FEB 1983 $2.35* NZ $2.75

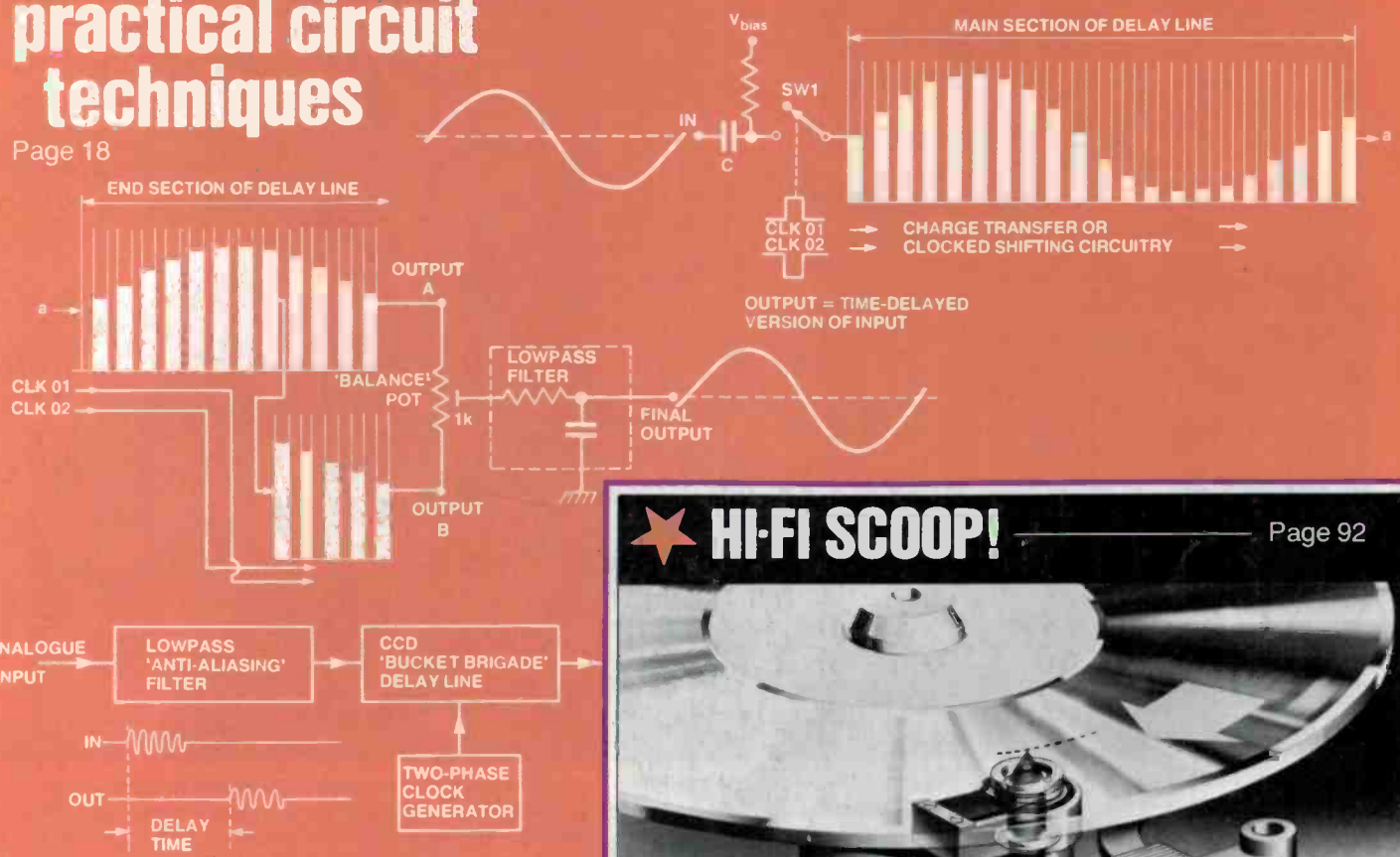
INSIDE ANOTHER RODIRVING ZIP-OUT MINI-CATALOGUE

eti ELECTRONICS TODAY INTERNATIONAL

ELECTRONIC AUDIO DELAY LINES

practical circuit techniques

Page 18



HI-FI SCOOP!

