click action" Great for alarm equip. intercoms, custom keyboards etc.

DISC DRIVES SPECIALS

MPIB51	$285	MPIB52	$395
MPIB91	$450	MPIB92	$550

* PHONE FOR BEST PRICES ON MITSUBISHI SLIM LINE DRIVES & POWER SUPPLIES

DIL PCB SWITCHES

4 Pole	$1.15
6 Pole	$1.60
8 Pole	$1.90
10 Pole	$3.20

MAIL ORDER MAIL ORDER MAIL ORDER

MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER

REVIEWS OF RECENT

Records & Tapes

CLASSICAL ● POPULAR ● SPECIAL INTEREST

ALPINE SYMPHONY: "Well worth acquiring"

STRAUSS, Richard — An Alpine Symphony. London Symphony Orchestra conducted by Andrew Davis. CBS Digital Masterwork Disc D37292.

Richard Strauss was immensely proud of his ability to score an orchestra to reproduce recognisably extra-musical sounds — a flock of sheep in Don Quixote is a good example. He even boasted of being able to reproduce a glass of beer in orchestral sound!

An Alpine Symphony gives him plenty of opportunities to exercise this talent. Strictly speaking, it is not a symphony at all but an extended tone poem full of realistic effects. It is in one movement divided into sections, all played without pause. As the name suggests, it describes the climbing and descent of a Bavarian Alp.

The score is marked liberally with descriptive phrases, each describing what Strauss had in mind as he progressed to the top. Here are some examples: Night, Sunrise, The Climb, A Walk Along The Brook and so on. All these are easy to recognise by tyros who read some brief notes on the back of the record sleeve. If there is some doubt about recognising "On The Glacier" there can certainly be none about "Thunder Storm", complete with wind machine!

There is much lovely Straussian sound, some of it reminiscent of earlier works — the Alpine is the last work of its kind Strauss wrote — all typical Strauss, with its melodies modulating into remote keys. The scoring, when not describing physical things, is sumptuous.

The work is long — just on an hour — and it has one aspect that I think spoils complete enjoyment of the piece. When you reach the top of a mountain what do you do? You look around at the view, perhaps do some sketching or make some scientific observations but, after having finished one or more of these chores, what remains to be done? Nothing but come down again.

And my beef is that Strauss seems to take the same path down as he took going up. So you have much of it again, but in reverse, so to speak. I must however admit that this is a perfectly permissible musical device, although not often used to the extent Strauss does here.

The work is beautifully played by the London Symphony conducted by Andrew Davis and the digital sound is first class. It is unique in bringing out the mass of detail in such a heavily scored work. By the way, the fact that there is no love music, despite the abundance of lovely tunes, could be taken to mean that Strauss did the climb alone!

Many devoted Straussians disparage the Alpine. Personally I think the disc well worth acquiring, especially if you admire the Strauss of up to the "Woman Without A Shadow" period. (J.R.)

JESSYE NORMAN: "Wonderfully effective"

WAGNER — The Wesendonck Lieder. The Liebestod from Tristan and Isolda. Jessye Norman (soprano) with the London Symphony Orchestra conducted by Colin Davis. Philips Analog Disc 9500 031.

If Elly Ameling charms one with her splendidly controlled, fresh-sounding voice, and even thrills in her fine climax in Asie, reviewed elsewhere, Jessye Norman's noble organ and her superb use of it in the Wesendonck Lieder and the Liebestod from Tristan is quite simply overwhelming.

It is difficult not to place her as the greatest female singer since Kirsten Flagstad. Perfectly, even throughout a wide range, she can reduce her voice to what amounts to a thrilling whisper or increase it to a hall-filling climax. And she can maintain passion at both ends of her dynamic range. The emotion she can generate in the barely audible last notes of "In The Hothouse" must be heard to be believed, no matter how many superlatives I use. And I have never heard "Dreams" sound so passion-filled since the afore mentioned Flagstad.

She unfailingly finds the exact mood for the other songs in this cycle, two of which Wagner used as studies for Tristan. Mathilde von Wesendonck was the wife of a man who rescued Wagner from poverty by lending him a house on part of his large estate and supplying him with money, as well. Wagner displayed his typical gratitude to this generous man by seducing his wife.

The second side starts with a moving account of the Tristan Prelude by the London Symphony under Colin Davis. This same combination supplies lustrous accompaniment to Ms Norman's lieder recital. It also acts in the same capacity in the Liebestod which concludes this great recital. She wisely goes straight from the last note of the Prelude to her solo without the usual moment's pause. This establishes a continuity that makes the two dissimilar excerpts sound like one

Reviews in this section are by Julian Russell (J.R.), Neville Williams (W.N.W.), Leo Simpson (L.D.S.), Norman Marks (N.J.M.), Greg Swain (G.S.), and Danny Hooper (D.H.).

piece. More singers should do it.

There are a few moments when Ms Norman seems to be recording too close to the mike so that one must listen a shade too carefully to hear the orchestra satisfactorily. I must stress, however, that she offends only slightly. The effect can fancifully be taken to mean that Davis himself was just as overwhelmed as the performance left me. In two short well separated places Ms Norman displays the tiniest exhibition of excitement in just the right spots. I have never heard this treatment before. It is wonderfully effective.

Her final diminuendo would be frankly unbelievable until you hear it no matter how much I praise it. The only niggling fault I could find with this production is that my pressing was a little prickly. But then I may just have been unlucky. Otherwise the sound was fine. (J.R.)

AMERLING: "Delightful"

RAVEL — Scheherazade. Song Cycle. Elly Amerling (soprano) with the San Francisco Symphony Orchestra conducted by Edo de Waart.

DEBUSSY — La Demoiselle Elue (The Blessed Damozel) Cantata. San Francisco Symphony Chorus and Symphony Orchestra conducted by Edo de Waart. Philips Digital Disc 6514 199

Here is another example of music that responds gratefully to complex scoring — a trifle too indulgently now and again, so that the vocal part is slightly obscured.

Ms Ameling faces impressive competition from other female singers in this suite right from the early days of LP when it was thrillingly performed by the Belgian soprano Susanne Danco.

I would have thought Ms Ameling's voice a little too light to deal successfully with the dark sensualities of Asie and still more surprised that she chose it as the first number of the suite. I prefer them in the order I first heard them — Flute Enchantee, Asie and l'Indifferent. In the order sung here they tend to lose tension and to dwindle towards the last.

However, Ms Ameling put me right about the suitability of her voice with her very first notes of Asie — deep, full toned and mysterious. She takes the early parts of the song a trifle slower than many of her competitors, making it, to me, rather more languorous. But she soon adopts a more orthodox tempo.

She is delightful in the freshness of her middle range in the middle reaches of this great song and achieves a grand climax in the "assassin" climax. Her voice is always steady, even under full pressure, and has enough pulse to give it warmth. She has an unshakeable sense of pitch. Altogether an excitingly disturbing exercise.

The San Francisco Orchestra plays admirably under de Waart, even is it does miss a little French delicacy in the woodwind.

The Enchanted Flute is a song that tests a singer's ability to handle successfully the dangers of a true French legato. Ms Ameling does so with complete ease.

She manages just as well the conversational style of l'Indifferent. This song has long been regarded as mysterious, because the sex of the beautiful passer-by is not made perfectly clear. The hopeful host is certainly male and to me the first line: "Your eyes are soft like those of a girl" clears up any doubt about the passer's-by-gender.

On the reverse side of Debussy's La Demoiselle Elue the San Franciscans again lack all the delicacy of the best French orchestras but play with commendable accuracy. Although an early work, Debussy is already beginning to acquire his own inimitable personal style. I always regard the work as a bridge between early and later compositions. The choir is splendid, without sibilence in the quiet bars and filling out a massive tone when necessary. De Waart conducts sympathetically but holds a firm hand over the discipline of the whole. (J.R.)

Music for Woodwinds

EROTICA. The Complete Music for Woodwinds by Jose Serebrier. The Australian Saxophone Quartet and The Australian Wind Virtuosi. Stereo, RCA VRL10404.

With an impressionistic cover design in predominantly red and yellow, and the title "Erotica", first glance at the album might suggest that the contents are something different from what they actually are. Even so, one has to work through the not very distinct type to extract the required information.

Although released through RCA, the recordings were made in the Sydney Studios of the Australian Broadcasting Commission in 1980 and 1981, presumably coinciding with the composer's second and third visits to this country. He personally conducts the title composition on the album "Erotica".

Jacket notes by Ron Wills trace Jose Serebrier's career from his birth and early training in Uruguay, leading to a scholarship which took him to the USA to study conducting under Dorati and Monteux and composing under Copland and Giannini. Subsequently he became associate conductor with Stokowski, and with Szell as composer-in-residence with the Cleveland orchestra. Since then, he has toured widely.

The music on this album mirrors Serebrier the emerging conductor. There are five tracks in all:

"Saxophone Quartet" (1955) a four part composition played by the Australian Saxophone Quartet. "Seis For Television" a four part suite adapted from music composed by Serebrier for three Shakespearean plays featured on American television. This is played by the Australian Wind Virtuosi, as are the compositions on side 2:

"Erotica" (1968) a 12 tone work featuring a wordless soprano voice. "Suite Canina" (1957) really the "Canine Suite", a whimsical tribute to his boyhood pet dog but reflecting the musical aspirations of a 17-year-old lad from Uruguay with ambitions to pursue a musical career in USA.

The final track is "O Pequena Musica" or "Little Music Suite" composed in 1955 but one that remains popular with woodwind groups.

It's obviously rather specialised music but different, with the compositions brief enough to serve as conversation pieces in situations where conversation about music flows easily. (W.N.W.)

BOLLING: "for baroqueniks"

BOLLING — Concerto for Classic Guitar and Jazz Piano. Claude Bolling (piano) and Alexandre Lagoya (guitar). CBS Analog Disc FM37264.

Although Bolling has reached middle age and spent most of his time busily, this is the first time I, who am considerably older, have come across him and his music. A virtuoso in the jazz piano style, he spends most of his time in his native France.

His object in life, at any rate nowadays, seems to be to combine in respectable marriage, jazz and classical form. In this work he is moderately successful. He calls it a concerto but its six shortish movements, mostly in dance form, are more in the style of a baroque suite, a la Bach, for instance.

The slow piano passages are sometimes very reminiscent of Gershwin and Bolling plays the piano part in the strict time of a dance pianist. Each of the two instruments have their own characteristic style but Bolling's piano has a sharpish tone which occasionally makes it difficult to separate from that of the guitar.

Lagoya is a well known classical guitar virtuoso and uses his instrument to good purpose throughout the concerto. The movement marked Rhapsodie is warmer melodically and harmonically than the other six which have a tendency, in their strict time and fast tempo, to sound a bit like a two-stroke motor.

The analog sound is always very clean. The bass and drums contribute only minor roles until the final movement when they are more active but always discreetly so. They add just that extra little bit of jazz colour. The work and its players should be fashionable with the younger generation, and, of course, baroqueniks. (J.R.)

BUSH FANTASY

THE MAGIC PUDDING by Norman Lindsay. Music by Louis McManus. Produced by the Marionette Theatre of Australia Ltd. Stereo, Cherry Pie L-25378. (Released through Festival.)

Just imagine a pudding — a pie — which had the unique ability to offer a variety of flavours to your fancy, and the ability to renew itself, despite the onslaught of many willing appetites. It would be a valuable acquisition, I guess, and a potential target for thieves.

Such, indeed, is Norman Lindsay's "Magic Pudding", the subject of this particular album. However, the characters contesting the fate of the personable pudding are an odd lot indeed: Bill Barnacle, Uncle Wattleberry, Possum, Rooster, Judge, Bunyip Bluegum, Hedgehog, Policeman, Sam Sawnoff,

Rumpus Bumpus and so on. On the album, their sixteen voices are provided by six actors.

If you don't have a basic interest in "The Magic Pudding", the album probably won't do much for you. On the other hand, if you have an educational involvement, an interest in the Marionette Theatre, or an interest in another side of artist Norman Lindsay, you may be glad to know about the release of the album.

Recorded only last year in the Trafalgar Studios, the sound quality and production is fine except for one thing: the narration is well down in level in comparison with the main dramatic segments and the musical bridges. A little more care would have made the album just that much better. (W.N.W.)

CHRISTIAN CIRCUS

GINGERBROOK FARE. A Circus Full of Fun and Learning. A Christian Musical with music arranged and produced by Fletch Wiley. Word stereo WSB-8885. [From Word Records Aust, 18-26 Canterbury Rd, Heathmont, Vic 3135. Phone (03) 729 3777.

You are excused if you don't know quite what to expect at first encounter with this album. The front cover design shows a carload of cartoon character kids in clown get-up with only the small endorsement "Word" to indicate, to those who know the brand, that it may have a Christian content.

Inside the triple-fold jacket is a full-scale full-colour comic, continuing the circus theme. Only later do you realise that this is probably intended to give you some idea of what's in the producer's mind as you listen, and if you should be inclined to obtain the music — hopefully via Word — to attempt your own production.

The lyrics, but not the narration, are given on the actual record sleeve and the theme turns out to be the goings-on in a school for clowns. The music is up-tempo and of a kind that has all the atmosphere of the big-top; but built into the words is a Gospel theme.

If you can gain access to the rights and the music, a small but capable group of musicians and some big kids who would enjoy playing little kids, this would be a fun highlight for a Christian musical presentation. The song titles:

Students — It's What In You Heart That Counts — A Heart So You Can Love — My Heart — My Best Friend — Laughing Song — Motives — Von Villain's Audition — His Love — Red Nose.

The sound quality on the album is excellent so, if you're at all interested, get yourself a copy. (W.N.W.)

CHRISTIAN HEROINE

JONI, SPIRIT WINGS. Word Stereo WSB-8878. [From Word Records Aust, 18-26 Canterbury Rd, Heathmont, Vic 3135. Phone (03) 729 3777.

If there was an Oscar for courage and strength of faith, this young lady would win without any trouble. Left a quadraplegic after a diving accident, she has fought back against both physical and emotional handicaps to be an inspiration to many. If you saw the film "Joni", released in Sydney a few years ago, you will remember how as a beautiful young woman, with the world at her feet, she was suddenly plunged into a world where she was utterly dependant on others for her very existence, being paralysed from the neck down.

After a period of bitterness and despair, even contemplating suicide, she regained her faith and found that through her many gifts of art and music, she could share the story of God's caring to a huge audience on TV and by personal appearances.

If her voice on this record does not seem to have the usual dynamic range, keep in mind, that with her physical condition, she has to depend on external pressure on her diaphragm in order to finish the phrases without running out of breath.

There are eight titles: Spirit Wings — Hosanna — The Only Thing I Want — Portrait Of Jesus — My Jesus, As Thou Wilt — Run That Race — When Pretty Things Get Broken — Take My Life — Heaven — He Careth For You.

Technically, the album is well up to Word's usual high standard. (N.J.M.)

MOUNTAIN RIDE

THE MAN FROM SNOWY RIVER. Original motion picture soundtrack. Composed, arranged and conducted by Bruce Rowland. Audiophile stereo, Festival LA-07773.

For the many who enjoyed the film "The Man From Snowy River", with Kirk Douglas and Jack Thompson, this soundtrack album may be welcome as a pleasant way to re-live the events portrayed.

Here's a run-down of the track titles: Main Title – Clancy's Theme – Henry Dies/Farewell to Frew – Harrison's Homestead/Jim Gets His Horse – Mountain Theme – The Brumbies – Jessica's Sonata – Tom Fool's Knot – Searching For Jessica – Jessica's Theme – The Chase – Rosemary Recalls – Jim's Ride – Jim Brings In The Brumbies – Closing Theme.

That adds up to 15 tracks and a variety of story episodes but the brevity of some of the tracks creates a certain jumpiness which militates against complete enjoyment of the album at a purely audio level. On the plus side, however, the music is melodic and well played and potentially agreeable listening for anyone present who may not have seen the film.

The recording itself has been well mastered using Festival's half-speed mastering facilities and the pressing is good. It comes to hand in a colourful double-fold jacket, although I imagine that most buyers would have preferred that some of the space had been devoted to a story synopsis and biographical notes. There would have been no shortage of subject matter and it would have added up to a more complete piece of memorabilia. (W.N.W.)

SKY IN CONCERT

SKY FIVE LIVE, Sky. Recorded live during Australian concerts. Arista L 60003/4. (Festival release).

Sky is a five-man group with four previous albums to its credit. This latest release is a two-record set titled "Sky Five Live", recorded live during their October/November, 1982, tour of Australia.

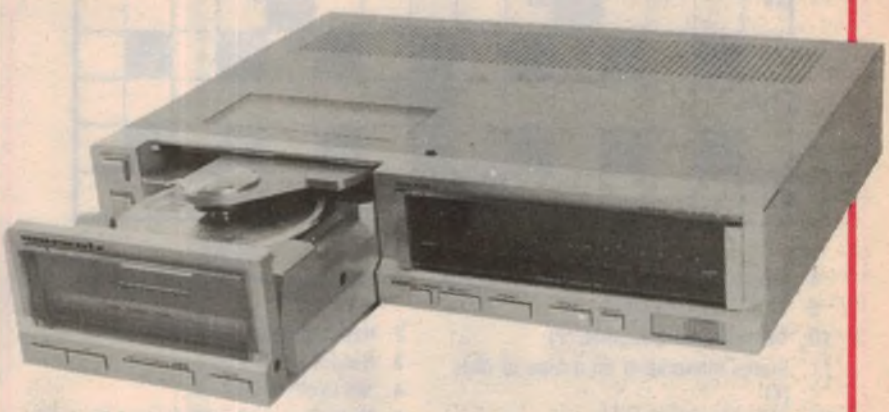
The five musicians who make up Sky are John Williams, Herbie Flowers, Steve Gray, Kevin Peek and Tristan Fry. John Williams is known as one of the best classical guitarists in the world, while the other four are talented session musicians who have worked with artists such as Frank Sinatra, Elton John, Paul McCartney and Olivia Newton-John, to name a few.

Sky Five Live contains a total of 12 tracks; all are essentially instrumental pieces, although one track does contain some vocals. The varied backgrounds of

COMPACT disc DIGITAL AUDIO

YOU COULD WIN

this magnificent new Marantz CD-73 Compact Disc player . . . valued at $999



from Marantz (Aust) Pty Ltd, 19 Chard Rd, Brookvale, NSW 2100

Phone (02) 939 1900

CONDITIONS AND WHAT TO DO . . .

CUT OUT this two-column panel with the crossword and clues on the back. Alternatively, in states where this requirement is illegal, make a clear, same-size photostat copy of the panel containing the crossword, clues and entry form and use this for your entry.

COMPLETE the crossword overleaf in clearly readable block letters. The correct solution will be as supplied by the designer of the crossword.

RETURN the panel, uncut, containing your solution, the clues and the completed entry form, so as to reach our editorial office not later than 5pm on June 30, 1983.

POSTAL ADDRESS: Endorse your envelope Marantz Competition and post to Electronics Australia, PO Box 163, Chippendale 2008. Our street address: 57 Regent St, Sydney (near Central Railway).

JUDGING will be supervised by Neville Williams, Editor-in-Chief of Electronics Australia. His decision will be final and no correspondence will be entered into.

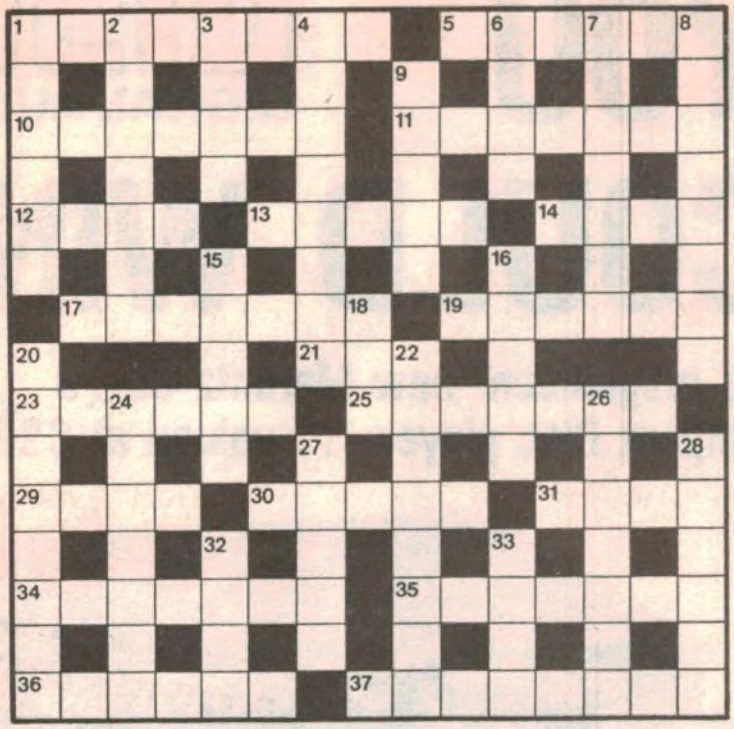
THE WINNER will be the first correct entry drawn at random from a suitable container. (Permit number TC 83/512.

THE PRIZE will be supplied to the winner, by arrangement, by Marantz (Aust) Pty Ltd, 19 Chard Rd, Brookvale, 2100.

EMPLOYEES, and their immediate families, of Magazine Promotions Pty Ltd, John Fairfax and Sons Ltd, or Marantz (Aust) Pty Ltd and their associated advertising agencies are not eligible to enter the competition.

See overleaf

Marantz competition crossword



ACROSS

1. Programmable electronic device. (8)
5. Type of counter. (6)
10. Movement of electrons. (7)
11. Stores information on a tape or disk. (7)
12. Magnetic element. (4)
13. Bidirectional triode thyristor. (5)
14. How electricity can make you turn nuts! (4)
17. Pertaining to discrete electronic pulses. (7)
19. A conducting cell in the body. (6)
21. Type of diode. (3)
23. Wire in mains supply. (6)
25. Slow charge. (7)
29. Vital component in a tape recorder. (4)
30. Term used for radar jamming material. (5)
31. Prefix meaning "all". (4)
34. Speakers in the back seat? (7)
35. Where would you find vast amounts of helium? (2,1,4)
36. Electronic message. (6)
37. Mercury-arc rectifying tube. (8)

DOWN

1. Characterised by recurrence of events. (6)
2. Radio pioneer. (7)
3. Second-hand. (4)
4. Not in circuit. (8)
6. Make a printed circuit board by using a corrosive chemical. (4)
7. Pseudo inductor used in equalisers. (7)
8. Type of circuit used in a tuner. (8)
9. Switch off the current. (5)
15. Soil filter made out of wire mesh. (5)
16. Place where devices are tested flat out! (5)
18. Replay in tennis. (3)
20. Electron emitters. (8)
22. Unwanted shifting of an electronic property. (8)
24. Picture fault in TV. (7)
26. Electronic device which sets a boundary value to a signal. (7)
27. Synchronised signals are said to be in? (5)
28. A millionth of a metre. (6)
32. Kind of charged particle. (4)
33. Type of antenna. (4)

ENTRY FORM Marantz/Electronics Australia contest

Please read carefully the conditions and instructions (previous page)

NAME .....

ADDRESS .....

..... POSTCODE .....

the respective musicians shows through clearly.

In places, the music comes very close to pop, particularly when the electric guitars and drums dominate. At other times, the guitar of John Williams gives the music quite a classical sound. The overall effect of this mixture of styles is quite pleasant, with no single style dominating for too long.

With such a mixture of styles on the album it would be an unusual person who could not find at least some tracks they like.

The inside of the dust jacket contains an amusing commentary by various band members on the tracks contained in the album. The commentary gives some insight into the ideas behind the music and also lists the instruments played by each member of the band.

Playing time is quoted as 96 minutes 11 seconds. The recording and pressing quality is excellent, with very little background noise. In fact, except for the applause at the end of each track, the recording could easily be mistaken for a carefully engineered studio production rather than a live performance.

If only more albums were produced to this standard! (J.S.)

★ ★ ★

FATS WALLER PIANO SOLOS Vol 2. RCA Victor VPL 17450

His untimely death at the early age of 39 in 1943 robbed the world of one of its greatest exponents of jazz piano and organ playing and it is to RCA's credit that they have been able to produce such excellent sound from masters dating back to 1929. Out of some 500 sides that Waller recorded, only 33 were piano solos, 19 of them being on this album.

Some of the titles are: Love Me Or Leave Me – My Feelings Are Hurt – After You've Gone – St Louis Blues – E Flat Blues – Stardust – Georgia On My Mind – Rockin' Chair – Ring Dem Bells. Seven of the tracks are Fats Waller's own compositions and even now, fifty years on, still have a freshness and spontaneity that makes for enjoyable listening.

Most of Fats Waller's recording output was with rhythm or vocal accompaniment, one of the best known being, "Aint Misbehaving". (N.J.M.)

SAVE $$$

System 80: MODEL II
Australia's most popular Home Computer

Over 10,000 owners cannot be wrong! They've chosen the System 80 over all others. Just look at the System 80's incredible advantages and you'll see why:

- **Inbuilt 12K Microsoft BASIC**
- **High bandwidth direct video output**
- **Screen print facility (obtains printout of any 'page' on the screen).**
- **Provision for full expansion to 48K of memory, to 4 floppy disk drives, printer and RS232 communications ports**
- **Full upper and lower case video display, PLUS 16 key numeric keypad PLUS 4 software defined special function keys!**
- **PLUS the worlds largest range of software available for just about every purpose: home, games, etc., etc.**

See how they Compare

FEATURE	System 80	Apple IIE	Commodore 64
Processor Used	Z-80	6510	6502A
Screen Display	16 x 64	25 x 40	24 x 40
Optional Display Format	Yes	No	Yes
Screen Print Routine	Yes	No	No
No. of Drives Per Controller	4	2	1
S-100 Expansion	Yes	No	No
Basic System Price	$550	$2050	$699

LOOKING FOR A GAMES COMPUTER?

VIC 20

A great little computer for the kids! When they're finished playing games, they can practise computing! Comes complete with 5K RAM, and a huge range of add-ons is available.

NOW ONLY $299
Cat X-2000

SPECIFICATIONS
- 5K RAM
- 8 Colours
- 3 sound channels
- Typewriter keyboard

The amazing Dick Smith Wizzard – the TV game that becomes a home computer – just by plugging in a low-cost computer cartridge! Why buy JUST a TV game when you can have the Dick Smith Wizzard: the best of both worlds!

ONLY $295
Cat Y-1600

- 17K RAM
- 16 colours
- 3 sound channels
- Splashproof keyboard.

E-X-P-A-N-D YOUR SYSTEM 80 AT LOW COST

Expansion Unit $425 — Gives disk control, printer port, extra 16K RAM plus provision for another 16K, S-100 & RS-232 interfaces. Cat X-4020

Disk Drives $495 — Dollars cheaper per byte! 315K per drive,already configured for drive 0 (Cat X-4060)or drive 1 Cat X-4061

Printers: — Low cost dot matrix printers from only $395, (Cat X-3250) quality word processor printers only $1650 Cat X-3265

Huge range of other peripherals available too!

DICK'S 7 DAY Money Back Satisfaction Guarantee

If you're not completely happy, you can return your purchase within 7 days in original condition and packing for full refund! You owe nothing – not even an explanation!
(SPECIALLY EXTENDED TO 14 DAYS FOR MAIL ORDERS)

DICK SMITH Electronics

See Page 98 For Full Address Details

A 502

DON'T PAY $400!

DICK SMITH INTRODUCES

the first direct modem to meet new Telecom regulations & at an incredibly low price!

The data communications revolution has now reached Australia. More and more personal computer users are communicating with other computers via the telephone network, to exchange data and programs with other personal computer users and to access the growing amount of valuable information in the big computer "data bases".
Until now, the only type of telephone modem available for use with personal computers has been the acoustic coupled type. These are expensive, and also depend heavily on the telephone's old-fashioned carbon microphone. As a result, even the best units of this type are often not capable of really reliable, trouble-free operation. But now, after months of development work and negotiation with Telecom Australia, Dick Smith Electronics presents the Dataphone — a telephone modem that really is suitable for personal computers. It's not an acoustic-coupled type, but a true high performance, direct connect model. And it's authorised by Telecom. Even more importantly, it will cost you less than half the price of a comparable acoustic modem!

- Operates at the standard data rate of 300 baud.
- Designed and manufactured in Australia.
- Standard RS 232C interface — so it can be used with almost any personal computer.
- Fully complies with both Telecom regulations and CCITT recommendation V.21 — hence it is not only legal, but also fully compatible with other modems. (Telecom Authorisation No. C82/37/557).
- Operates in either Answer or Originate mode, at the flick of a switch, for complete flexibility.
- Has a phone/modem switch, for convenient operation.

Comes complete with approved power supply and detailed user manual

IMPORTANT NOTE
If you build a modem of your own, you'll have to get your assembled modem tested and authorised by telecom before it can be legally connected to a line. The cost is over $300 – much more than the cost of our complete, tested and already authorised X-3272 modem.

OVER 1,600 SOLD!

the world's data at your command for $199!

designed and manufactured by

Cat. X-3272

DICK SMITH Electronics

CHECK AVAILABILITY WITH YOUR LOCAL STORE, SEE PAGE 98 FOR FULL ADDRESS DETAILS

A330/LM

50 & 25 YEARS AGO

"Electronics Australia" is one of the longest running technical publications in the world. We started as "Wireless Weekly" in August 1922 and became "Radio and Hobbies in Australia" in April 1939. The title was changed to "Radio, Television and Hobbies" in February 1955 and finally, to "Electronics Australia" in April 1965. Below we feature some items from past issues.

Wireless Weekly 3d

June 1933

The 1933 Standard Superhet: This circuit is the latest and the finest thing of its kind. Latest, because it is the furthermost projection of the natural trend of radio progress, which is toward a simplification and cheapening of design: a novice may assemble this set in an evening and it is cheaper than anything of equal power and performance anywhere in the world. We believe it is the finest, because we have never heard reproduction to equal it, or a set with such sensitivity.

(Editorial note: This was the first practical use of the new phase splitter circuit, described in the 5th May, 1933 issue, and referred to in our May 1983 history notes.)

☆ ☆ ☆

Australian valves: A notable feature of the newly established radio valve works of Amalgamated Wireless (A'sia), Ltd., at Ashfield is the application of gas for heating in the moulding and welding of glass in various shapes and positions. The plant installed by AWA Ltd, is the latest type used in overseas valve factories, where, in the course of years, experience has shown that the most suitable fuel is gas.

Accordingly, the engineers of the Australian Gas Light Company were called into consultation, and the AWA valve works now include 720 feet of piping ranging from 6in and 4in to ¾in in diameter to convey gas from the main in Parramatta Road to the point of application.

☆ ☆ ☆

Police radio: The New South Wales Police Department, not to be outdone by the Melbourne force, which is testing a wireless patrol of eight motor cycles, is making plans for the erection of a Police Broadcasting Station, and the equipping of all New South Wales police vehicles with receivers.

In America, the police have found it necessary to broadcast on short-waves, to keep their wave lengths secret, and to code their signals; otherwise too many interested persons hear them, or the bold, bad bandits jam their transmissions, or take down their instructions in shorthand, so they will know what places NOT to visit.

☆ ☆ ☆

Shades of TV: It was interesting to read of the successful venture of the English amateur station, G6QB, who installed a special 56MC or 5-metres' transmitter and receiver on top of the Crystal Palace Tower in London. Within visual range from the top of the tower are eight counties, and G6QB was successful in holding two-way communication over a range exceeding 100 miles – a really creditable performance.

RADIO TELEVISION AND HOBBIES

June 1958

First video recorder: The BBC has developed a completely new equipment for recording TV programs on tape. It is quite different from proposed American systems and marks a big step forward in technique. No photographic process is involved, and the signals recorded are those from the television camera itself. The information is established immediately and no processing of the tape is required. The recording can be reproduced immediately the tape has been rewound.

The machine employs half-inch magnetic tape and a reel (20½in diameter) will accommodate 15 minutes of program.

Continuous recording is possible by the use of two machines.

The tape speed employed in the present model is 200in/sec and the magnetic tape used may be a normal thin-base sound-recording tape of good quality.

☆ ☆ ☆

Birth of stereo: As the date for large-scale release of stereo records draws nearer, interest overseas is stepping up almost to fever heat in the record world.

The recent Audio Fair held in London saw desperate efforts by all interested manufacturers to show something allied to stereo.

In America, publicity is mounting in much the same way as it did when the LP record was first introduced. Articles are appearing in topical magazines, not primarily interested in such matters, explaining to all and sundry what stereo is and how it works. Most of these are authentic and quite extensive.

☆ ☆ ☆

BBC try UHF TV: On Monday, May 5, the BBC commenced a second series of high-power experimental television transmissions on UHF in Band V (610Mc/s-960Mc/s) from the Crystal Palace. The purpose of these experimental transmissions, as in the first series, is to test the suitability of this band of frequencies for television broadcasting.

The first series of tests, which ran from November 1957 to the end of March 1958, used the normal British 405-line television standards.

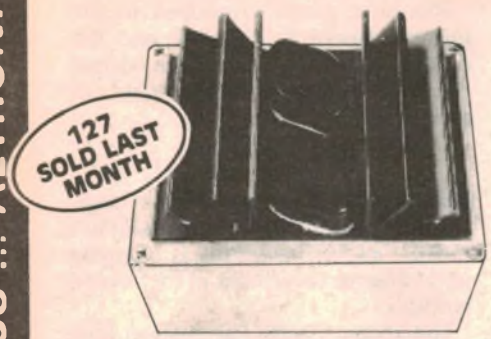
The second series of tests, which will continue for three months, will use the Western European standard of 625-lines and the results will be compared with those obtained in the recent 405-line tests. It is hoped that these further tests will throw some light on the problems which would be encountered if it were decided to use the 625-line standard for a television service in Bands IV and V.

☆ ☆ ☆

The transistor: This is a transistor year for Australia. The first transistor receivers are now on sale in the shops, and before 1959 appears there will be many more. Transistor production in this country has now begun, and soon there will be a number of firms engaged in this important new industry. Mounting production will eventually remove the biggest drawback of the present time – relatively high price. There is a great future ahead for this mighty little midget.

ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ...

TRANSISTOR ASSISTED IGNITION WITH DWELL EXTENSION



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

Yes, it's bad enough paying $2.00 a gallon for petrol without wasting a fortune on an out of tune engine. Fit this transistor assisted ignition kit in minutes and start saving money from the very next petrol stop. Easy to build!

K 4010 . . . . . **$35.00**

THE EVER POPULAR MUSICOLOUR IV EA PROJECT

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

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

ELECTRONIC FLUORO STARTER

(SEE EA OCT 1982)

Save a fortune on Flouro Tubes

- Extends the life of your flouro tubes by 1,000's of hours
- Instant "ON" — no more flickering at switch on

K6300 . . . . . **$4.95**

MICROCOMPUTER POWER SUPPLY

+ 5 Volts @ 3 Amps,
+ 12 Volts @ 2 Amps,
− 12 Volts @ 200 mA.

This universal computer power supply is based upon an EA design. (Our version is uprated).

+ 5 Volts for memory, CPU all Micro's.
+ 12 Volts for RS232 interfaces etc.
— 12 Volts handy for additional hardware using OP Amps.

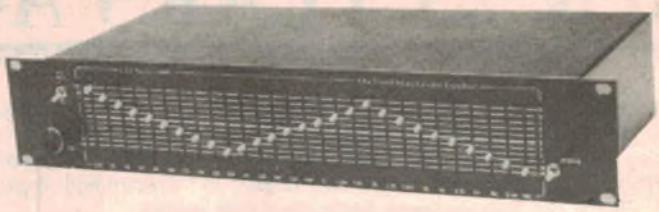
- Uses TO-3 Regulators + 5 V and + 12 V.
- Heavy Duty Fan Type Heatsink.
- Complete Boxed Kit with Delux Front Panel. **NOTE: This unit has enough grunt to power most small disk drives.**

K 3350. . . . . **$59.50**

THE INCREDIBLE SERIES 5000 FROM ETI

SERIES 5000 1/3 OCTAVE GRAPHIC EQUALIZER

Another brilliant DAVID TILBROOK no compromise design



SPECIFICATIONS:
Noise — at zero gain and 20 KHZ Bandwidth — 102 db. **Distortion** 1 KHZ — typically .007%. **Bandwidth** — 12HZ — 105 KHZ + 0 — 1 db. **Boost/Cut** + and — 14 db.

ALTRONICS EXCLUSIVES:
* All IC sockets provided * Quality series Racking Case supplied * Genuine Philips Sygnetics Low Noise 5534 IC op amps supplied * Specially imported high accuracy linear slide potentiometers employed for precision control adjustment. (**NOTE**: Not compromise "Null Centre" types that some suppliers offer.)

K 5025 . . . . . See ETI Magazine November 1982 . . . . . **$199.50**

STUDIO FORMAT ETI 5000 STEREO CONTROL PREAMPLIFIER

There have been countless accolades exclaiming this brilliant design by Australia's top audio design engineer David Tilbrook — and with good reason!

As a demonstration of our faith in this classic designed preamplifier we proudly release the **STUDIO FORMAT 5000 PREAMP** which includes some very worthwhile refinements as detailed here:—

* Gold plated RCA Jacks on all phono inputs * 1 x pair gold plated RCA Line Plugs, supplied * Military spec. National Semiconductor LM 394's employed * Low capacitance screened cable, supplied; IC sockets provided throughout; Multicoloured led display * Metal film 1% resistors used throughout all audio circuitry * Pretinned PCB's * Satin Black brush finished, aluminium control knobs

DELUXE STUDIO FORMAT 5000 PREAMP KIT Complete kit

Includes all ETI specified parts plus the Studio Format Package. Full instruction booklet included. SEE ETI MAG. JULY '81—OCT. '81 FOR FULL DETAILS.

K 5001 . . . . . **$275.00**

ETI 5000 STEREO MOSFET AMPLIFIER

See ETI magazine Jan. '81—April '81. New generation mosfet power semis facilitate David Tilbrook's classic power amplifier. Listening tests prove it surpasses even the best in conventional amplifiers in low fatique, high definition audio. Completely uncoloured crisp sound purity.

EVEN BETTER: This beautifully engineered amp design is based principally on two identical printed circuit boards with a minimum of other wiring, thus enabling even a relative "beginner" to accomplish building this project as long as the step by step instructions are followed.