Page 92

Sony digital audio disc player – first review

MICRO BEE EPROM PROGRAMMER

simple, low cost

Page 45

ELECTRIC FENCE TESTER ~ beats 'grass roots' methods!

Page 33

Six more super programs for the '660 computer

Page 82

IF YOU'RE SWITCHED ON, THIS IS PARADISE.

Australia's Hornet. The cockpit contains the latest in the world. Enough electronics to keep any switched on enthusiast happy for years. The Hornet will form the backbone of Australia's Air Force. You can form the backbone of the people who will keep it in the air. Simply phone your Air Force Careers Adviser on Sydney 212 1011, Newcastle 25476, Wollongong 286492, Parramatta 635 1511, Canberra 822333, Melbourne 61 3731, Geelong 21 1588, Brisbane 226 2626, Townsville 724566, Adelaide 212 1455, Perth 3256222, Hobart 347077, Launceston 31 1005.

JOIN AUSTRALIA'S AIR FORCE.

Authorised by Director General Recruiting Dept. Defence.

RG6.FPC.52

advertisers

features

projects and technical

computing today

sight & sound

news

contests and special offers

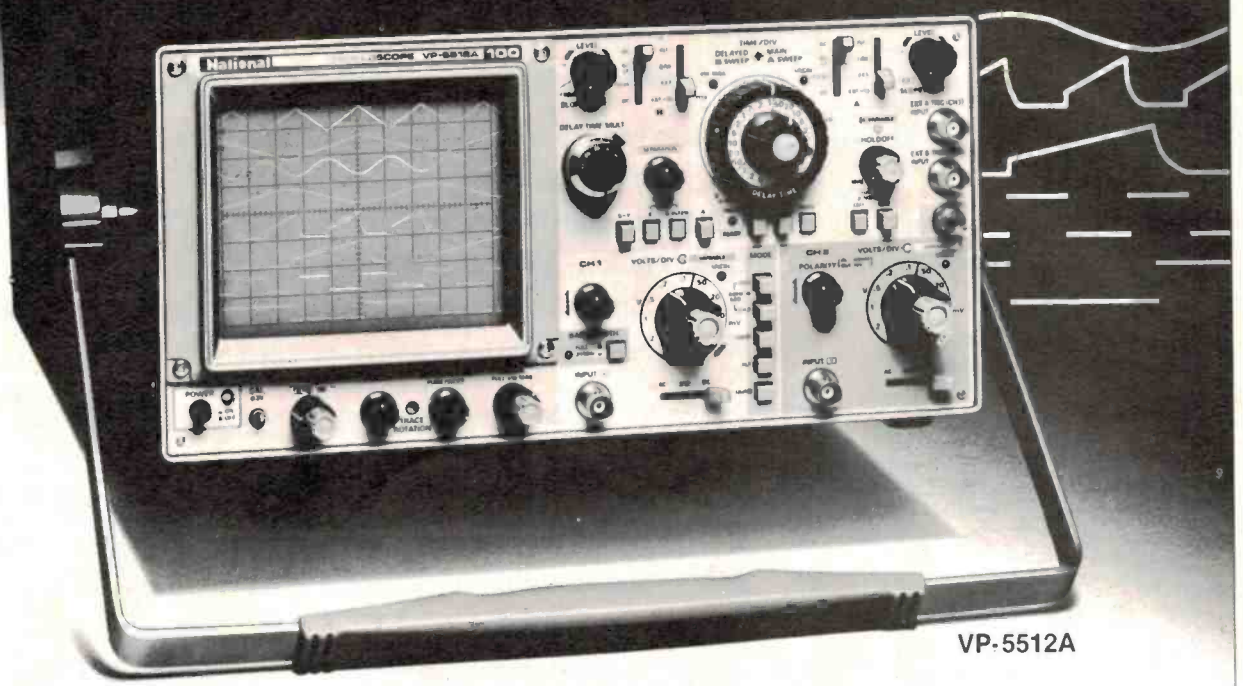
general

This month's cover features diagrams from the Circuit File article on Audio Delay Lines, page 18. The inset picture is from our review of the first digital audio disc player to arrive here, page 92.

Cover design: by Ali White

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

The National VP-5512A Pana Scope.



VP-5512A

We increased the range to 100MHz, the channels to 4 and the trace to 8, but you'd never know it from the price.

A Scope that does more and tells more

Here, for the bottom liner, is a scope that really performs! You get your 100MHz with an alternate sweep function in a compact package. You get a 4-channel, 8-trace format so that a large number of signals can be simultaneously observed with ease. And you not only watch 4 different kinds of waveforms at the same time but you also get measurements of phase differences in signals and their timing.

Features galore in a unit you can trust

And that's not all. Listen to these outstanding features: an Auto-Fix circuit for easy triggering, a National exclusive; bright, clear waveforms on an advanced domed-mesh CRT, a National speciality; 2mV/DIV sensitivity; 2 nSec/DIV maximum sweep rate; ±2% time axis accuracy; a TV sync separation circuit for video signals; variable hold-off function for trigger stabilization; alternate triggering; drift compensation; and more.