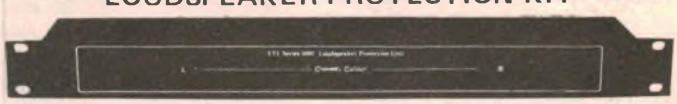
The ALTRONICS Kit includes the DELUXE FINISH FRONT PANEL HEATSINK

*** Original specified chassis bar design case * All metal work finished satin black * Flux shorting strap transformers used to minimise hum * Low leakage power supply electrolytics**

SPECIFICATIONS: **Power Output**: 100 watts into 8 ohms x 2. **Frequency Response**: 8 HZ - 20 KHZ + 0 db — .4 db. **Noise**: 116 db below full output. **Input sensitivity**: 1V RMS for 100 W output. **Distortion**: Less than .001% at 1 KHZ and full output. **Stability**: Unconditional stable.

COMPLETE MOSFET AMP KIT K 5005 . . . . . **$299.00**

LOUDSPEAKER PROTECTION KIT



Protect your valuable loudspeaker system with this easy to build, professional appearance kit. This easy to construct kit, based on the latest ETI design (Oct. '82), provides both DC and overpower protection for your valuable Hi-Fi speakers.

Self-powered unit disconnects the speakers within 1/10th of a second of a fault occuring yet in no way effects the sound quality.

The ALTRONICS Kit comes in a superb 1 unit rack box including quality silk screened front panel.

EXCLUSIVES: * LED Monitoring of channel cutout * Fujitsu 10 amp relays * ALTRONICS Kit, stereo unit complete to last nut bolt and washer * Input/Output speaker cable terminals supplied.

Install it in minutes — no AC or DC connections required — simply connects into the left and right channel speaker lines.

K 5050 Stereo Rack Version **$79.50**

BANKCARD JETSERVICE DELIVERY NEXT DAY BANKCARD JETSERVICE

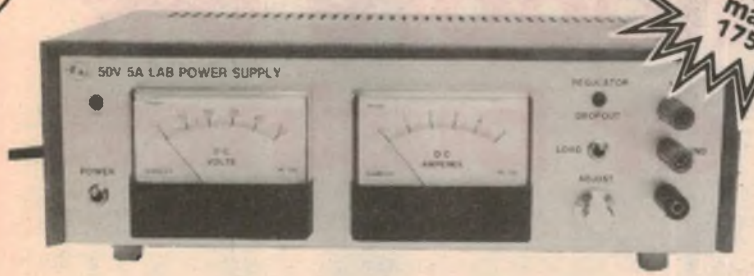
ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ...

KIT OF THE MONTH

EA's BRILLIANT LABORATORY POWER SUPPLY

See EA May and June 1983

2-50V DC at a massive 175W



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

Most Importantly it's dead easy to build (ours worked first time!!)

Specifications

Input 240V 50Hz

Output Variable 2 – 50V at up to 5 amps

Cat K3300 ..... $139.50

Why pay over $250 for an inferior commercial unit?

NEW

TOUCH LAMP DIMMER

HALF THE COST OF COMMERCIAL UNITS

Great new kit from EA. (April '83) Based on new Seimens IC S576A Light Dimmer IC.
Instantly turn lamps on and off with just a light touch on a wall panel, or provide mood lighting by touching the panel for a few seconds.
The Altronics Kit is complete in every way, including satin silver touch plates for that prestigous look.

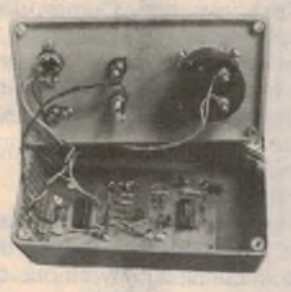
K6320 ..... $19.50

REMOTE CONTROL FOR K6320

This kit enables extra dimmer/switches to be installed in conjunction with the Dimmer Kit. Includes satin silver touch plate.

K6321 ..... ONLY $9.00

NEW



RADIOTELETYPE-COMPUTER DECODER

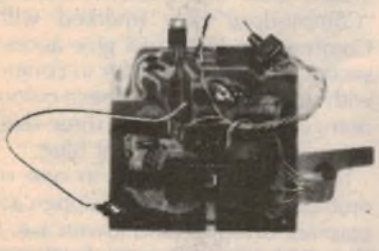
DESIGNED FOR THE MICROBEE

(SEE ETI APRIL '83)

Display RTTY encoded messages on your VIDEO Monitor.
Simple circuit uses PLL TECHNIQUES, most components mount on a single PLB simplifying construction. Complete Kit includes D15 Plug for connection to Microbee IN/OUT PORT.

K9733 ..... $19.50

'MICROBEE' EPROM PROGRAMMER



VERSATILE LOW COST & EASY TO BUILD
Great new project from ETI (Jan. 1983). All components mount on a single printed circuit board. Unit simply plugs into the Microbee 1 0 port. Suitable for 2716, 2732, 2532, 2732A and 2764's. Burn your games programmes and eliminate cassette loading times. ★ Zero insertion force IC socket for eproms ★ Sockets for all other IC ★ 1 x 2716 supplied — get started straight away. ★ Kit supplied in deluxe jiffy box, all mounting hardware included.

K9668 $48.50

VIDEO RF MODULATOR

(SEE ETI OCT. 1981)

If you cannot afford a Video Monitor for your computer this is the kit for you. Super stable oscillator design and very low modulation distortion ★ Works with both B & W and Colour TV sets ★ Suitable for computers, TV games, TV pattern generators or what have you. Deluxe kit featuring heavy duty diecast box for RF shielding ★ Input and output sockets.

K9760 $17.50

POWER UP

See EA November, 1982

A MUST FOR YOUR COMPUTER SYSTEM

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

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

Cat K6000 ..... $39.50

GO ANYWHERE 240V PWR. KITS

See EA May and June 82. These great new inverter kits enable you to power 240V appliances for your car, caravan or boat. (From Standard 12V car battery.)

40 WATT

Suits small appliances, i.e. turntable, tape deck, shaver etc. Variable frequency adjustment enables accurate speed control of turntable motors.

IC Sockets Provided

K6700 $55.00

300 WATT

Fully regulated and overload protected XTAL locked frequency.

★ ★ ★ ★ ★

NOW USING HIGH EFFICIENCY TRANSFORMER

★ ★ ★ ★ ★

Use to power hi-fi, TV sets and for emergency lighting.

- Gold plating on both PCB edge and edge connector.
- Low age rate parallel resonant XTAL used.
- Sockets for all IC's.

K6750 ..... $199.50

$10 DELIVERY ANYWHERE IN AUSTRALIA!

FOR DESPATCH P&P CHARGES and Altronics Address Details please refer to our advertisement on PAGE 85

BANKCARD JETSERVICE DELIVERY NEXT DAY BANKCARD JETSERVICE

The Commodore 64: for home or business

The Commodore 64 is Commodore Computer's new entry in the personal computer stakes. With an advertised 64K of memory, high resolution graphics in 16 colours, and extensive sound effects and music capabilities, the new machine has a lot to offer the beginner and experienced computer hobbyists.

by PETER VERNON

In appearance, the Commodore 64 is very similar to the VIC-20. It has the same 400 x 200 x 65mm plastic console, in beige rather than white, and the same layout of 62 keys and four programmable function keys. Connections for peripheral equipment are also very much the same, with the exception of an additional control port on the right hand side of the console so that two joysticks or a lightpen can be used.

The rear of the unit is entirely taken up by connectors for software cartridges, television output, serial port and expansion connector. It is here that one notable departure from the VIC-20 format is evident. The Commodore 64 has a built-in television modulator rather than the external black box that caused such problems with the VIC-20.

The internal modulator operates only on UHF channel 36, so if your television set does not have a UHF tuner, hard luck. On our lab TV set the picture was clear and steady, although exhibiting slight colour aberrations depending on the combination of background and text colours in use.

A separate 5-pin DIN connector provides outputs for a composite video signal for a colour monitor, and a separate audio channel. As the users' manual puts it; "Since the Commodore 64 furnishes a channel of high fidelity sound, you may wish to play it through a quality amplifier to realise the best sound possible".

Power for the computer is derived from a separate mains adapter, no doubt simplifying the manufacturing problems posed by varying international standards. The power supply does not have its own power switch and should be switched off at the mains when not in use. The power switch for the computer is a small rocker switch on the right side of the console and a red LED on top of the console indicates that the unit is on.

The Commodore 64 keyboard provides 62 alphanumeric keys and four programmable functions. Upper and lowercase and two set of graphics symbols are available.

Text display

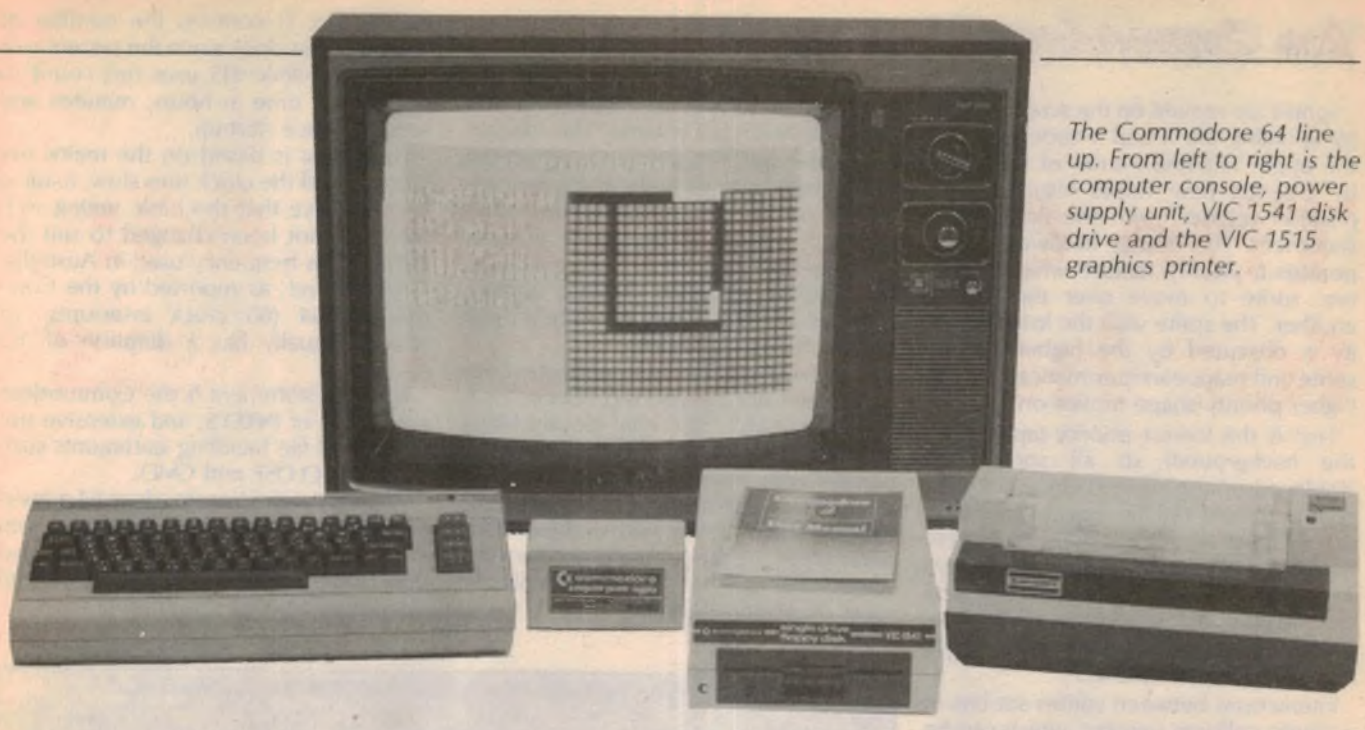
Text on the Commodore 64 is displayed in a 40-column by 25-line format on a "background" screen surrounded by a coloured border. On first switching on the border and text is a light blue with the background screen medium blue – a little lacking in contrast.

The text colour can be changed from the keyboard by pressing the Control key in conjunction with one of the eight numeric keys which carry the colour names black, white, red, cyan, purple, green, blue and yellow. Pressing the "Commodore" key (marked with the Commodore logo) will give access to a second set of text colours in conjunction with the numeric keys. These colours are orange, brown, light red, three shades of grey, light green and light blue.

Text can be displayed in one of two modes, combining either uppercase and graphics or upper and lowercase. In the first mode, typing on the keyboard produces uppercase letters but pressing a key in conjunction with Shift produces the graphic symbol marked on the righthand front of the key. This is the mode entered when the computer is first switched on.

The second mode is activated by pressing the Shift key and the Commodore key. In this mode the keyboard produces lowercase letters, with Shift activating uppercase in normal typewriter fashion. In this mode, the graphics symbols marked on the lefthand front of each key can be printed by pressing the Commodore key in conjunction with the key showing the required graphics character.

These two text display modes actually use two different character generators, so both cannot be used together from the keyboard. Changing from one mode



The Commodore 64 line up. From left to right is the computer console, power supply unit, VIC 1541 disk drive and the VIC 1515 graphics printer.

to the other affects the entire screen, not just those characters entered after the change is made.

Two other numeric keys carry the labels RVS ON and RVS OFF. Pressing Control and RVS ON activates an inverse mode which swaps the colours of the foreground and background. A space, for instance, becomes a solid block of colour in this mode while other characters are displayed in the current background colour on a block of the current foreground colour. The reverse colour mode remains in effect until the Return key is pressed or until disabled by a Control/RVS OFF key combination.

The colours of the screen background, text and border can also be changed by POKEing particular colour code values to specific locations in memory as explained in the users' manual.

Cursor control keys are provided with automatic repeat so moving the cursor on the screen for editing programs is easy. The cursor movement controls can also be used from within a program with a PRINT statement. Pressing a cursor control key after opening quotation marks will not produce cursor movement but will display the control code as an inverse video graphic symbol. By PRINTing sequences of cursor control characters the cursor can be moved around the screen to duplicate the function of the Microsoft PRINT@ statement.

Clearing the screen from a program is done by PRINTing a CLR/HOME character between quote marks. When this key is pressed after opening quote marks a heart symbol is displayed in inverse video. When the PRINT statement is executed the screen will be cleared and the cursor returned to the upper left corner of the display.

A feature of the Commodore 64 is its "full screen" editing. A program can be listed and various lines changed by moving the cursor to the desired point and re-typing. On pressing Return the alterations are incorporated in the program. Line numbers can be changed in this way, producing a copy of the old line with the new number (very handy when entering long programs which consist of lines with little variation, as in many graphics routines).

Sprites and graphics

The newest concept in graphics for home computers are "sprites", blocks of definable graphics which are handled in a special way by the graphics display hardware. The Commodore 64 provides eight sprites, each defined on a 24 x 21 pixel grid and displayed in a bit-mapped graphics mode which offers a display of 320 x 200 pixels.

The definition of each sprite is stored in a 63 byte table in memory, with a pointer to the definition block maintained in a register in the video display chip. The shape of a sprite can thus be changed almost instantaneously by altering this pointer to select a new definition block.

Two other locations in each sprite register enable sprites to be expanded by a factor of two in either (or both of) the horizontal or vertical dimensions.

Commodore 64 Specifications

Processor ..... 6510 (equivalent to the 6502)
RAM ..... 64K, 38911 bytes usable from Basic
Keyboard ..... Full size typewriter style, 62 keys plus 4 programmable function keys
Display ..... UHF channel 36 or colour video monitor, 16 colours, 40 x 25 lines text display, 320 x 200 graphics resolution, eight sprites.
Sound and music ..... Three voices, each with a 9 octave range, selectable waveforms, volume and ADSR parameters
Interfaces ..... Serial port for cassette interface, cartridge connector, two games connector ports, expansion port, direct video and audio connections, cassette recorder, plus optional cartridges.
Peripherals ..... Plug in program cartridges, disk drive, dot matrix printer, other peripherals require specialised interface cartridges.
Documentation ..... Users' manual — good for beginners, but lacking details of advanced capabilities. "Programmers Reference Guide" is available separately.

Sprites are moved on the screen simply by updating the X and Y-coordinates of the upper lefthand corner of the block by entering new values into a "sprite position register" with the Basic POKE statement. The display hardware incorporates a priority feature which allows one sprite to move over the top of another. The sprite with the lowest priority is obscured by the higher priority sprite and reappears automatically as the higher priority shape moves on.

Text is the lowest priority (apart from the background) so all sprites are displayed on top of text. Once enabled, sprites remain on the screen until they are disabled, again by a POKE to a sprite register. Two sprite display modes are available, one which produces single colour images and the other which produces multi-colour images, with up to three colours per sprite.

Interactions between sprites set bits in a "sprite collision register" which can be accessed with a PEEK statement to determine contacts between sprites or between sprites and a background object — a convenient feature when writing games programs, for example.

In addition to sprites the Commodore 64 allows the programmer to shift the entire character set memory into RAM and redefine any character, again either in single or multi-colour modes. With an extended character set definition high resolution graphics can be displayed on a 320 x 200 pixel grid, and freely mixed with text.

Commodore's approach to graphics, sound and other special features of their computer appears to be to provide a standard Basic interpreter, with special features activated by POKE statements referring to particular memory locations. Unlike Microsoft Basic there are no special graphics or sound statements. The Basic of the Commodore 64 in fact is exactly the same as that of the VIC-20 and the Commodore PET computers.

Sound effects and music

The Commodore 64 provides three voice sound with a nine octave range. Volume, waveform, attack/decay, and sustain and release parameters can be specified by entering certain codes into memory. Notes are specified in two entries as high and low settings because there are more frequencies available than the 255 which can be specified in a single byte.

Duration of each note is set by a delay loop within the program, with each note turned on and then turned off after the required delay.

The waveforms available are triangle, sawtooth, square wave and noise. "Attack" refers to the time taken for the sound to reach full volume. The "decay" parameter specifies the rate at which the sound falls from its highest volume setting to zero or the sustain volume. The "sustain" setting, as the name implies, specifies how long the sound remains at full volume, while the "release" setting specifies a rate at which the note returns to zero following sustain.

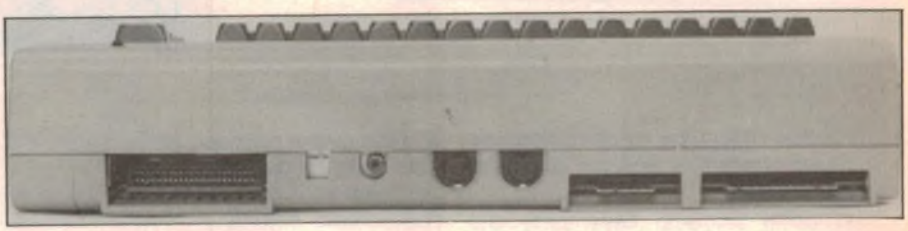
Each voice can be independently controlled and since sound is produced by a dedicated 6581 "SID" chip (Sound Interface Device) processing can continue in parallel with sound effects. A multitude of effects can be produced by mixing the various voices, each with independent parameters. Echoes, vibrato and varying waveforms can be set up to duplicate most musical instruments.

two is that TI contains the number of counts of the clock since the system was turned on while TI$ uses this count to display the time in hours, minutes and seconds since start-up.

This count is based on the mains frequency, and the clock runs slow, leading us to believe that the basic timing software has not been changed to suit the 50Hz mains frequency used in Australia. One "second" as reported by the Commodore 64 (60 clock interrupts, or "ticks") actually has a duration of 1.2 seconds.

The GET statement is the Commodore equivalent of INKEY$, and extensive use is made of file handling statements such as OPEN, CLOSE and CMD.

What gives the Commodore 64 a great deal of its versatility is its interrupt driven Input/Output structure and the serial data communications bus used with all peripheral devices.



Rear view of the Commodore 64 console shows the cartridge slot on the left, modulated RF output, DIN connector for direct video and audio, serial port and VIA and expansion connectors.