Ideal for lab, line or field service

You also get that world renowned National reliability in every National oscilloscope. We have, for example, reduced parts by one-quarter, which means, of course, less wiring and less failures. We have installed glass epoxy circuit boards which have far greater resistance to shock and heat. There is also a 15,000-hour MTBF (Mean Time Between Failures) rate, certainly one of the finest in the industry.

So the next time you're looking for a reliable scope that's been fully upgraded in range, channels and trace—everything, in fact, except price—remember the VP-5512A Pana Scope. From National.

VP-5234A
- DC-40MHz.
- 15,000 hours MTBF.
- Triggering waveform on CH 3.
- Auto-Fix and Hold-Off control.
- Delayed sweep.
- Alternate triggering function.
- TV sync separation circuit.

VP-5256A
- DC-60MHz.
- 15,000 hours MTBF.
- Alternate sweep function.
- Auto-Fix and Hold-Off control.
- Alternate triggering function.
- Triggering waveform on CH 3.
- Domed-mesh CRT with illuminated internal graticules.

PRICE: $2,200–
[& Sales Tax if applicable]

SCIENTIFIC DEVICES AUSTRALIA PTY. LTD.

2 JACKS ROAD, STH OAKLEIGH 3167. PHONE: 579 3622
31 HALSEY ROAD, ELIZABETH EAST, S.A. 5112. PHONE: 255 6575
35 - 37 HUME ST., CROWS NEST., N.S.W. 2065 PHONE: 43-5015

National

eti

Editor
Roger Harrison VK2ZTB

Technical Editor
David Tilbrook VK2YMI

Assistant Editor
Jennifer Whyte B. App. Sc.

Editorial Staff
Geoff Nicholls B.Sc./B.E.
Jonathan Scott
B.Sc./B.E. (Hons) VK2YBN
Jan Vernon B.A.

Draughting
David Currie

Advertising Production
John Gerrie

Advertising Sales
Bob Taylor (Group Manager)
John Whalen (National)

Art Staff
Ali White B.A.
Bill Crump
Githa Pilbrow

Typesetting
Julie Hewlett

Reader Services
Jane Nicholls

Managing Editor
Collyn Rivers

Acoustical Consultants
Louis Challis & Associates

Editorial and Sales Office
4th Floor, 15 Boundary St,
Rushcutters Bay NSW 2011
Ph: (02)268-9015; Tlx: 27243

Melbourne: Virginia Salmon and Mel Godfrey, 150 Lonsdale St, Melbourne Vic. 3000. Ph: 662-1222; Tlx AA34340.