Commodore Basic

The Basic used by the Commodore 64 (and the VIC-20) is very similar to the Microsoft version. String handling is identical and mathematical and logical operators are standard. Arithmetic is to ten digit precision, with scientific notation covering values from 2.93×10^{-39} to 1.701×10^{38}. Basic statements and functions are shown in Table 1.

Most Basic keywords can be entered in an abbreviated form by typing the first letter of the keyword, then Shift and the second letter of the instruction. This procedure will produce a graphics symbol on the screen but when listed the program will show the full form of each keyword.

The statements TI and TI$ are actually system defined variables which contain the current count of the Commodore 64's clock. The difference between the

The single serial port at the rear of the Commodore 64 console is used to connect a "Datasette" recorder or a disk drive, with the VIC-1515 graphics printer "daisy-chained" to the disk drive unit. All peripherals are treated as "logical files", and output from the computer is handled in the same way by the printer, disk drive or cassette recorder, allowing very sophisticated storage and manipulation of data from within a program.

Once a communication channel has been set up with the OPEN statement for instance, the statement CMD will transfer output from the screen to the device specified. From that point all PRINT and LIST commands will send data to the peripheral device. The commands for printing a listing for example, are:

```
OPEN 3,4
CMD3
LIST
```

Commodore 64 Basic statements and functions

ABS, AND, ASC, ATN, CHR$, CLOSE, CLR, CMD, CONT, DATA, DEF, DIM, END, EXP, FOR . . . NEXT, FRE, GET, GET#, GOSUB, GOTO, INPUT, INPUT#, LEFT$, LIST, LOAD, MID$, NOT, OPEN, PEEK, POKE, PRINT, PRINT#, READ, RESTORE, RETURN, RIGHT$, RND, RUN, SAVE, SGN, SIN, SPC, SQR, STEP, STOP, STR$, SYS, TAB, THEN, USR, VAL, VERIFY, WAIT

GREAT NEW BOOKS

FROM JAYCAR THE ELECTRONIC BOOK SPECIALIST.....

COMPUTERS

CP/M PRIMER

If you are a first-time microcomputer user wanting to increase your technical knowledge or a veteran who wants to explore switching to the CP/M operating system, this book can help you find the answers. It's the only complete one-stop source available on CP/M — the very popular operating system for 8080, 8085 and Z80 based micro computers. Includes a complete list of CP/M compatible software, too! 96 pages, 8½ x 11, soft.
Cat. BS0564 $24.95

ONLY $24.95

THE S-100 AND OTHER MICRO BUSES

2nd EDITION
The key to successful computer system expansion is a complete understanding of the bus system through which the computer communicates with peripherals. This book provides you that key, a general discussion of bus systems and an examination of each of the 21 most popular buses. Additional information is given which will help you interface one type of bus to another. 208 pages, 5½ x 8½, soft.
Cat. BS0566 $15.95

GREAT VALUE $15.95

APPLE INTERFACING

Apple interfacing helps you to understand the important task of successfully interfacing your Apple computer to a variety of electronic devices. Using this book, you will be able to perform useful experiments which will provide a much clearer understanding of the fundamentals of computer interfacing and computer electronics. You will be better able to understand interactions between computer hardware and software so that you can effectively communicate with your Apple computer. 208 pages, 5½ x 8½, soft.
Cat. BS0568 $15.95

A BARGAIN AT $15.95

EXPERIMENTS IN ARTIFICIAL INTELLIGENCE FOR SMALL COMPUTERS

Conducts interesting and exciting experiments in artificial intelligence with this book, a small computer with extended BASIC, and some knowledge of the BASIC language. The author first introduces you to artificial intelligence — the capability of a device to perform functions normally associated with human intelligence, such as game playing, problem solving, reasoning, creativity, and verbal communications. Then game playing programs, with a checkers-playing game as the main topic are explained. 112 pages, 5½ x 8½, soft.
Cat. BS0512 $12.95

ONLY $12.95

TRS-80 INTERFACING BOOK 1

Written for users who have a fairly good understanding of Level II BASIC. Author John Titus introduces you to the various I/O signals used by the TRS-80 and explains how these signals can be used in a number of interesting and practical circuits. Numerous hands-on experiments are included. 192 pages, 5½ x 8½, soft.
Cat. BS0572 $15.95

BOOK 1 $15.95

TRS-80 INTERFACING BOOK 2

Provides you with a number of practical and useful ways to utilize your knowledge from Book 1. Applications include how to generate voltage and current signals used in a variety of control applications, how to measure unknown voltages, how to drive high current and high voltage loads, and many more. Complete software programs are included. 256 pages 5½ x 8½, soft.
Cat. BS0574 $16.95

BOOK 2 $16.95

COMPUTERS

PET INTERFACING

Demonstrates how you can build numerous interfacing devices for your PET hardware. BASIC language programs are used throughout the book, so you should be familiar with this powerful programming language. The Commodore PET microcomputer has several special purpose interface connectors that ease the job of interfacing the computer to "real-world" hardware. Also includes a discussion of the microprocessor's internal architecture and general software/hardware interfacing. 264 pages, 5½ x 8½, soft.
Cat. BS0576 $25.95

INTERFACE FOR $25.95

PROGRAMMING AND INTERFACING THE 6502 WITH EXPERIMENTS

Excellent starting point for 6502 based microcomputer novices and veterans alike who may not have much assembly language and programming or chip level interfacing experience. Includes experiments and examples of simple I/O techniques, instructions, and chip level interfacing that can be reinforced with a low cost KIM, SYM, or AIM system. Helps you understand all 6502 based computer systems. 416 pages, 5½ x 8½, soft.
Cat. BS0580 $25.95
Also available: 6502 SOFTWARE DESIGN
Cat. BS0578 $17.95

We have dozens of other books — Call in and browse

16–BIT MICROPROCESSORS

Carefully steps you through the complex processes of programming and designing with the new and powerful 16 bit microprocessors. The major advantages and disadvantages of these state-of-the-art devices are discussed and numerous benchmarks are provided to help you in your comparison of the chips. The book begins with a simple, straightforward review of the basics of microprocessor design and construction, and then takes an in depth look at each of the most popular 16 bit microprocessors on the market today, including the 68000, 8086, Z8001/2, 9900 and NS16000. 352 pages, 5½ x 8½, soft.
Cat. BS0588 $24.95

16–BITS FOR $24.95

USING THE 6800 MICROPROCESSOR

No special background in digital electronics is needed to use this book which steps you through the conception, configuration, writing, and running of a variety of programs that demonstrate the practical application of the powerful 6800 microprocessor. The unit's straightforward internal architecture, efficient instruction set, and sophisticated support circuits are covered. 176 pages, 5½ x 8½, soft.
Cat. BS0584 $14.95

GREAT VALUE $14.95

COMPUTERS

8085A COOKBOOK

A design-it-yourself guide to developing a number of completely operational, low cost microcomputers around the 8085A microprocessor. Includes a discussion of all support hardware and 8085A family compatible chips. A tremendous amount of software is already available for use on these systems. Almost anyone can learn to design an 8085A based microcomputer with the 8085A Cookbook. 352 pages, 5½ x 8½, soft.
Cat. BS0582 $24.95

ONLY $24.95

Z-80 MICROCOMPUTER HANDBOOK

Designed to acquaint you with the hardware of the Z-80 and to discuss the impressive software aspects of this "computer on a chip". A number of chapters are devoted to the use of machine and assembly language. Also included is a discussion of many different microcomputers built around the Z-80, including the popular TRS-80. 304 pages, 5½ x 8½, soft.
Cat. BS0594 $16.95
Also available: Z-80 MICROCOMPUTER DESIGN PROJECTS. 208 pages.
Cat. BS0596 $23.95

GENERAL

SON OF CHEAP VIDEO

This sequel to The Cheap Video Cookbook provides a complete video display system which you can build for as little as $7. Likewise, transparency display can be created for under $1 by using a video circuit called "The Snuffler" which is completely described in chapter 2. This book makes cheap video even cheaper. 224 pages, 5½ x 8½, soft.
Cat. BS0604 $15.95

CHEAP AT ONLY $15.95

THE CHEAP VIDEO COOKBOOK

Complete discussion of a new, low cost way to get words, pictures, and opcode out of your computer and onto any ordinary TV set. Don Lancaster outlines an easy-to-build seven IC circuit which you can build for less than $20. This circuit can be software-controlled to provide any alphanumeric or graphics format including high resolution (256 x 256) and a four colour mode. 256 pages, 5½ x 8½, soft.
Cat. BS0510 $11.95

A practical, easy-to-read discussion of the many types and uses of active filters. Learn how to construct filters of all types including high-pass, low-pass, and band-pass having Bessel, Chabyshev or Butterworth response characteristics. Easy to understand — no advanced math or obscure theory is used. Active Filter Cookbook can be used as an introduction to active filter circuits or as a reference book for analysis and synthesis techniques for active filter specialists. 240 pages, 5½ x 8½, soft.
Cat. BS0518 $21.00

REGULATED POWER SUPPLIES

(3rd Edition)
The newest, most comprehensive discussion of internal architecture and operation of the latest solid state regulators. Thoroughly explains when regulated supplies are needed and how to incorporate them into your design projects. Discusses modern, practical circuitry including linear and switching circuits and late ICs. A valuable asset for any technician or egineer involved in servicing or design. 424 pages, 5½ x 8½, soft.
Cat. BS0526 $27.95

GREAT VALUE $27.95

RF CIRCUIT DESIGN

A user-oriented text with a practical approach to the design of RF amplifiers, impedance matching networks, and filters. Can be used in cookbook fashion as a catalogue of useful circuits with component values. Utilizes a minimum of complex math. A valuable bridge between the classroom and "real world" application, and an excellent reference manual. 352 pages, 5½ x 8½, soft.
Cat. BS0530 $27.95

DESIGN OF PHASE-LOCKED LOOP CIRCUITS WITH EXPERIMENTS

An excellent introduction to the theory, design and implementation of phase-locked loop circuits using various TTL and CMOS devices. Useful self-study course for the experimenter and for inclusion in college courses on control systems or linear ICs. Includes manufacturers' data sheets and describes the use of breadboarding aids in the wide range of laboratory type experiments. 256 pages 5½ x 8½, soft.
Cat. BS0534 $15.95

VALUE AT $15.95

ELECTRONIC MUSIC CIRCUITS

Written for computer and electronics hobbyists with an interest in music, as well as musicians and studio engineers. The author describes how to build a custom electronic music synthesiser, outlines numerous other circuit designs and then shows you how to modify them to achieve particular responses. Many of the circuits can be used as special effects boxes for guitars and other musical instruments. Approximately 288 pages, 5½ x 8½, soft.
Cat. BS0528 $25.95

OTHER BOOKS

Cat No.	Description/Title	Pages	Price
BS0516	Solar cells & photo cells	96	$8.95
BS0518	CMOS cookbook	416	$18.95
BS0520	IC OP amp cookbook	480	$22.95
BS0522	555 timer sourcebook	160	$10.95
BS0524	Design of OP amp ccts/exp.	224	$15.95
BS0532	Design of active filters/w exp.	240	$15.95
BS0538	How to read electronic cct dia.	192	$10.95
BS0540	Modern dictionary of electronics	832	$29.95
BS0542	TV ant & signal dist. systems	256	$13.95
BS0546	Modern recording techniques	388	$18.95
BS0548	73 dipole & longwire antennas	160	$10.95
BS0550	Handbook elect. tables/formulas	288	$17.95
BS0556	IC timer cookbook	288	$15.95
BS0558	Digital counter handbook	264	$15.95
BS0560	Cable TV	392	$21.00
BS0562	Sound system engineering	296	$29.95
BS0578	6502 software design	272	$17.95
BS0582	How to prog./interface 6800	416	$24.95
BS0586	68000: principles & programing	240	$24.95
BS0590	8080/8085 software design	336	$17.95
BS0596	Z-80 micro. design projects	208	$23.95
BS0598	Microcomputer analogue conv. software/hardware interfacing	200	$16.95
BS0600	Mostly basic: app. for Apple II	180	$17.95
BS0602	Micros for busness applications	256	$15.95
BS0606	Audio IC OP amp applications	208	$14.95
BS0608	Interfacing & scientific data communication experiments	160	$11.95
BS0614	Electronic telephone projects	168	$10.95

Jaycar

SEE OUR OTHER ADS IN THIS MAGAZINE FOR STORE ADDRESSES AND PHONE NUMBERS.....

At the conclusion of the listing the printer must be de-activated (called "unlistening" by Commodore) and the printer file closed with;
PRINT#3 (a blank line)
CLOSE3

Similarly, to record data in a disk file the commands would be;
OPEN 2,8
CMD2
PRINT#3 (list of data items)
The disk must also be "unlistened" and the I/O file CLOSEd in the same way as a printer file.

Input can be handled in the same way by use of the GET# statement, allowing cassette or disk data files to be used by a program in exactly the same way the keyboard is normally used.

Although Commodore make a big point of the 64K memory of the computer, there are actually just 38,911 bytes available for Basic programs and data. The remainder is taken up by video memory, character generator memory and memory mapped-sound and display controllers.

One criticism of the Commodore 64 is that there is no Reset switch. Pressing RUN/STOP and RESTORE will re-initialise pointers to the character set definitions etc but it will not return control to Basic if the microprocessor is in an endless loop. With so many locations in memory dealt with directly by POKE statements it is easy to make a mistake that may be fatal to a program, and the absence of a Reset switch is annoying at these times.

Peripherals and expansion

As with the VIC-20 only Commodore peripherals can be used with the Commodore 64 unless the user builds or buys special-purpose interfaces. The 30 character per second VIC 1515 graphics printer can be used for listings, text or high resolution dot graphics, and can reproduce the full graphics character set of the computer without any special preparation or commands.

The "Datasette" recorder is a standard cassette mechanism adapted by Commodore for digital recording and communication on the serial I/O bus of the system. The same recorder in a slightly different package is used by the VIC-20.

The recorder can be programmed to accept data files and read back data in a number of ways, and provision has been made for motor control, an advantage of the system. During cassette operations there are display messages such as "PRESS PLAY ON THE RECORDER" and the Commodore 64 can read the status of the Datasette's controls before power is supplied to the recorder.

A new disk drive has been produced specifically for the Commodore 64 computer, and the existing VIC-20 disk drive cannot be used. In the future however, the Commodore 64 drive will be reprogrammed so that it can be used by the VIC-20. Disk performance is lamentably slow, limited by the serial communications scheme used for transferring data to and from the computer. On the plus side the disk drive is easy to use and in combination with Commodore Basic, is versatile.

The Commodore 64 "Datasette" recorder.

The cartridge slot of the Commodore 64 is of a different configuration to that of the VIC-20. No doubt many VIC-20 programs could be run on the '64 with only minor changes, but users will need to invest in an entirely new collection of cartridges if they switch from the VIC-20.

Expansion cartridges will be available to allow the Commodore 64 to use standard printers, modems and other peripherals, and an IEEE-488 cartridge will allow use of the full range of Commodore peripherals with the system, including daisy-wheel printers and 20cm disk drives.

The "user port" at the rear of the Commodore 64 console provides access to the bus of the 6510 microprocessor and two uncommitted ports of the 6521 VIA (Versatile Interface Adapter). As with the VIC-20 there is plenty of scope for the hobbyist or experimenter who wishes to add their own hardware devices to the system, although special precautions will have to be taken to avoid addressing conflicts between the add-on equipment and the Commodore's 64K memory complement.

Software and expanded Basic

The range of program cartridges available for the Commodore 64 is as yet rather limited. The excellent screen resolution and sound effects of the machine mean that "arcade style" video games will probably be strongly supported, while a word processor, database manager and a spreadsheet calculator for the system are in an advanced state of preparation.

The word processing program, called "Easy Script" is supplied with an extensive users' manual and allows the Commodore 64 with either disk or cassette storage to be used as a word processor. Justification and centring, headers and foot-notes, page numbering and various line and page lengths are supported in addition to standard word processing features.

We were also supplied with a draft copy of the manual for "Easymail 64", a mailing list maintenance program capable of storing, sorting and searching lists of up to 700 names and addresses. Use of the system requires at least one disk drive and a printer.

Commodore also supplied a manual for the soon-to-come "Simon's Basic", a disk extension of Commodore Basic which moves away from the emphasis on PEEKs and POKEs for activating special features of the system. "Simon's Basic" adds programming aids such as a TRACE command, text handling commands, extra arithmetic operators, graphics plotting commands including DRAW, CIRCLE and PAINT and music commands including WAVE and ENVELOPE to simplify sound synthesis.

Structured programming commands including REPEAT . . . UNTIL, LOOP . . .EXIT, procedure calls and local and global variables are also included.

Other statements support the use of joysticks and a lightpen and simplify disk program use and file handling.

Simon's Basic will be available either on disk or as a cartridge, and will considerably simplify the use of the Commodore 64's extensive features.

Machine language programmers will be interested in the "64MON" cartridge, a machine language monitor and debugging program which includes a line-by-line assembler. The instruction set of the 6510 is identical to that of the 6502, and the "Commodore 64 Programmer's Reference Guide ($25) contains all the information necessary to use the full capabilities of the system from machine language.

Conclusions

The Commodore 64 is a system with a lot of potential. If it proves even half as popular as the VIC-20 it will have a large following. It has much to offer to the enthusiast interested in computer graphics, and its sound capabilities are equal to systems of much higher price. Coupled with existing and soon-to-come business and home management software it is an exceptional all-round computer system.

The Commodore 64 is priced at $699, with the Datasette recorder an additional $99. Further information is available form Commodore Business Machines Pty Ltd, 5 Orion Road, Lane Cove, NSW, 2066. Phone 427 4888.

Learning is Fun

Green Screen Monitor pictured is an optional extra.

16K PLUS

The 16K PLUS has built in features such as music generation, PCG high and low resolution graphics, with a screen display of 16 lines each containing 64 upper and lower case characters. When you also consider all of the standard extras like continuous memory, built in printer and input/output interfaces and parallel port, 4.5 volt battery back-up and self testing BASIC in ROM, the Microbee 16K PLUS is unbeatable in its class.

$449

32K PLUS

All of the standard features of the 16K Plus with twice as much usable RAM. When you add the new Wordbee ROM Pack, you have a powerful word processing capability which does a lot more than play the many games available for the Microbee. Add a printer and just see what you and your family can now do with your home computer.

$549

microbee®

AUSTRALIA'S OWN EDUCATIONAL AND PERSONAL COMPUTER

Designed and manufactured in Australia by

APPLIED TECHNOLOGY PTY LTD

Head Office/Showroom: 1 Pattison Avenue, Waitara 2077 N.S.W.
Telephone: (02) 487 2711

Factory: 1 Debenham Road, West Gosford 2256 N.S.W.
Telephone: (043) 24 2711 Telex: AA72767

For direct enquiries or the name of your nearest dealer, Phone: (02) 487 2711.

bankcard welcomehere

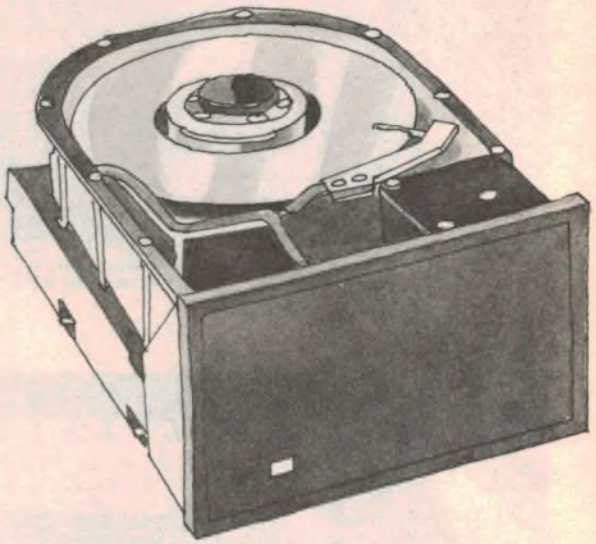
CEAT 2645

MEET THE LOW COST DRIVING FORCE.