Adelaide: Admedia Group, 24 Kensington Rd, Rose Park SA 5067. Ph: 332-8144; Tlx AA82182.

Brisbane: Geoff Horne Agencies, 16 Bellbowrie Centre, Bellbowrie Qld 4070. Ph: 202-6813.

Perth: C. Thomas, Adrep Advertising WA 6000. Ph: 325-6395; Tlx ADREP PERTH

New Zealand: Frank Hargreaves, Circulation Marketing Manager, c/- ACP, 4th Floor, Sun Alliance House, 42-44 Shortland St, Auckland. Ph: (9)30311.

United Kingdom: Australian Consolidated Press, Ludgate House, 107 Fleet St, London EC4A 2AL. Ph: 353-1040; Tlx: 267163.

Japan: Genzo Uchida, Bancho Media Services, 15 Sanyeicho, Shin Juku-Ku, Tokyo 160. Ph: 359-8866; Cable: Elbanchorito; Tlx: BMSINC J25472 Tokyo.

USA: Australian Consolidated Press, 21 East 40th Street, (Floor 23), New York NY 10016. Phone: (212)685-9570.

Electronics Today International is published by Murray Publishers Pty Ltd, 15 Boundary St, Rushcutters Bay NSW 2011. This issue was printed by Offset Alpine, cnr Wetherill and Derby Sts, Silverwater NSW, and distributed by Network.

* Recommended retail price only

comment

We are entering a new era in sound reproduction technology. The digital audio disc is a commercial reality. Discs and players will be on sale here in six weeks or so (maybe less!).

It has been a decade in coming and a lot was 'promised' along the way. But, having heard it, I can say the performance certainly lives up to the promises. Where musical performances have been digitally recorded and transferred to digital disc, the lack of background noise is immediately apparent and the dynamic range positively breathtaking. The clarity and imaging has to be heard to be believed.

I can remember, as a boy, my first hearing stereo sound. Two Sydney AM broadcast stations cooperated in Australia's first public stereo broadcast. The family set up two 'wirelesses' to hear it. The stations played all the gimmicks of the time (a ping-pong game, trains rushing past etc) as well as musical selections. I was spellbound. Some short time later I heard my first stereo microgroove recording on what was then regarded as hi-fi equipment and was even more amazed.

Upon hearing my first digital disc demonstration (courtesy of Technics in Japan last June) I hardly believed what I heard. Then, upon hearing the Sony and Philips systems demonstrated late last year I once again experienced that boyhood amazement.

It will be another decade before there's a DAD player in every home, just as it took a decade or more for the 33⅓ rpm microgroove disc to oust 78s.

The microgroove disc (and stereo) had an impact on every piece of equipment in the sound reproduction chain. I guess we can expect the digital audio disc to do the same for this generation of audio equipment. For audio technology, the next decade should prove interesting indeed.

Roger Harrison
Editor

services

Technical enquiries: We can only answer readers' technical enquiries by **telephone after 4.30 pm Mondays to Thursdays.** The technical enquiry number is: **(02)33-5669.** Technical enquiries by mail must be accompanied by a stamped, self-addressed envelope. There is no charge. We can only answer queries relating to projects and articles as published. We cannot advise on modifications, other than errata or addenda. We try to answer letters as soon as possible. Difficult questions may take some time to answer.

General enquiries: For enquiries about back issues, photostats of articles, artwork or submitting articles, call **(02)268-9015** or write to the address on this page.

The publisher accepts no responsibility for unsolicited manuscripts, illustrations or photographic material.

next month

CIRCUIT FILE: SCRS, TRIACS & POWER CONTROL

This article is the first of a two-part Circuit File explaining the basic principles and applications of SCRs and Triacs. If these devices are unfamiliar to you, don't miss it!