TANDON TM500 Series Disk Drives

Disk Drives up to 19.1 megabytes

Today Tandon 5¼" rigid disk drives are used in many proprietary systems on sale in Australia.
And now you can get the same performance and reliability as the professionals get, direct from the distributor, at huge savings.



Specifications:			
MODEL:	TM501	TM502	TM503
Capacity (unformatted)	6.4Mb	12.8Mb	19.1Mb

Case, power supplies and controllers also available.

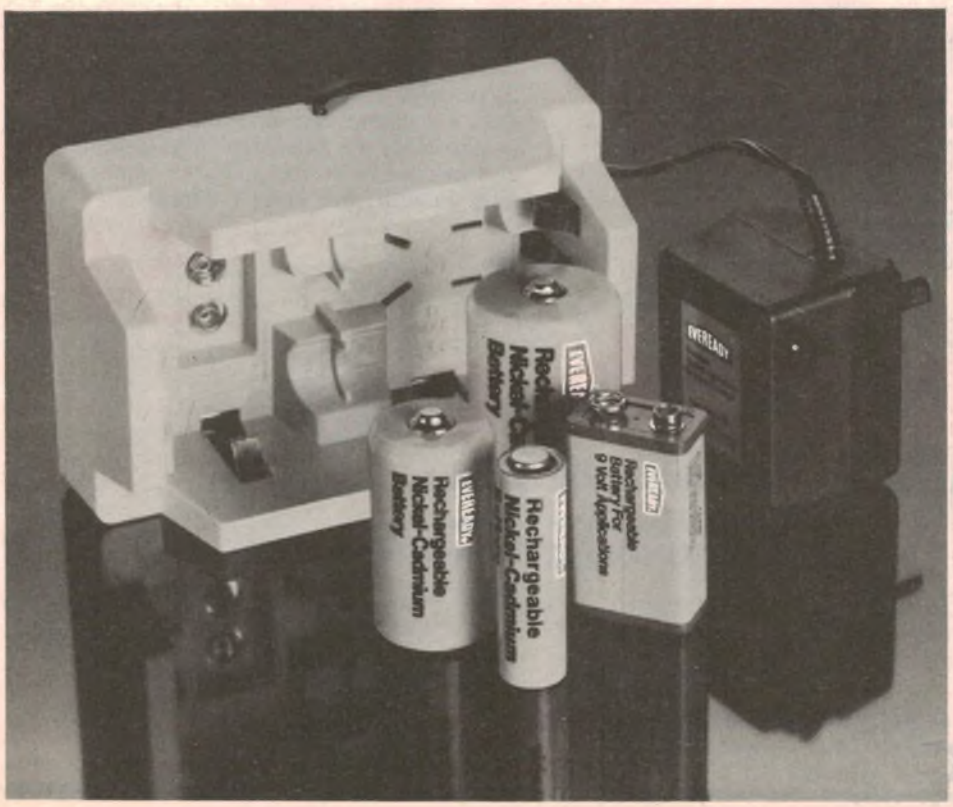
For further information contact:-

AE ADAPTIVE ELECTRONICS P/L

418 St. Kilda Road, Melbourne. 3004. (03) 267 6800.

JHA/4731/HP

Plug into 'Eveready' rechargeables.



Our rechargeable range, in popular sizes, can be charged up to 1000 times on the new model ACC50E Charger, thus offering an extremely economical power source to the heavy-battery user. Especially ideal for photo-flash, movie cameras, tape recorders, transceivers and electronic games and toys.

Please don't hesitate to call for further information.

EVEREADY

Rechargeable Nickel-Cadmium Batteries.

Union Carbide Australia Limited,
Battery Products Division,
157-167 Liverpool Street, Sydney.
Phone: 269 0656

SALES OFFICES:
Brisbane: 47-49 Sherwood Road, Toowong. Phone: 371 6877.
Adelaide: 121 Greenhill Road, Unley. Phone: 272 0611
Melbourne: 14 Queens Road. Phone: 261241, 262332
Perth: 901 Hay Street. Phone: 321 2926

UNION CARBIDE

'Eveready' and 'Union Carbide' are registered trade marks. 085 P.834A

Microcomputer News

Green screen video monitor from Altronics

Altronics Pty Ltd has available the Micron 12, a quality 30cm green phosphor video monitor suitable for use with computers of all types. Features of the monitor include a 20MHz bandwidth and operation from the mains or 12V DC battery pack, with power consumption of 40W.

Front panel controls are provided for power, contrast and brightness and by turning the contrast control fully down and the brightness control up an inverse video mode is activated, producing black characters on a green background. In the inverse mode the green background extends the full width of the screen but not completely to the top or bottom of the display. The review unit also showed a distracting flickering line at the lower right side of the screen in this mode but we understand this will be eliminated in production units.

The contrast and brightness controls provide a limited range of adjustment of the inverse display before the screen reverts to the normal mode. Normally the display would be used in the green-on-black mode, with the contrast and brightness controls providing a range of adjustment of the display for various lighting conditions.

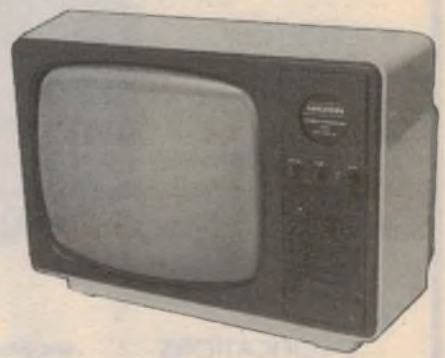
The face-plate of the screen is of plain glass rather than a non-glare material so normal attention will need to be paid to lighting and positioning.

The power switch is a push on/push off type and a red LED power-on indicator is provided. Since the monitor circuitry suppresses noise when there is no video input the screen is completely dark in the absence of a video signal and the monitor appears to be off. The power-on indicator is thus a useful feature as it reduces the possibility that the monitor could inadvertently be left on after the computer has been switched off.

Height/linearity and horizontal and vertical hold controls are pre-set potentiometers accessible from small cut-outs in the rear panel of the unit. Also at the rear is the RCA socket for a composite video signal input and an output for 12V DC, able to provide up to 1.1A. This output is an added attraction of the monitor, ideal for powering the Microbee or any other computer which normally uses a plug pack or special mains adapter.

Although there is a speaker grille on the front of the cabinet there is no provision for a volume control and no speaker behind the grille.

The unit accepts a composite video signal at up to 4V peak to peak with



negative going sync.

The review unit was provided without documentation, so we cannot comment on this aspect of the Micron 12.

The wide bandwidth of the Micron monitor provides a crisp, clear display of characters and graphics, even in an 80 column format, and the picture quality is excellent, with none of the interference and waviness associated with television sets driven by an RF modulator.

Price of the unit is $199.50, from Altronics, PO Box 8280, Stirling St, Perth, WA 6000. Altronics now offer a 24 hour, seven days a week phone order service for bankcard holders and a "next day" delivery service to anywhere in Australia for just $4.50 (items up to 10kg).

New low-cost computer has colour graphics, sound effects

Dick Smith Electronics has introduced a new low-cost personal computer, the VZ-200. Features of the unit include a Z80A processor, eight colour graphics, sound effects, Microsoft Basic in 16K of ROM and both RF and composite video outputs for connection to a standard television set or a colour monitor.

Perhaps the most exciting feature however is the price – just $199, a new low for a colour computer.

The VZ-200 has a 45 key typewriter style keyboard with pushbutton switches (not membrane switches). As the announcement from Dick Smith Electronics puts it "In keeping with the simplified format, the confusing number of switches and controls have been kept to a minimum".

Text is displayed in 32 lines of 64 columns each and graphics resolution is 128 x 64 (horizontal by vertical). Cursor-controlled editing and an inverse video facility is provided as standard and the interpreter allows single key entry of Basic keywords.

As standard, the VZ-200 has 8K of user programmable memory built-in. A 16K memory expansion module is available for $79 which increases this RAM to 24K, plugging into the expansion socket at the rear of the unit.

A cassette interface is standard and a separate printer interface module ($49.50) allows a printer to be connected to the computer.

The VZ-200 is available from any of the 37 Dick Smith stores nationwide.

SPHERE COMPUTERS

DISCOVER THE WORLD OF THE 6809 MICROPROCESSOR

THE NEW MK III SYSTEM BASED ON THE 6809 MICROPROCESSOR

- EFFICIENT
- VERSATILE
- EXCELLENT SUPPORT
- SUPERB SOFTWARE
- BUILT IN DISK DRIVES
- MK 3 SPECIFICATIONS

PROCESSOR
The heart of the system is the Motorola 6809 CPU and considered to be the most powerful CPU and considered to be the most powerful 8 bit Microprocessor available today. The CPU board is fitted with Memory Management hardware which allows it to directly address up to 1 Megabyte of memory using a 20 Bit address bus. The system is provided with a 2716 compatible 2k Monitor ROM or EPROM.

MEMORY
A 64K Ram board is provided as standard. However the system may be provided with as little as 8k if desired and more added later.

BUILT IN DISK DRIVES
The MK III system includes two 40 track double sided double density slim line 5¼" floppy disk drives. Twin 80s can be added for extra capacity. The disk controller is capable of double sided double density operation.

POWER SUPPLY
Provides 8.5V + 12V, —12V unregulated supply to the bus. All components are PC board mounted and fuses readily accessible.

PERIPHERALS
Additional VDUs, Dot Matrix Printers, Daisy Wheel Printers, 8" Floppy Disk System and a hard disk drive of up to 40MB may be connected to the system. Interface boards and software are available to support all these devices in a singular or multi-user environment.

INPUT/OUTPUT
8 I/O Boards slots are provided, each of which may be fitted with a dual serial or dual parallel interface board using DB 25 "D-TYPE" Connectors. Many other types of interface Boards are also available.

CABINET
The Cabinet is made of heavy gauge (approx 1/8") Aluminium Anodised in Delightful blue.

SIZE
Approx 16" wide by 20" deep by 7.5" high.

WEIGHT
Approx 10kg (including supply, CPU, 64K RAM, and I/O board)
AC POWER INPUT: 115-240 VOLTS AC +/-10%, 50-60Hz.

SOFTWARE SPECIALIST FOR THE 68XX SERIES

MICROWARE SYSTEM CORP
OS-9 Level 1 Operating System
OS-9 Level 2 Operating System
Basic 09 Programming Language
Pascal OS-9
Macro Text Editor
Assembler
Debugger
Cobol Programming Language
C Programming Language

TECHNICAL SYSTEMS CONSULTANTS
UNIFlex Operating System
UNIFlex Basic
UNIFlex Pascal
UNIFlex Fortran 77
UNIFlex Relocating Assembler & Linkage Editor
General Purpose Flex 6809
General Purpose Flex 6800
Exorcisor FLex 6809
SWTPC Flex 6809
GIMIX Flex 6809
Fortran 77 for Flex
Extended Basic
Utilities
Pascal for Flex
68000 Cross Assembler for Flex
Sort Merge Package
Text Editor
Assembler
Debug Package
Diagnostics
Text Processor

FRANK HOGG LABORATORY INC
XForth
Basic Programmer Tool Kit
Extended Use Utilities Pack
Password Protection Pack
Dynasoft Pascal Flex
Bill Payer System
Spell Test
Super Sleuth
Stylograph 2:0 Flex, OS-9 Dynastar Full Screen Editor OS-9, Flex
CRASMB Cross Assembler, Flex, 6809, 6800, Z80, 8080, 6502
Dataman + DBM
Plot
Tabula Rasa
Job Control Program
TRS80C Colour Flex
MCommand
Color Flex Utilities
Stylograph for Color Flex
Autotask
Ed/Asm
CCForth

WASHINGTON COMPUTER SERVICES
6809 RMS DBM for Flex
6809 RMS DBM for UNIFlex
6809 RMS DBM for OS-9

UNIVERSAL DATA RESEARCH INC
DBM 2 Flex
DBM 2 UNIFlex
Payroll
Accts Receivable
Accts Payable
General Ledger
Inventory
DBM 2 for Color Flex

TALBOT MICROSYSTEMS
tForth
tForth +

COMPUTER SYSTEM CENTRE
DYNAMITE Disassembler
DYNACALC
Dynashare

DUGGERS GROWING SYSTEMS
6809 C Compiler ver 2:0

OMEGASOFT PRODUCTS
PCS2 Pascal Compiler Flex, OS-9, MDOS
Rall 1 Relocatable Assembler & Linking Loader

SWTPC
EDIT Word Processing Editor Flex
C Compiler for UNIFlex

MAGAZINES
68 Micro Journal
System-68
The Rainbow
Colour Computer News

INTROL CORPORATION
Introl C /6809 C Compiler
Flex, Uniflex, OS-9

AVAILABLE FROM offices and showroom:

MAGRATHS ELECTRONICS
55 A'Beckett St
Melbourne 3000.
VICTORIA
Tel (03) 347 1122

PARIS RADIO ELECTRONICS
SHOP 1
165 BUNNERONG ROAD
KINGSFORD. NSW 2032
Postal address:
PO Box 380. Darlinghurst,
NSW 2010. Tel (02) 344 9111.
Telex AA22579

MICRO EDP & HARDWARE
9A/1 Leura Ave
Claremont 6010
W. AUSTRALIA
Tel (09) 384 5787

Microcomputer News

Enhanced monitor for Exidy Sorcerer computer

A new machine language monitor program is now available for the Exidy Sorcerer computer which greatly expands the capabilities of the machine. The monitor is supplied as a pair of EPROMs which replace those already present in the computer. A graphics enhancement EPROM is also available for use with the Basic ROM pack.

Unlike many similar computers the Sorcerer includes a monitor program.

Powerful as this monitor is it does give cause for dissatisfaction. The RS-232 routine does not work correctly in either Mark I or Mark II Sorcerers, as the keyboard scan routine uses the same port and resets the RS232 interface each time it is called. There is also no convenient way to set the RS232 mode or baud rate from the monitor command level.

All of these problems are fixed with the revised monitor from D. K. Wong. The new program, called DWMON 2.2, also adds a considerable number of enhancements to the standard Sorcerer monitor.

Using DWMON the existing memory dump and enter commands will now work with ASCII characters as well as hex. The built-in memory test command has been changed so that it can now be used with a single memory location as well as blocks of memory. The memory move command has also been altered to allow moving a block of memory to any location, even if the new location overlaps the block to be moved.

New commands added by DWMON include CM, to compare a block of memory with another block. The routine returns to the monitor if no differences are found, and otherwise all differences are reported. A Fill Memory (FM) command has been added, allowing a specified block of memory to be filled with any hexadecimal number. Also added is a search command which allows memory to be searched through a specified range for any pattern of bytes, including mixed strings of hex and ASCII characters.

A new command, DK, will automatically boot up a disk operating system. The routine checks to see that a disk drive controller is attached and returns to the monitor if not. Otherwise the command will boot the disk, working with either the Micropolis disk drive or the Exidy FDS system.

Another new command, VT, will change the Sorcerer to a new Video Terminal mode. Parameters for baud rate (300 or 1200), full or half duplex operation, word length, parity and number of stop bits can be entered, allowing the configuration of the terminal to be altered to suit almost any database servide or mainframe computer.

A new graphics EPROM is available separately which places the pre-defined graphics of the Sorcerer in the Basic ROM pack rather than in the monitor ROMs. If this EPROM is installed subsequent clearing of the screen will not rewrite the graphics characters, a reverse video graphics set is available and a special video driver can be used to magnify all characters on the screen by 16, making a 16-column by 7-line display for teaching or demonstration purposes.

An optional solid-state beeper can also be added to the Sorcerer, supported by a routine in the new monitor which produces a 100ms tone in response to the ASCII character BEL (07) or Control-G. The tone is produced by hardware and does not affect programs in any way.

This review cannot provide an exhaustive listing of all of the features of DWMON. The new monitor is compatible with most of the existing software for the Sorcerer, as the addresses of the major monitor routines are unchanged. System 3, the enhanced Basic editor program, works perfectly in Basic but changes I/O vectors which affect the DUmp command of the monitor. These vectors can be easily changed back.

If the new monitor is installed alone the existing Sorcerer graphics set (card suits, line segments, etc) will be lost. Mr Wong advises saving the character set on tape or disk before installing the new DWMON. If the additional Basic EPROM is also installed the graphics set remains available.

The pair of new monitor EPROMs costs $32 and the graphics EPROM costs $15. When both sets are ordered together the combined price is $40. The optional beeper costs $30, with three EPROMs and the beeper available for $65. The prices include postage and packing. For further information contact D. K. Wong, PO Box 32, Westmead, NSW 2145.

Make way for the microfloppy, says IRD

The 8.8cm "microfloppy" disk drive will soon take its place as the primary storage medium for personal computers according to a new report from market research firm International Resource Development Co. The report, on printer forms, ribbons and storage media for personal computers states that the Sony version of the miniature disk has been licensed to several major computer and disk manufacturers and will sharply

Mail — Purchase From Hong Kong

Personnel Computers
TV Monitors
Printers
Disc Drivers
Computer Accessories
Radio Cassette Recorders
Digital Clock Radios
Car Radio Cassettes
Electronic Components

If you are looking for excellent quality electronic products manufactured in Far East countries with almost factory price, write to us now for free catalogue.

COBO INTERNATIONAL ENTERPRISES

P.O. Box 335 Shatin N.T. Hong Kong

EA Magazine Holders

The magazine holders are available over the counter from Electronics Australia. 57 Regent Street, Chippendale. 2008 — Price; $4.50.

Mail orders should be sent to Electronics Australia, PO Box 163, Chippendale, NSW 2008.

Price including postage is: $5.50 NSW; $5.60 other states: or six for $29.00 NSW; $31.50 other states, $A33.00 NZ.

The FAMOUS DICK SMITH

WIZZARD

low cost personal computer

and only **$295**

BASIC CARTRIDGE EXTRA

YOU REAP THE BENEFIT!

YEARS AHEAD

Yes! It's not 1970's technology like most other computers — the Dick Smith Wizzard's superb design was finalised just a few short months ago.

JUST PLUG IN THE BASIC CARTRIDGE

And the Dick Smith Wizzard becomes a powerful personal computer, ready to go to work for you! Complete with 17K RAM (more than most computers!) expandable externally to a massive 64K! As well, the Wizzard offers you up to 16 different user-programmable colours, with characters and character background all independently programmable. PLUS there's programmable sound — up to three notes simultaneously for complex chords! To help you understand the Wizzard computer, each BASIC cartridge includes, at no extra cost, a comprehensive manual especially written for the Wizzard by Jamieson Rowe, SMIREE, Australia's "father of personal computers." Cat. Y-1605

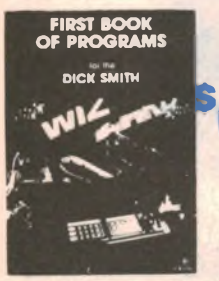
ONLY **$69.50**

ONLY **$49.50**

QUALITY MOVING KEY KEYBOARD

The Wizzard comes complete with a splashproof 'QWERTY' keyboard, but for advanced computer programming many people feel that a 'proper' moving key keyboard can't be beaten. This keyboard simply slots into the Wizzard's keyboard socket. Top Value! Cat. Y-1608

NEW NEW NEW



ONLY **$6.95**

THE FIRST BOOK OF WIZZARD PROGRAMS

A collection of 18 interesting and absorbing programs especially written for the Wizzard. You'll have hours of enjoyment, learning more about your computer as you go. Cat. B-6196

AND WHEN YOU'VE FINISHED COMPUTING

You're ready to start playing the most advanced computer games around — unbelievable graphics realism . . . they'll keep you (or the family – or both!) amused for hours.