NICAD 'FLOAT' CHARGER

There is more to charging NiCad batteries than meets the eye. There are controlled current chargers, trickle chargers and fast chargers. Controlled current and trickle chargers will never damage a NiCad but won't bring it to full charge within a reasonable time either. Fast chargers (like the ETI-563) are bulky and cost more money. This NiCad 'Float' Charger provides a happy medium. It's cheap, simple to build and will bring a battery to full charge from complete discharge in 12 hours, then keep it there. And your NiCads are safe from overcharging damage.

GENERAL PURPOSE INTERFACE FOR THE APPLE II

Designed to plug into one of the Apple's 'slots', this board has one analogue input, one analogue output, eight digital inputs and eight digital outputs. You can use it to connect your Apple to computer peripherals, electronic instruments and science experiments. Applications include: controlling a Tasman Turtle Robot, automatic control of a slot car, driving a printer, reading a DVM or recording a potentiometer connected to a physics experiment. Plug in your Apple to the real world!

COLOUR CLOCKS FOR TANDY'S "COCO"

Sorry, but we've had to hold this one over from this issue. Making good use of the Tandy Color Computer graphics and powerful extended BASIC commands, two clock programs are presented. Your grandfather never saw clocks like these!

CHIP 8 CHARACTER GEN. & VIDEO TYPEWRITER

Another gem from Frank Rees for CHIP 8 fans, whether you own a COSMAC, a '660 or whatever. With a small 'character generator' routine combined with a short 'video typewriter' program, you can write messages on screen by typing in an appropriate set of tokens. Combine this with your own programs and you've got a powerful message generator.

SHURE V15 TYPE V CARTRIDGE REVIEW

Facing imminent threat from the digital audio disc, Shure have risen to the task of developing their V15 series cartridge to the utmost and produced a fine product with superlative performance. There's lots of life in the microgroove yet!

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

RED HOT SPECIALS

OVER 500 CERAMICS – 5 BUCKS!!!

Not your Asian rubbish either! Quality made in the USA, military grade units made by Corning. These devices are basically military style CK-12 devices (MIL-C-39012). They are very small, axial and are 10% tolerance. Values are mixed but range from 82pF thru to 0.022uF. They are very stable, long life units that sold in quantities to military contractors for up to 60 cents each. This offer represents outstanding value for money. Hey! Ceramics less than 1 cent each!!!

☆ ☆ ☆ **$5**

OVER 100 TANTALUMS – 5 BUCKS!!!

Once again, mil spec devices. Tiny long life and very high quality made in the USA by Corning.
We do not have many packs so hurry!!
Limit of 2 packs per customer.
Once again, less than 5 cents each!!

☆ ☆ ☆ **$5**

EA SOUND PRESSURE LEVEL METER

We have a small quantity of the EA Sound Pressure Level Meter PCB (81Sp5) & the pre-punched Scotchcal front panel to suit. For the month of Feb. only you can have the pair for $2.95 Normally the PCb alone sells for this.

☆ ☆ **$2.95**

JUMBO SPAGHETTI PACK

Genuine P.V.C. Spaghetti tubing. Always handy. From ½mm I.D. through to 13mm. Over 20m in all!!! Many colours. ONLY $3.50

JUMBO HEATSHRINK TUBING PACK

Amazing value. A huge bag of lengths of Heatshrink sleeving. At least 5 different colours in sleeving ranging from 3mm Ø to 32mm Ø. You will probably never need to buy heatshrink again.

ONLY $3.50

UGLY MES LAMP BEZELS

We cannot win. At one stage we had thousands of these. We slowly sold them off to manufacturers who somehow or other needed a bright panel mount pilot lamp. You know the lamp we mean. It takes a torch globe & has a glass multi-facet lens that looks like a cheap piece of costume jewellery Kitsch electronics. We recently bought a large consignment of manufacturers stock. You guessed it. We got em back! But at least they didn't cost much. Any redeeming features? Yes, they are well made & you can change the globe from the front panel.
$2 will get you 10 (mixed colours)
No other deals.