$89 ONLY **$69**

SAVE $20.00

Cat. Y-1607

SAVE THEM FOR RE-USE With the new Wizzard Cassette storage module Unique connection arrangement — it slots onto the side of the Wizzard console. Get the most from your Wizzard: save your programs and reload them from cassettes. It's much quicker than re-keyboarding them!

SUPPLIED WITH FREE SONIC INVADERS GAME CARTRIDGE. WORTH $39.95

GREAT FEATURES GREAT PRICE!

All one low price: Just **$39.95**

Choose from the following:

Tank Attack Y-1610
Dick Smith Championship Tennis Y-1620
Auto Chase Y-1630
Crazy Chicky Y-1640
Planet Defender Y-1650
Air/Sea Attack Y-1660
Police Jump Y-1622
Mouse Puzzle Y-1680
Astro Pinball Y-1685

COMING SOON!
Music Maker Y-1635
Soccer Y-1645

7 DAY TRIAL OFFER

If you're not completely happy you can return the WIZZARD within 7 days in original condition & packing for a full refund. So why not try a WIZZARD today!

DICK SMITH Electronics

INC.IN NSW

See page 98 for full address details

DSE/A456/JW

Microcomputer News

reduce the market for 20cm and 14cm disk drives.

By the end of the decade says the report it should be possible to obtain a microfloppy drive storing 100K bytes and priced at around $150. Overall, IRD expect the market for disks and disk drives will top $US20 billion by 1992.

Other accessories such as cassette tapes, printer ribbons and printwheels are also expected to do well under the impetus of booming microcomputer sales.

Sinclair computer add-ons from Vendale

The Sinclair ZX80 and ZX81 are now perhaps the most common of low-cost personal computers, with users ranging from hobbyists to teachers and professionals. A wide range of software is available covering games, education, utilities and business applications, and there is even a complete magazine in the UK devoted to the Sinclair computers.

Australian company Vendale Pty Ltd has participated in this growth by supplying a range of hardware add-ons that significantly increase the power and flexibility of the ZX80 and ZX81. Their video upgrade kit has been used to convert many ZX80s to the full graphics potential of the ZX81 and their 32K RAM pack is one of the most cost effective expansion units for the ZX81. A programmable character generator with supporting software is also available, allowing ZX81 users to create special graphics characters of their choice.

Vendale has now released a new series of products to further upgrade the ZX80 and ZX81. The new range comprises a special 16K RAM pack, their X-ROM board and "ZON", a ZX81 sound generator.

The RAM pack is an improved design, with a case which clips firmly to the case of the ZX81 and an expansion connector able to accept – in the same case – the X-ROM pack. The keyboard sounder, a popular ZX81 option, is already fitted inside the Vendale RAM pack.

The Vendale X-ROM pack can be used separately or in conjunction with the Special RAM pack. It provides an autostart feature so that programs in ROM can be run automatically when the ZX81 is switched on. Also built-in is a standard parallel printer interface and an EPROM Programmer. 4K of ROM is standard in the pack but it can be readily expanded to 8K. A machine code monitor and printer driver software is provided with the X-ROM pack.

For further information contact Vendale Pty Ltd, Dept A7, PO Box 456, Glen Waverley, Victoria 3150. Send a large, self-addressed envelope if you wish to receive a free catalog of the company's products.

An interview with Barry Jones . . . from p31

and will the five-sector analysis of the workforce be introduced officially?

Well, I don't think that governments can legislate for the five-sector analysis or even for the four-sector analysis. If it comes to that, no-one ever legislated on the three-sector analysis. It's just that it became recognised as a very useful tool, and I think that governments are conscious, for example, that the four-sector analysis is generally recognised now by OECD and UNESCO and has been adopted by the United States Department of Commerce, by the British Department of Information Technology and even by our own Bureau of Industrial Economics, the BIE in the Department of Industry and Commerce. I think it's one of those things that will be increasingly "talked up" where people look at things in a different light, and think "Well, look, all those measuring techniques that we applied to the '50s and '60s simply aren't relevant anymore.

Changing the subject, what's your attitude to the Davidson Report on Telecommunications?

Like the curate's egg it was good in parts. There were some parts that we wouldn't have been unhappy about but essentially I think the philosophy in the Davidson Report was very much contrary to our predisposition in the party.

And the national satellite. Who would you see as the principal beneficiaries of the national satellite?

From a direct point of view, the immediate users, but in an indirect way it's undoubtedly going to contribute to the national wealth. It was similar to the point I was making about the new technology. You'd look at it and say "Ahh, there's only a comparatively small number of users, how's that going to benefit the nation?" but in fact I think there's a tremendous amount more that we'll get to know about our economy from it.

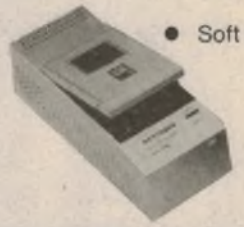
And what of the future of home computers?

Well, one of the sunrise industries that I'm very enthusiastic about is the development of our own personal computers. I take it for granted that between now and 1990 we'd have as many personal computers as telephones.

NEW RELEASE

VIDEO CASSETTE REWINDER
VHS — Beta

- Auto Stop
- Soft reject



Prolong mechanism of your VCR

ATTENTION:
DUPLICATION HOUSES
VIDEO RENTAL STORES

Rewinds your tapes faster.

Releases your VCR for rental quicker.

VIDEO DETAIL ENHANCER

Video detail enhancer particularly designed to rectify loss in detail derived from VCR tapes and picture impairment. Ideal for off-air recording — dubbing, etc.

IMAGE STABILISER

Image Stabiliser
Ensures no vertical roll or blackout occurs. With slight adjustment immediately stabilises picture of pre-recorded tapes removing copy guard signal.

Also available
VIDEO ACCESSORIES, CABLES, HEAD CLEANERS ETC.

VIDEO BAR
343 Illawarra Rd, Marrickville
N.S.W.
OPEN 7 DAYS A WEEK
Phone: (02) 559 5492
Melbourne 379 3208
Adelaide 51 4388
Agents for other states required

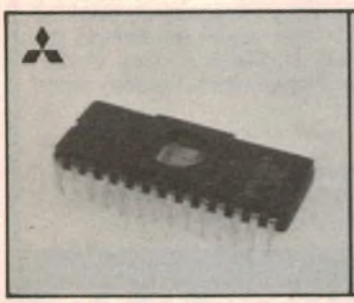
MITSUBISHI ELECTRIC

"I'm from Nexus"

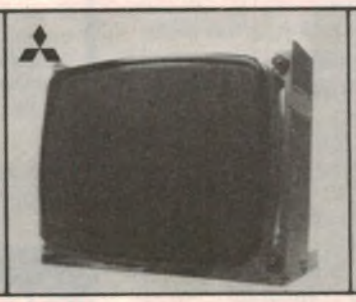
Meet Move Master, Mitsubishi's sophisticated micro-robot capable of all manner of complex manipulations in response to simple commands, easily programmed on a personal computer.

With five degrees of freedom and six axes of rotation under simultaneous micro-computer control, Move Master is the ideal low-cost way to gain practical robotics experience.

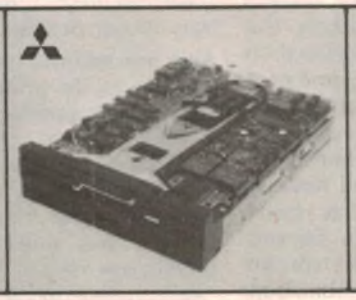
Details on Move Master, together with the other three fine Mitsubishi products below, are available from the new name in electronics, Nexus.



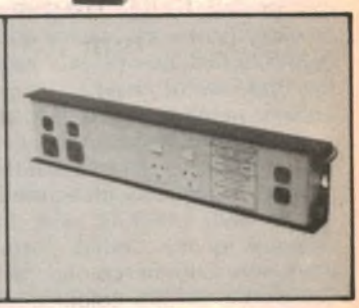
Mitsubishi semiconductors Designed for reliability and built for performance, Mitsubishi semiconductors ensure superior performance for your system.



Mitsubishi monochrome display monitors Mitsubishi's CRT and TV technology leadership lies behind each unit, with rapid, accurate, and highly legible display of complex alphanumeric or graphic data.



Mitsubishi disk drives 5¼ and 8 inch slim-line flexible disk drives, backed by Mitsubishi's reputation for top performance and extraordinary reliability.



Mains Muffler The perfect insurance for personal computers, small business systems, computer monitors and disk drives. The Mains Muffler range ensures full protection against troublesome mains interference.

NEXUS

Your best electronics connection

Available throughout Australia. For the name of your nearest outlet, telephone (02) 9221722.
Nexus Electronics Pty. Ltd. (Inc in NSW) 339 Pacific Highway, Crows Nest, NSW 2065.

NX1

Microcomputer News

Centre Industries 300bps direct connect modem

The Cicada 300 modem from Centre Industries looks like setting a new price/performance standard for 300 baud direct connect modems.

Launched at an introductory price of $175 the Cicada is a compact answer/originate unit designed for direct connection to a phone line and with a computer interface using an RS232C or V24/V28 system. The unit is approved by Telecom (number C83/37/1011). The manufacturer, Centre Industries has traditionally supplied Telecom Australia with a variety of telephone components and is the Australian assembler of the Sagem teleprinters marketed by Telecom.

According to the company initial enquiries for the modem have substantially exceeded expectations, leading it to step up manufacturing capability.

For further information contact Centre Industries, 187 Allambie Rd, Allambie Heights, NSW 2100.

New 1200XL home computer from Atari

Atari has introduced a new home computer, the Model 1200XL. Features of the new machine include 64K bytes of RAM, an improved typewriter style keyboard and compatibility with existing software and peripherals used by the Atari 400 and 800 models.

High resolution colour graphics are supported in 256 colour combinations and four voice sound is provided, with each voice covering two-and-a-half octaves. The keyboard includes four user definable function keys and a special "help" function.

Games cartridges can be plugged into a slot on the side of the keyboard console and two control games controller ports are provided. Also included is a serial port and built-in RF modulator.

The Atari 1200 sells for around $US1200, but it is not known when it will be available in Australia.

LIKE TO GET AN AMATEUR RADIO CERTIFICATE? IT'S MUCH EASIER WITH PROFESSIONAL HELP.

If something's worth doing, it's worth doing well. So don't waste your valuable spare time finding your own way through the Amateur Radio maze. Ask Stott's instead. We have top professional instructors, who'll make sure your time is well spent on your way to an operator's certificate. You'll have individual attention, working at your own speed, in the comfort of your own home. Any queries will be answered personally, and promptly.

So don't delay. Mail the coupon for full details.

Over and out.

Stotts CORRESPONDENCE COLLEGE

The name to trust in correspondence education.

Please send me free, and without obligation, full details of the following courses:

_____ (PLEASE PRINT)

_____

MR MRS MISS _____ AGE ____

ADDRESS _____

_____ POSTCODE _____

Stott s undertake that no sales counsellor will visit you

Melbourne, 159 Flinders Lane, 3000 Tel 63 6212
Sydney, 383 George Street 2000 Tel 29 2445
Brisbane, Suite 3 65 Mary Street 4000 Tel 221 3972
Adelaide, 85 Pirie Street 5000 Tel 223 3700
W. Perth, 25 Richardson Street 6005 Tel 322 5481
Hobart, 150 Collins Street 7000 Tel 34 2399
New Zealand, Box No 30 990 Lower Hutt Tel 670 370

The Stott's range of courses in Amateur Radio is:

- Novice Amateur Operator's Certificate of Proficiency.
- Amateur Operator's Certificate of Proficiency.
- Amateur Operator's Limited Certificate of Proficiency.
- Radio for Amateurs.

ALA/ST4163/EA683

Microcomputer News

News from the Clubs

● The Northside Microbee Users Club meets on the third Saturday of each month from 1pm to 5pm at the McMahons Point Community Centre, at the junction of Lavender Street and Blues Point Road.

A monthly newsletter goes to club members and a series of lectures explaining how the Microbee works will commence shortly. Membership costs $20 per year, including the newsletter. For further information contact Tony Williams on (02) 267 7747 during business hours or send a stamped self-addressed envelope to the club at 6 Tunks St, Waverton, NSW 2060.

● The Devonport Computer Interest Group held its first meeting on the 18th of April, and advertises meetings in the local paper. Contact John Stevenson, RSD 422, Sheffield, Tasmania 7306, or phone (004) 92 3237.

● An Australian BBC and Econet Users Group has been formed in South Australia and is looking for new members. The club intends to publish a monthly newsletter with hints, software reviews and other items of interest. Contact the club by writing to "Beenet", PO Box 262, Kingswood, SA 5062.

● The Adelaide Micro User Group Inc meets monthly at the Service Club Centre, 49 Oxford Ave, Unley, SA. Forthcoming sessions include talks on the Tandy Color Computer, Basic programming, Z80 and 6809 machine language and hardware projects. The club has recently switched to a daisywheel print-out for its newsletter, a welcome development, and has much to offer members.

For further information contact the club at 36 Sturt St, Adelaide, SA 5000.

● The South Australian Microprocessor Group has published a six month schedule of forthcoming meetings, with topics including a vector graphics display controller project, 8088/Z80 dual processor board for the S-100 bus and a visit to a working BBC computer network installation. The newsletter is packed with news, hints and tips for users of all types of computers and is good value. Meetings are held monthly at the Adelaide Archery club rooms, North Adelaide. The postal address is PO Box 113, Plympton, SA, 40 5038.

● The Melbourne Super-80 Users Group will hold an open day on Saturday June 18, from 9am to 5pm at the Uniting Church Hall, Canterbury Rd, Heathmont. All interested readers (and their computers) will be welcome, and a market will be held for those wishing to buy, sell or exchange computer gear.

Further information can be obtained from Victor Shuttleworth, 17 Stephen Cres, Croydon, Vic 3136. Phone (03) 723 2713.

The Serviceman

. . . from p83

believe that anyone would import 110V microwave ovens into a 240V country? Or, that if they did, that they could be used on 240V without being damaged?

And, of course, she fell into the classic trap of believing that the approximate two to one voltage ratio would automatically mean the same ratio of cooking time, presumably on the basis that the oven would get twice as hot. I don't know whether a microwave oven would follow a linear law – assuming that it was able to withstand such abuse for a significant period – but someone ought to tell her that doubling the voltage normally means quadrupling the power.

So, to be logical, she should have advised her listeners to reduce the cooking times to one quarter!

But that was not the end of the story. Some months later – this all happened some time ago – my colleague was talking to another retailer (not in the same town as the one who sponsored the demonstration) and, noticing a microwave oven in his stock, was reminded of the incident and related it.

Suddenly the retailer was all ears. "Aha," he exclaimed, "that explains something. For the last several months I have had womenfolk who have bought microwave ovens from me coming back and saying, 'Look, it's fine to have those recipe books supplied with the oven, but they are not printed in Australia and we need an Australian edition to give us the correct cooking times'."

And the poor retailer, who was quite unaware of what had started it all, couldn't understand what they were on about. All he could do was insist that the cooking times given in the book were correct, while the womenfolk were equally vehement in disputing this and saying, "No, you have to have an Australian edition."

The result was complete confusion, with a good deal of bad will being inadvertently generated on both sides. No wonder the retailer was interested; he could now meet these strange requests with a logical debunking of the story and set everyone's mind at rest.

So, if you encounter this story, you'll not only know how to deal with it, but where it came from.

★ BRIGHT STAR CRYSTALS

Specifications, Dimensions and data sheets available on request

BULK ORDERS: In addition to our normal range we can supply quantity orders (100 up) at very competitive prices. All we ask is 50% of cost with order balance 30 days.

DELIVERY: 5-6 weeks from receipt of Order. Ring for quote: (03) 546 5076. Telex: AA 36004.

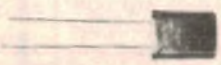
NEW NSW AGENT: APP Master Communications, Sydney (02) 682 5044

BRIGHT STAR CRYSTALS

35 EILEEN RD, CLAYTON, VIC
ALL MAIL TO: PO BOX 42, SPRINGVALE 3171

CRYSTAL OVENS AND OVEN OSCILLATOR UNITS

CRYSTALS



CRYSTAL UNITS FOR QUARTZ CRYSTAL CLOCK

SORCERER SLAUGHTERED!

NOW ONLY **$995**

48K SORCERER COMPUTER

Amazing price for an amazing computer . . . the mighty Sorcerer, the best choice for serious or professional users. With a huge 48K RAM (INBUILT!!!) and more computing power than you'd have believed possible.

Now there's no excuse to settle for second best - the best is so incredibly low in price. And some shop-soiled models are even lower! (Ask your nearest store manager if he has any left).

NOTE
Shop soiled & Demo Models Fully Guaranteed
LIMITED STOCK
$795

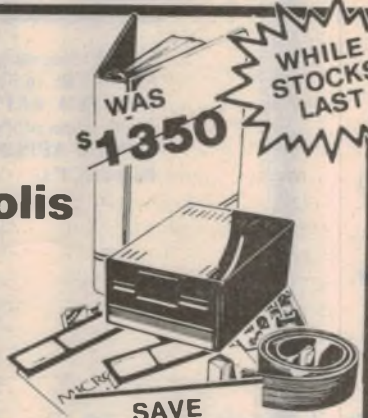
UNBELIEVABLE SAVINGS

On Famous Micropolis Disk Drives

Yes - unbelievable savings on one of the world's leading name disk drives. Get 315K bytes per drive, with the 77 track system - giving four to seven times the capacity of other systems. They're ideal for the Sorcerer with S-100 system.

The Micropolis 1043/mod 2 drive comes complete with controller and full instruction manual, etc.

Originally sold for $1350 - now save a huge $855!!! That's right, while remaining stocks last they're only $495 each! Cat X-3205



SAVE $855

AMAZING VALUE $495

Also Available:
Micropolis 1023/model 2 add-on

Micropolis 1023/mod 2 drive (add-on drive) without controller. Originally sold for $750 now an amazing $455 - but only while stocks last. (1023 mod 2 can also be used as add-on 77 track drive with existing disk systems).

Hurry - strictly limited stocks in stores. When they're gone, that's it!!!

Cat X-3208

WAS ~~$750~~

NOW ONLY $455

HURRY LAST CHANCE

UNBELIEVABLE SAVINGS ON SOFTWARE

DISK PROGRAMS

SAVE UP TO $220

Hurry - incredible savings on disk programs - accounting packages were $250 - now $29.95!!!
Limited store stock only

WERE UP TO $250

AMAZING VALUE ONLY $29.95

GAMES ON CASSETTE

Yes - equally ridiculous prices on Sorcerer games programs. Were up to $58.50; now from only $2.95. Limited store stock only

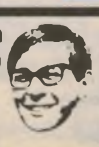
All Games Way Below Cost

SAVE UP TO $55.55

NOW FROM $2.95

LIMITED STORE STOCK
ENQUIRE AT YOUR NEAREST STORE

DICK SMITH ELECTRONICS



bankcard

See page 98 for full address details. A497 LL

UNIVERSE

SUPERCOMPUTER II

FASTER: 6 & 8 MHz 8 & 16 Bit dual C.P.U.'s.
MORE APPLICATIONS: via CP/M, CP/M-86, MS-DOS, MULTI/OS, & MP/M-86.
HIGHER SPEED: 8" 1.2 MEG DMA Floppy & DMA 16 MEG hard disc fixed & removable.
MORE EXPANDABLE: Due to S100 IEEE 696 compliance from hundreds of manufacturers.
THE ONLY SYSTEM with the magnificent **'MPS' INSTANT TASK SWAPPING CAPABILITY.**

SLOW: Non standard 5¼" discs.
SLOWER: 16 Bit only C.P.U.
LIMITED EXPANDABILITY: Cards from only a small number of manufacturers.
FEWER APPLICATION PROGRAMS: Due to 16 Bit only C.P.U.

We can help you with:

• CONSULTANCY • SERVICE CONTRACTS • CUSTOM SOFTWARE • STANDARD SOFTWARE

The choice is yours.

AED **Contact AED for your local dealer or information kit. 130 Military Rd., Guildford, NSW 2161. Phone: (02) 681-4966. Tlx. 70664.**

INFORMATION CENTRE

BAUDOT PRINTER: With reference to the letter from A. V., Whitton, NSW in the March issue regarding the use of a Baudot Printer with the Super 80 computer:

I have a machine language program that resides in the 256 byte block at the beginning of the Super 80's memory. It begins with the Super 80 Basic Printer rountine flag (55) so is protected after loading from tape. I understand that the program was originally devised by a fellow member of the Brisbane Super 80 user's group.

The program sends serial Baudot data to the printer port at the rear of the Super 80 board. I designed a simple circuit using an optocoupler to switch 25 volts to an ex-Telecom telex machine. Allowing for the slow speed of the telex machine and some character printing deficiencies, the program works very well.

I would be pleased to make a copy of the program and the interface circuit available to A. V. and any other interested Super 80 owner. (C. H., Claremont, Tas.)

PERMEABILITY: The solenoid article in the March 1983 edition was most interesting and it has certainly cleared up misconceptions I had about their operation. In the article, it is mentioned that some alloys have very high permeabilities (up to 10^6). Could you tell me whether it is possible to obtain these materials in Australia?

● The most commonly encountered metal with a high permeability is an allow called "mu-metal" which is often used to make shields for cathode ray tubes used in high quality oscilloscopes. The metal is very expensive and difficult to fabricate without impairing its desirable shielding qualities. Unfortunately, we do not know whether this material is made or is available in Australia.

WINDPOWER: With reference to April EA magazine, on wind generators and DC inverters page 139:

When you install your own power plant you do not fool around with building propellers or, worst of all, old car alternators etc. You install the correct system as shown in the photo on page 27 plus a solar float charger. The float charger is a very important part of the system but is seldom mentioned in the context of wind generators.

The article on page 27 is very good for back-yarders with time, money and SEC supply. I was more interested in the inverter articles. We (brother) also run a rotary 1000 watts (24VDC) inverter – be lost without it. But you do not run them 24 hours a day because of: (1) high wear rate, (2) drain on batteries, (3) noisy at night.

Nor do you run TV or electric blankets for the above reasons.

This is why we were interested in the DC inverter in the May '82 issue and since my letter (featured in the August '82 issue) have made both 12V and 24V/60 watts inverters as you suggested by uprating the transformers PL18/60VA and PF3993 for 24V. The performance is as follows:

12V no load 1 amp; 60 watts 6 amps

24V no load .7 amp; 60 watts 3 amps

The variable oscillator is the better version and the 24V variant runs cooler than the 12V original. You need a 12V three-terminal regulator to run the CMOS ICs though.

From your answer on page 139 of the April '83 issue, this simple inverter should run a 30cm 50 watt colour TV should it not? Also it would seem that by using two Ferguson PF3993 transformers in parallel, I should get 120 watts with no other changes (with 24V in). (I. K., Carnegie, Vic.)

● As implied in our answer on this subject in the April issue, the 40 watt inverter should run a 50 watt TV provided a suitable transformer is employed. Connecting two PF3993 transformers in parallel for operation at 24V should be workable but attempting to obtain 120 watts from the original design while still working at 12V would be too much for the existing output transistors. We must emphasise that we have not tried any of these variations so there could possibly be unforeseen problems.

SYSTEM-80 RS232 INTERFACE: Concerning the System-80 RS232 interface converter published in your February '81 issue. Since it is wired for input and output I was wondering whether it would be possible to convert it to run with a modem and terminal program.

If it is possible could you please give me some hints (in BASIC) on how to make the computer send any signals addressed to the RS232 port to the cassette port. (T. P., East Malvern, Vic.)

● We must clear up a misunderstanding here. The RS-232C serial interface design published in the February 1981 issue is wired for output only. There is no Receive Data input, as the interface is intended to allow the use of a serial printer from the System-80's cassette port. It could still be used with a modem, but only for transmission of data, not reception.

For two-way communication, you need our bi-directional serial interface published in the April, 1981 issue. This design connects to the expansion interface of the System-80 and allows the use of a modem with standard "dumb terminal" programs.

Communications programs are rarely written in BASIC as the language interpreter is too slow to guarantee reliable operation, even at 300 bits per second. Most terminal programs use BASIC for setting up etc, and contain a machine language driver for the actual RS-232C interface.

Green LEDs for the Car Computer

CAR COMPUTER: I have made up the Car Computer kit which I am very pleased with but I am still having problems as sometimes when starting the motor (V8 Falcon) I lose the readout, especially when running the air conditioner.

I have carried out the modifications which you have published in later issues. I do intend getting a new crystal to the specifications given.

But all that is not my problem. The problem is, being colour blind, I find the red displays hard to see in the davtime so would like to change to green NKG163. However, I am not having any luck as to who sells them.

I require eight of the green displays as I intend making the remote unit as well. (W. P., Lismore, NSW.)

● The green displays equivalent to FND507 are FND537. These are available from George Brown Electronics at 174 Parramatta Road, Camperdown 2050. NSW. At present they are $2.36 each +20% sales tax. Add $2 for pack and post.

Regarding your problem with loss of data, see this month's notes and errata.

STOP WASTING TIME TESTING BOARDS

MD will pin-point microtroubles in seconds. Portable and simple to use by non-technical staff in the REPAIR SHOP or on the PRODUCTION LINE. MD tests ROM, RAM & I/O and prints diagnostic reports. MICRODOCTOR can be plugged into an unknown system to perform a general diagnostic and print a MEMORY-MAP.
The ENGINEER may enter sequences of CHECKSUMS and RAMTESTS, READS and WRITES to specific MEMORY and I/O locations, SHORTING tests on DATA and ADDRESS LINES, PRINT-OUTS of memory in ASCII or HEX. These sequences are retained in CONTINUOUS MEMORY, available always at the push of a key.

* FREE Z80 DISASSEMBLER with each MD (other disassemblers soon to retrofit at low cost). Get a DISASSEMBLER LISTING of ROM in any microsystem!

MICRODOCTOR — $595.00

Z80 DEVELOPMENT SYSTEM

MENTA puts out a TV PICTURE of memory in hexadecimal. The 40 key keyboard will accept inputs, both in hexadecimal and Z80 mnemonics; there is a quick cassette data storage system, a powerful editor which permits program debugging by showing contents of registers and stack. Also there are 24 bits of I/O for external control. A Z80 disassembler is also available which outputs to any RS232 device such as a printer or terminal. MENTA was designed as a low-budget device for teaching microprocessing in schools: professional course-material is available to teachers together with add-on boards for a variety of control functions and robotic applications.

MENTA — $249.00

INTELLIGENT EPROM PROGRAMMER

Good tools need not be expensive. SOFTY 2 is the latest version of the engineer's favourite EPROM HANDLER for anybody who uses 2516, 2716, 2532 and 2732 EPROMS. SOFTY will program any of these EPROMS or copy any type into another.
SOFTY puts out a TV picture of memory contents, with many code-manipulating and editing facilities. There is also a fast cassette data storage system. SOFTY is also a ROMULATOR (a lead is supplied which may be inserted into a board under development to emulate the ROM using SOFTY's internal RAM. This procedure can also be used on the single-chipper piggy-back type MPU.)
SOFTY is complete in itself as a PRODUCT DEVELOPMENT SYSTEM. Code may be entered in HEXADECIMAL via the keyboard also SERIAL and PARALLEL inputs and outputs allow down-loading of object code from your computer or printing EPROM contents on your printer.

SOFTY 2 — $379.00

Castle ELECTRONICS **P.O. Box 311, Castle Hill NSW 2154. Ph. (02)634 7597.**

BILLCO ELECTRONICS

UNDER NEW MANAGEMENT

Shop 2, 31 Pultney Street, Dandenong, Victoria, 3175.
Telephone: (03) 791 8655

ELUSTRONICS Breadboard sytem

IZUMIYA I-C INC. Printed Circuit Aids

ARLEC Transformers and accessories

ok OK MACHINE & TOOL CORPORATION Wire wrap tools & equipment

TOYO Mini lathes and drills

PRODUCTS AT COMPETITIVE PRICES INCLUDE:

★ Comprehensive range of transistors, resistors and capacitors ★ Kits ★ Meters and instruments ★ LED and LCD Displays ★ Plugs, sockets, cables ★ Tools and hardware ★ Books and magazines ★ Instrument cases ★ PCBs for ETI, EA and TE Projects

- **ETI 660 COMPUTER KIT (PCB & COMPONENTS) $100.00**
- **TRANSFORMER $7.50**
- **CASES (KEYBOARD & PCB) $27.00**

TOTAL PRICE

PACK & POST $10.00

- **ETI COMPUTERS & COMPUTING (ETI 660 PROJECTS COVERED) $10.00**

RECOMMENDED FOR 660 CONSTRUCTION $4.95

MAIL ORDERS WELCOME

HOURS OF TRADING

Mon — Thurs 9.00am — 5.30pm
Friday 9.00am — 9.00pm
Saturday 9.00am — 12 noon

SCHOOLS AND TRADE SUPPLIED

Desolder in seconds!

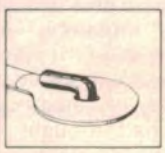
WITH

Soderwick

DESOLDERING BRAID

Select from standard or NEW FINEBRAID

1. Hold Soderwick on termination with hot soldering tip. Wicking action soaks up solder.



2. Remove tip and braid. Termination is left clean and solder-free.

- Fast, safe and easy.
- Soaks up molten solder like a sponge.
- Acts as a heat sink to protect circuits and components.
- Six braid widths available.

Buy from your electronic parts supplier

DISTRIBUTED BY

ROYSTON ELECTRONICS

NSW (02) 709 5293 QLD. (07) 277 4311
VIC. (03) 543 5122 S.A. (08) 42 6655
TAS. (002) 34 2233 W.A. (09) 381 5500

F582

The April 1981 article describes how such a driver is written, and BASIC and machine language listings for use with the bi-directional interface are available from our Information Service at a cost of $3.00 including postage.

COMPUVOICE SPEECH SYNTHESIZER: I have in my possession a copy of "Electronics Australia", October '82, in which the construction of the Compuvoice Speech Synthesizer was featured. It was a very attractive article, especially to me, a fan of speech synthesis.

Seeing the review of the Microbee in the February '83 edition, led me to the question: will the voice synthesizer work on the Microbee 16K Plus via the parallel port or will the voice synthesizer need modifications? Finally, what does it sound like? (R. V., Glenroy, Vic.)

● The Compuvoice speech synthesizer design published in October 1982 can be used with the Microbee without alteration. Simply attach the STROBE and READY (A/R) lines to the corresponding pins of the Microbee's parallel interface port and the data lines to the six least significant bits of the port. The two highest bits of the Microbee output port, D6 and D7, are not required.

The program on p77 of the October issue will run on the Microbee with the addition of an OUTL 1 before the LPRINT statement in line 490. This statement redirects the output of the Microbee from the serial printer port to the parallel port to which the Compuvoice is attached.

As to how it sounds, ask for a demonstration of the Votrax "Type-n-Talk" unit at a Dick Smith store. This device uses the same SC-01 chip as our Compuvoice. The Compuvoice, however, lacks the inflection controls of the "Type-n-Talk" so the speech is flatter. The speech quality is roughly on a par with that from a Texas Instruments "Speak & Spell".

CAR COMPUTER: Further to my last letter published in the January 1983 edition Information Centre, I have some more details which could be useful.

Judging by the other letter in the Information Centre, I am not the only one who has been getting unexpected variations in the litres/100km readings. I have had problems with erratic but cyclic increase/decrease in the instantaneous litres/100km, which I had thought to have been caused by there being a lag between fuel being used from the carburettor and it being replaced by the engine driven fuel pump. While this lag had some bearing on the variation in "instantaneous" litres/100km, I have found in my case that there was another more significant cause of the variation.

This cause lies with the fuel sensor (Moray). The Moray fuel sensor has a black cylindrical part clamped onto the outlet side of the sensor. Inside this part is a flexible rubber non-return valve. I have found from practical experience that this non-return valve places such a restriction on the flow of fuel that the fuel pump has little success in delivering enough fuel to the engine, although some fuel does get through. This fact was evident in no uncertain terms during a recent 100km/hour trip of about 200km.

At that speed the engine driven fuel pump could not pump enough fuel through the fuel sensor to maintain a steady 100km/hour. The end result was that the engine was starved of fuel, and stopped about every 3km, and restarted once the speed had dropped to about 50km/hour.

I have since removed this non-return valve from the fuel sensor (by cutting off the end of the rubber valve and reclamping the black cylinder and rubber seal onto the sensor). As I have the fuel sensor only about 15cm from the carburettor, absence of this non return valve should not cause any significant errors from reverse fuel flow while the computer is off. Also, since cutting off the valve, the cyclic variations in the "instantaneous" litres/100km have been reduced, but some variation still occurs, particularly during acceleration where engine (and hence fuel pump) speed variations occur.

You mentioned in the January '83 issue that there is a new calculation for the fuel sensor calibration number. The number one gets from this calculation still appears to be too low, however it is too early to be sure about this until I recheck the calibration.

And last but not least, there appear to be some errors in the Car Computer EPROM listing given in the September '82 issue. The relevant part which appears to be in error is as follows (at least in part): EPROM addresses 0i2D (14) to address 013C(7B).

If the listing is correct could you please advise the OP. CODE addresses in this above range of EPROM addresses. Once again I trust this information will be or interest to yourselves and readers, (D. H., Hazelmere, WA.)

● The original Moray flow sensor that we used for our Car Computer prototype had a one way return valve that appeared to provide a very little flow restriction in the forward direction. A further Moray flow sensor supplied several months later tended to offer considerable flow restriction in the forward direction. The manufacturers, however, insisted that this restriction would offer no starvation problems on cars with adequate fuel pressure.

Our opinion differs from the manufacturer's and, as you suggest, cutting the return valve to reduce the restriction is perhaps the best solution. The return valve action could still be retained if the rubber flaps are thinned sufficiently.

We are not sure why you think there is an error in the EPROM listing. Possibly you are attempting to dissassemble the listing and are finding that the codes at addresses 012D to 013C are not instruction codes for the microprocessor. This is because the listing between these addresses is a lookup table which allows decoding of the switches and converting from binary to the seven segment code necessary to drive the LED displays. There is no error in this part of the listing.

Notes & Errata:

CAR COMPUTER: (August 1982 1982, File 3/AU/31) A 10kΩ resistor should be connected from pin 9 of IC6c to ground to keep CB2 low after the Reset and before it is driven high. This ensures that the NMI does not occur before all initial conditions have been set, and will present data loss at switch-on.

Electronics Australia Reader Service

"Electronics Australia" provides the following services:

PHOTOSTAT COPIES: $3 per project, or $6 where a project spreads over multiple issues (price includes postage). Requests can be handled more speedily if projects are positively identified, and if not accompanied by technical queries. We reserve the right to supply complete back issues instead of photostats, where these are available.

CHASSIS DIAGRAMS: For the few projects which require a custom metal chassis (as distinct from standard cases) dyeline plans showing dimensions are normally available. $3 including postage.

PC BOARD PATTERNS: High contrast, actual size transparencies: $3, including postage. Please specify positive or negative.

PROJECT QUERIES: Members of our technical staff are not normally available to discuss individual projects, either in person at our office, or by telephone.

REPLIES BY POST: Limited to advice concerning projects published within the last three years. Charge $3. We cannot provide lengthy answers, undertake special research, or discuss design changes. Nor can we provide any information on commercial equipment.

OTHER QUERIES: Technical queries outside the scope of "Replies by Post" or submitted without fee may be answered in the "Information Centre" pages, at the discretion of the Editor.

COMPONENTS: We do not sell electronic components. Prices and specifications should be sought from advertisers or agents.

BACK ISSUES: Available only until our stocks are exhausted. Within six months of publication, face value plus 30c for post and packing for each issue. Seven months and older, $3 (includes post and packing and storage fee).

REMITTANCES: Must be negotiable in Australia and made payable to "Electronics Australia". Where the exact charge may be in doubt, we recommend submitting an open cheque endorsed with a suitable limitation.

ADDRESS: All requests to the Assistant Editor, "Electronics Australia", Box 163, Chippendale, 2008.

MARKETPLACE

DISPLAY ADVERTS IN MARKETPLACE are available in sizes from a minimum of 2cm x 1 col rated at $15 for a col cm.

CLASSIFIED RATES $3.60 for 40 letters or part thereof per insertion payable in advance. Minimum 80 letters.

CLOSING DATE is six weeks prior to the on-sale date. Issues are on sale the first Wednesday of each month.

FOR SALE

SUPER 80 USERS: Define your own characters, symbols, etc with the Programmable Character Generator (as detailed in May EA). 128 programmable and 128 fixed characters. Complete kit: $89.95. Short-form kit (PCB, EPROM, inst): $47.50. P&P: $2.00. Computer Clinic, PO Box 68, Aspley, Qld. (07) 269 8573. Bankcard.

MICROBEE — EA COMPUVOICE: plain — text to speech software (machine language) use from BASIC. Certified tape $14.95; details SAE; Easysbeeker 8/45 Stonehouse Ave, Camden Park 5038.

AMIDON FERROMAGNETIC CORES: Large range for all receiver and transmitter applications. For data and price list send 105 x 220 SASE to: R.J. & U.S. Imports, PO Box 157, Mortdale, NSW 2223.

RCS Radio Pty Ltd
Tel. (02) 587 3491
IS THE ONLY COMPANY
WHICH MANUFACTURES AND
SELLS EVERY PCB & FRONT PANEL
published in EA and ETI
651 Forest Road Bexley 2207
AUSTRALIA
RING FOR INSTANT PRICES
24 HOUR TURNAROUND SERVICE

COMPONENTS: R F Power, Audio, I.f. & Switching transistors, CMOS TTL & Audio IC's, Resistors, Caps, various Common freq xtals, Miniature relays, Knobs, Switches, Filters etc. Everything for professional or hobbyist. Apply for full list. Good price to clear — Private Sale. D. Steele, 8 Kangaroo Place, South Hedland, WA 6722. Phone (091) 73 8192.