$2

½ KILO CAPACITORS

Staggering. Probably one of the greatest bargains we have seen.
Each bag contains: Electros, Ceramics, Styros, Greencaps, other plastic capacitors, Micas etc. We don't even know why we are doing this! No, we aren't giving away two 1950 style electro's at 250g each, it is not a con. You will (on average) get over 200 capacitors! Unfortunately, if you order this on its own we must charge $2.00 p&p – below cost anyway. Limit 1 per customer.

☆ ☆ **$4**

You don't think sometimes. We saw these in an obscure part of our warehouse some time ago but did not think much about them. After idly playing with one on his bench one day our technician realised how fantastic they actually were. He'd dreamed of such a component in the past but never really thought that they were made. Basically this all metal device is a stereo 6.5mm (¼") jack. When a plug is inserted, however TWO SEPARATE single pole single throw switch contacts are opened. The switched contacts are isolated from the signal. Just imagine you can actually turn the appliance on and off simply by plugging in! No need for a separate switch! (Note that the contacts are normally closed and go open when a plug is inserted). Such a component would normally sell for about $2.95.

THE ULTIMATE $1.00 6.5mm SOCKET??

(Limit 5 per customer).

☆

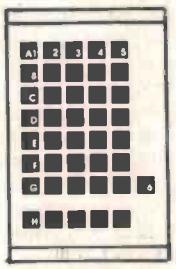
4116 RAMs 150nS – GOING CHEAP

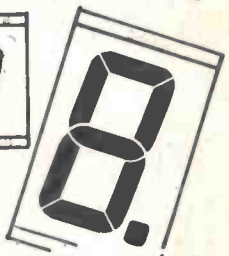
We have secured a quantity of 4116 (150nS) RAMs at a price which means great savings to you.
Why are they cheap? Well they don't actually have '4116' branded on them. They have '9016 FPC' on their little backs. They are used in a well known TV-game computer and this is the 'House Number' for their 4116. If you have ever had to buy a non-standard replacement part you will know that the 'House Number' part can be VERY expensive. We don't want to sell them as 9016 FPC's we want to sell them as 4116's – and at a great price. The normal (i.e. lower than most) price for our 250nS 4116 is $2.50 You can grab a 9016 FPC (150nS) 1-off for only $1.95!!!
For larger quantities see below:

This price includes sales tax!!

1-9 pcs	$1.95
10-24 pcs	$1.85
25-99 pcs	$1.75
100+	$1.65

LIQUID CRYSTAL DISPLAY





☆ ☆ ☆ ☆ ☆

LCD's from less than a dollar each!!!
We have over 50 different types of LCD Displays. They range from 10mm high 6 digit displays to 75mm high single alphanumerics in both transmission and reflective styles.
In our January ads we said that we would have a list with each type and a description. Quite frankly, we did not have the time and space to do this. We are going to offer you an even better deal instead. TWO deals in fact.
DEAL 1 – You send $3.95 (plus p&p) and we send you THREE LCD Displays. That's right, made in the USA high quality displays for around $1.30 each. You will get 3 different displays. They could be alphanumeric (up to 3" high), dot matrix, or multi-segment numeric or – whatever!! The data manual with pin connections for most types will cost you another 50 cents.
DEAL 2 – You send $9.95 (plus p&p) and we send you TEN (10) LCD Displays. Some will be the same but most of you will see this as a benefit. You get the connection manual for ziltch.