NI-CAD BATTERIES: New, quality. Cheap. AA; sub C, C and D size at 4 amp. Fast charge. Suit most gear incl flashguns, toys and Big Jim torches, etc. Last for years. Info 557 Merrylands Rd, Merrylands 2160. (02) 636 1592 any time.

BIG BOARD: Double density controller. Uses WD1795 with support chips, plugs into 1771 socket. No board modifications necessary, runs on 2.5 Mhz clock. Software switchable for 5 or 8 inch, single or double density, any sector size. Total kit $135, Documentation only $15. Software only $25. Details $2. Tech Edge Companies. PO Box 10, Aranda, ACT 2614.

FOR SALE
SOLTEC/W + W RECORDER
New 6 pen multichannel recorder for industrial or laboratory use. 250mm chart width. Amplifier input 1mV to 10V in 12 ranges. 16 chart speeds or can be externally driven.
Pen recorder has inbuilt microprocessor which can be switched in to compensate for pen offset. Data and control is accessible via IEEE 488 interface.
Purchased originally for a project whose requirements have since changed.
Cost **$13,000** will sell for **$8,000**
Phone Adelaide (05) 268 2600

D. S. WIZZARD GAME: (Monster Meal) on cassette, send $10.00 to M. F. Thomas "Claremont" Wee Waa, NSW 2388.

FOR HIRE

COMPUTER CLINIC: Repairs and services Sorcerer, Apple, Ohio, Osborne, Super 80, System 80, Tandy, Commodore, Microbee, Peach, etc — 5¼" disk drives — printers. Businesses and hobbyists catered for. Country agents throughout Queensland. Bankcard. (07) 269 8573, PO Box 68, Aspley 4034.

READER SERVICE

MICROCOMPUTERS: For weekly rental . . . $25 per week. Commodore PET systems, with manuals and software tapes. Cassettes include games and self-teaching tutorials in BASIC and 6502 Machine Language. David Bates & Associates. Ph: (02) 630 8652.

PROGRAMS: Bought, sold or swapped all types, systems and formats (games business etc) all inquiries; ComputerTalk, 32 Glyde St, Mosman Park 6012.

COMMODORE 64/VIC-20: Cassette Interface to SAVE/LOAD programs (including Commodore tapes) using your audio cassette recorder. $45.00 plus $3.00 p&p. Canberra Computers & Consultancy, PO Box 382, Dickson, Canberra, ACT 2602. Tel: (062) 41 3746.

SORCERER
SUPER SOFTWARE
SALE!
BARGAINS GALORE!
SEND STAMPED SAE FOR FREE CATALOGUE TO:
P.J.B. 24A SIMPSON STREET, BONDI. 2026
ACCESSORIES. PERIPHERALS AVAILABLE

WANT A FAST COLOUR 16 BIT?
With tons of software available?
Excellent **games, business** and **educational!** with unlimited expansion.
AND ONLY $499?
Texas Instruments Colour Computer TI 99/4A!
ORDERS:
SOFTWARE CONNECTION
Box 375, PO Pymble 2073
Cheques, Money Orders, Bankcard Welcome! Or ring
Order Hotline (02) 30 1839
(Add $9 freight or pack)

Marantz SD 820 cassette deck

. . .ctd from p54

In addition, recordings made from records do not require an MPX filter.

The ideal arrangement would be to include an MPX filter switch on the front panel (as is done in most cassette decks) so that the user could decide whether or not to include the filter.

DIN weighted peak wow and flutter was measured as ±0.07%, an excellent result. Tape speed was exact — or as near to it as can possibly be achieved.

The line output voltage at an indicated 0dB and with the output level control set at maximum was measured as 0.51V RMS for both left and right channels, indicating that the SD 820 will provide sufficient output voltage for most power amplifiers.

The LED bar graph displays were found to be within ±0.5dB over their range of −20 to +6dB, a very good result.

Signal-to-noise ratios were measured using various combinations of tape types and noise reduction systems. The results are shown in Table 1.

The figures show that the SD 820 cassette deck has only an average signal to noise ratio until dbx is switched in. This produces an excellent 80dB signal to noise ratio, virtually removing any trace of tape hiss.

The last test results are those for distortion. These were done both with and without the Compu-Bias circuit in operation to see if the extra bandwidth gained was done so at the expense of increased distortion. From the figures tabulated in Table 2 this would indeed appear to be the case, and this is in line with the performance of other computer-optimised cassette decks.

In summary then, the Marantz SD 820 DBX is a fine machine with an excellent range of operating features. The inclusion of dbx noise reduction makes it a particularly attractive machine. In fact, it is one of a select few that can be regarded as being compatible with the new compact disc players. In fact, it would team very well with the Marantz CD-73 compact disc player.

The recommended retail price of the SD 820 DBX is $559 including sales tax. The optional remote control unit, the RMC-1, is available for an extra $40. For further information on the SD 820 DBX contact hi-fi retailers stocking Marantz equipment or Marantz (Australia) Pty Ltd, 19 Chard Rd, Brookvale, NSW 2100. (J.S.)

A.C.E. RADIO ELECTRONICS CENTRE

136 VICTORIA RD. MARRICKVILLE, NSW 2204
PHONE 51 3845

PROUD TO BE AUSTRALIAN

BARGAIN PRICES ● PERSONAL ATTENTION ● SLICK MAIL ORDER SERVICE ● SATISFACTION

* SUPER SCOOP *

MAGNAVOX 6W HI-FI WOOFER

8 ohm 20 watt ● Freq respon 50-6500Hz. Reson 45Hz. Rolled foam surround ● High compliance suspension ● Barium ferrite magnet ● Excellent linearity at high power (ideal mid-range in systems to 65wrms).

$12.95 EACH
P-P NSW $2.75
INTERSTATE $4.50

(Normal factory price in 100 lots $18 each).

KRIESLER

240 VAC
50Hz

BRAND NEW GUARANTEED

$66

BELT DRIVE STEREO PLAYER

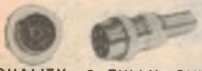
● MAGNETIC CARTRIDGE AND DIAMOND STYLUS ●

P-P NSW $4.50
Q. V. T. SA $5.50
WA. NT $6.50

Features — big aluminium turntable ● 2 speeds 33-45rpm ● Cue lever ● Calibrated adjustable counterweight ● Calibrated anti-skate ● Auto return-stop ● Switch click suppressor ● Power cable, RCA connectors ● OUR BEST PRICE EVER. BE QUICK.

DIODE IN 4004. 50 FOR $5.50

AMPHENOL 6 PIN PLUG-SOCKET



PRO-QUALITY ● FULLY SHIELDED ● CHROME PLATED ● HEAVY DUTY ● WILL ACCEPT 10mm DIA CABLE.

$2.95 P-P 75c

20 + 20W STEREO AMPLIFIER MODULE

BRAND NEW FACTORY OVER-RUN

$19.95 P-P $3.50

FACTORY ASSEMBLED AND TESTED ● 16 TRANSISTORS DISCRETE COMPONENTS ● GOOD CLEAN HI-FI REPRODUCTION ● INPUTS — MAGNETIC, CERAMIC CARTRIDGE, TAPE, AUX ● OUTPUT 8 OHMS ● INBUILT CIRCUITRY FOR HEADPHONES, LOUDNESS, SCRATCH FILTER ● CIRCUIT SHOWING COMPONENT VALUES INCLUDED ● POWER REQUIREMENTS — 24V DC.

POWER TRANSFORMER SALE

Modern types. Brand new.

Primary 240V 50Hz

No. 1. 0-12V. 1A	$2.95
No. 2. 0-18V. 1.8A	$3.95
No. 3. 12-0-12V. .5A	$2.50
No. 4. 0-38V. 2A	$4.95
No. 5. 34-0-34V. 1.5A	$4.50
No. 6. 0-240V. 60MA	$3.50
No. 7. 35-0-35V. .75A	$4.00
No. 8. 0-40V. 200MA	$1.75
No. 9. 0-20v .2A 6.3V. 1A	$2.50

P.P. NSW $2.50 INTERSTATE $3.50

HIGH GRADE POTTER AND BRUMFIELD RELAY

$3.50 P-P 95c

KU series ● 240 VAC 50Hz operation ● 3 sets of 240V 10 amp change over contacts ● perspex cover and mounting base included ● size 50mm x 37mm x 35mm ● ex-computer ● as new condition. At less than ⅓ of the normal price.

2SD200 = BU205 TRANSISTOR

NPN VCBO 1500V ● VCEO 700V ● 2.5 AMPS

4 FOR **$3.75** P-P 75c

555 TIMERS 10 FOR $3

CABINETS

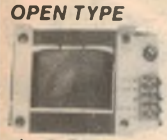
$22.95

P.P. NSW $4.50. V, SA, Q, T $5.50. WA, NT $6.50

Direct from a manufacturer of sophisticated electronics ● Fully moulded, hi-impact, heavy duty ABS plastic ● The colour is battleship grey ● Detachable U-shape top and bottom, front and back panels ● Front panel has cut-outs, and will easily accept a blank panel ● 4 jumbo countersunk plastic screws secure the 4 sections • Underside has ample ventilation, and dimples for rubber feet ● Dimensions 350mm (W) x 130mm (H) x 350mm (D) material 5mm thick. BRAND NEW PERFECTS. **PROFESSIONAL QUALITY**

● 240VAC 50Hz TO 115VAC 500VA. STEP-DOWN TRANSFORMERS ● Approved — Double Wound — Fuse Protected — 3 Types.

OPEN TYPE



$19.95
P-P. NSW. $7.50

END COVERS

$23.95
V. SA. Q. T. $11.50

FULLY ENCLOSED

$29.95
WA. NT. $15.50

!KEEP IT COOL! WITH EX-COMPUTER FAN MOTORS

Amps ● Power Supplies ● Electronic Equipment will operate far more efficiently ● Imp protected ● Excellent condition, perfect order guaranteed. 2 sizes — 3" and 4" 2 voltages — 115VAC 50/60HZ and 230VAC 50/60HZ

$8.95 EA

P.P. NSW $2.50
INTERSTATE $3.50

ATTENTION!! ELECTRONICS HOBBYISTS

BARGAIN BUY — BIG PCBs

EX-COMPUTER AND ELECTRONIC GEAR BOARDS CRAMMED WITH **USEFUL** COMPONENTS.

5 MIXED BOARDS FOR **$7** P-P NSW $2.50. INTERSTATE $3.50

PERSONAL SHOPPERS — WE HAVE A HUGE SELECTION OF PCBs TOO HEAVY FOR MAIL ORDER

GENUINE FACTORY PRICES

ETONE SPEAKER SPECIALS

Rugged top quality Aust made brand new bargains — all with factory warranty.

Model	Size	Cone Type	V/coil	Reson Hz	Freq Hz	Watts Rms	Price Ea	or	2 for
6110	30cm	Ribbed surround	8/15 Ohms	65	50-8000	30	$28.50	or	$49.95
6160	30cm	Twin cone	8 or 15 Ohms	65	50-15000	30	$29.50	or	$52.00
6180	30cm	Foam surround	8 Ohms	30	30-4000	60	$34.95	or	$64.00
4310	38cm	Straight surround	8-15 Ohms	45	40-6000	60	$63.00	or	$120.00
4510	38cm	Straight surround	8-15 Ohms	45	40-6000	100	$84.00	or	$156.00
4350	38cm	Hi-Fi	8-15 Ohms	30	30-4000	120	$63.00	or	$120.00

Pack — Postage add for one 30cm model. NSW $3.50. Interstate $5. For two 30cm models. NSW $5. Interstate $7. For one 38cm model. NSW $4.00. Interstate $6. For two 38cm models. NSW $7. Interstate $8.50.

LATEST DESIGN BLACK SEE-THROU

Speaker grill cloth material ● Knitted stretch jersey ● 1.5m wide.

NOT $25M

$9.50 MTR P-P $1.50

EA Magazine Holders

The binders and magazine holders are available over the counter from Electronics Australia, 57 Regent Street, Sydney, NSW — Price: $5.10 binders, $4.50 holders.

Mail orders should be sent to Electronics Australia, PO Box 163, Chippendale, NSW 2008.

Prices including postage are:

Holders: $5.50 NSW; $5.60 other states; or six for $29.00 NSW; $31.50 other states, $A33.00 NZ.

Binders: $7.00 NSW; $8.50 other states; or six for $33.00 NSW; $36.00 other states, $A37.00 NZ.

EA PC BOARDS AND FRONT PANELS

Some readers have problems obtaining PC boards and front panels for projects. Many of our advertisers sell these items and their advertisements should be checked in the first instance. Failing that, below is a list of firms which produce or sell PC boards and front panels.

NSW

Dick Smith Electronics,
125 York Street,
Sydney, 2000.
Telephone 290 3377.
DSE also has branches and resellers throughout Australia.

Electronic Agencies,
115-117 Parramatta Road,
Concord, 2137.
Telephone 745 3077.

117 York Street,
Sydney 2000.
Telephone 29 2098.

Jaycar Pty Ltd,
125 York Street,
Sydney 2000.
Telephone 264 6688.

Radio Despatch Service,
869 George Street,
Sydney 2000.
Telephone 211 0816.

RCS Radio Pty Ltd,
651 Forest Road,
Bexley, NSW 2207.
Telephone: 587 3491

VIC.

Rod Irving Electronics,
425 High Street,
Northcote, 3070.
Telephone 489 8131.

Kalextronics,
101 Burgundy Street,
Heidelberg 3084.
Telephone 743 1011.

Shop 11,
Regional Shopping Centre,
Melton 3338.
Telephone 743 1011.

Sunbury Printed Circuits,
Lot 14, Factory 3,
MacDougal Road,
Sunbury 3429.
Telephone 744 2714

Altronics,
105 Stirling Street,
Perth 6000.
Telephone 328 1599.

Jemal Products,
8/120 Briggs Street,
Welshpool, 6106.

N.Z.

Marday Services,
PO Box 19 189,
Avondale, Auckland.

Mini Tech Manufacturing Co Ltd,
PO Box 9194,
Newmarket.

Printed Circuits Limited,
PO Box 4248,
Christchurch.

SUBSCRIPTION SERVICE

Subscription Rates

$29.00 per year within Australia
$31.00 per year elsewhere

Make sure you receive every copy of the magazine by ordering it from your newsagent or the publisher. For publisher subscriptions post this coupon, with your remittance to Electronics Australia Subscription Dept, John Fairfax & Sons Ltd, GPO Box 506, Sydney 2001. Subscription will start with first available issue.

Name .....

Address .....

Postcode ..... **Enclosed is** ..... **for** ..... **years**

ADVERTISING INDEX

COLOUR GENIE

HERE TODAY? GONE TODAY!

Bertas International Pty. Ltd. would like to make an apology to the people who enquired about the Colour Genie home computer. Due to numerous complications we have decided not to pursue, further, the importing of the Colour Genie computer. However we may consider the upgraded Colour Genie due to be released around the end of this year!!!

Bertas International Pty. Ltd. is currently sourcing the Japanese market for a computer that will meet the requirements of the Australian market.

BERT TASSONI
MANAGING DIRECTOR,
BERTAS INTERNATIONAL PTY. LTD.

ELECTRONET®

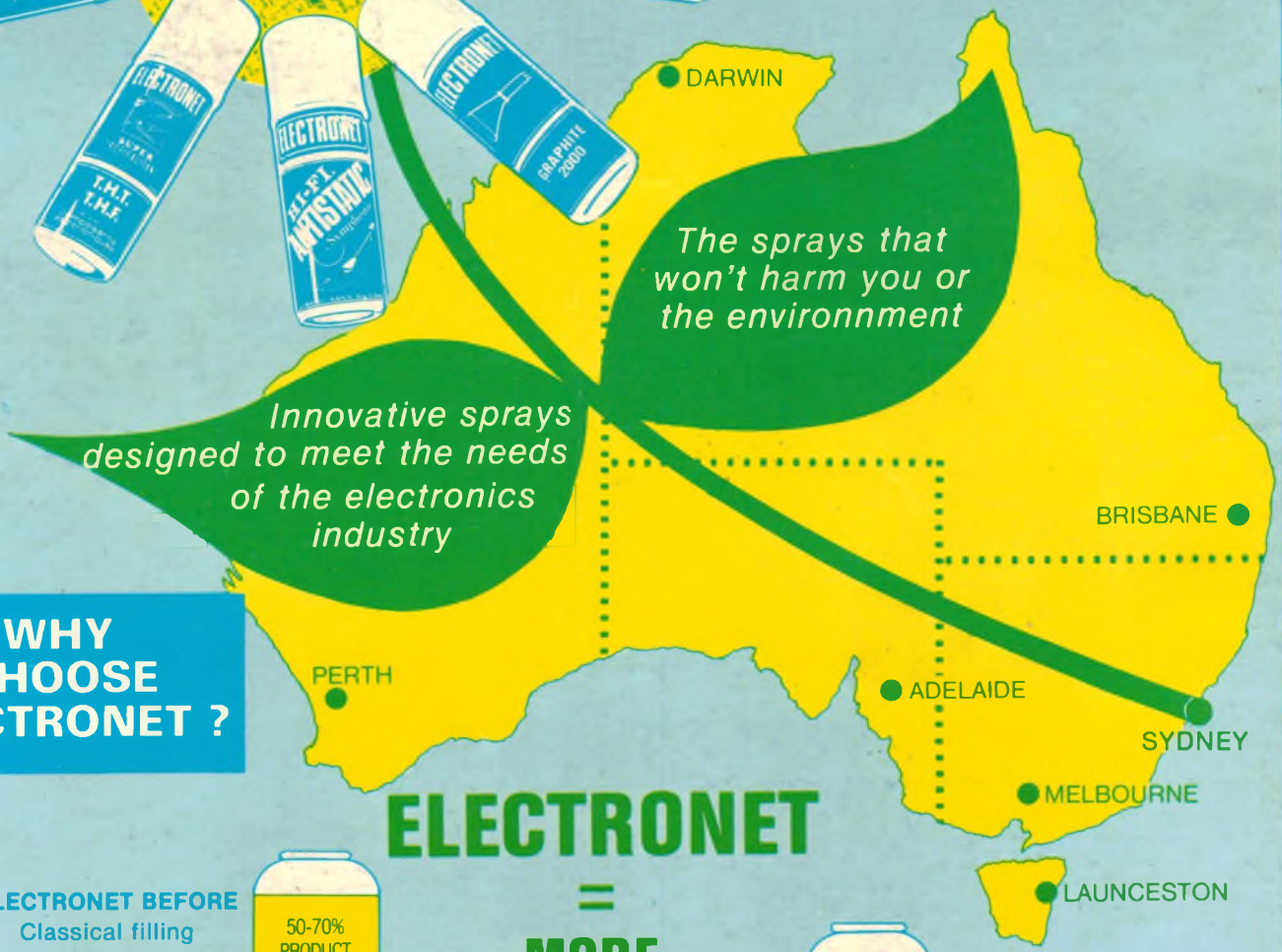
AEROSOL SPRAYS

ELECTRONET is competitively priced.

ELECTRONET is technically better.

ELECTRONET has passed the toughest swiss environment controls.

ELECTRONET is pressurized by nitrous oxide, the detail that makes the difference.



WHY CHOOSE ELECTRONET ?

ELECTRONET = MORE FOR LESS

ELECTRONET BEFORE
Classical filling
Propellent :
F 12, Butane
Propane

ELECTRONET NOW
New filling with nitrous oxide as propellent

AVAILABLE AT YOUR FAVOURITE RETAILER

ADISTA