HIGH QUALITY BARGAIN

Multimeter

MOVEMENT	– 8.7uA super high sensitivity meter
DC VOLTS	– 6 ranges 0.5 · 2.5 · 10 · 50 · 250 · 1000 Input Resistance – 100K ohms per volt Accuracy – ±3% of full scale all DC ranges except 1000V ±4%
AC VOLTS	– 5 ranges 2.5 · 10 · 50 · 250 · 1000 Input Resistance – 10K ohms/V Accuracy – ±4% of full scale all AC ranges
DC AMPS	– 6 ranges 10u · 500u · 5m · 50m · 500m · 10A Accuracy – ±3% of full scale all DC ranges except 10A ±4%
AC AMPS	– 1 range 10A ±4%
OHMS	– 5 ranges RX1 · RX10 · RX1000 · RX10k · RX100k (13 ohm mid scale) RX1 – 0 · 1k RX10 – 0 · 10k RX100 – 0 · 1M RX1k – 0 · 10M RX10k – 0 · 100M Accuracy – ±3% of DC scale with full battery
FUNCTION SWITCH	+DC · ohms · AC, –DC, DC A, AC A, (+)V · ohm · A, ( )COM, AC 1kV, DC 1kV, DC & AC 10A
SIZE	135(h) x 172(w) x 86(d)
WEIGHT	1.27 kg

Incredible value for a high quality Analogue unit. We have secured a small quantity (less than 100) of the "STANDARD" ST-100 HNU Multimeter. This very same unit sells 'trade' for $72 + tax under a different name. Even if you could get it for $72 including tax you would be doing well. Our Price? Check the specs first.

ONLY ~ $59.95

THIS MONTH ONLY

HANIMEX

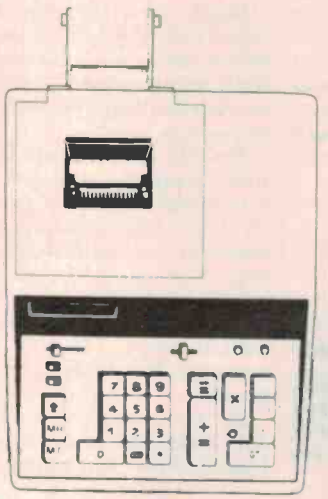
PRINTING CALCULATOR
– MASSIVE PRICE BREAKTHROUGH

- Quality Hanimex Brand Model MC 1500P
- 12 Digits, (12 Digit Print Plus D.P. Comma & Two Symbols)
- Seiko Printer
- Uses Standard Plain Paper Rolls (not expensive and hard to get Aluminium coated paper)
- Floating or Fixed Decimal Point
- Selectable % Mode, & most of the usual features found in machines costing well over $100!!
- A Real Accountant's Special
- Weighs over 3Kg!!
- Roll of Paper Supplied – available virtually everywhere.

Staggering Value

$59.50

WE ONLY HAVE A SMALL QUANTITY OF THESE UNITS.
STRICTLY ONE PER CUSTOMER



28 pin IC skt.

We're stocked to the rafters with 28 pin IC sockets. What to do? Slash the price to clear them of course!
They are quality sockets made by Robinson Nugent of the USA. Each socket features tapered guides for unaligned pins and is a low profile design. The pins are tin plated. Normally we sell 28 pin sockets for 60 cents each, however for FEBRUARY ONLY you pay only 30 cents each!
(Minimum 10 sockets) but there's no limit. So Hurry!!

30¢ each min. 10

Stop ** Press

Disco strobes. 240V Mains powered. Not a kit. Built in a woodgrain (walnut) cabinet measuring 150 x 150 x 120mm. High efficiency wide angle reflector. 0 - 12 flashes per second fully variable. But that is no big deal. The big deal is the price.
NORMALLY $36.50
BUT because we get desperate in February ONLY $12.50 each!!

ALMOST 2/3 OFF!!
(Goods are brand new but reworked Q.C. controlled stock) . . . . . .

$12.50 Normally $36.50

POT PACKS *

Guess what? We've made more of these very popular packs.
In EA and ETI August last year we advertised packs of high quality European manufactured potentiometers. They sold quickly and we asked the question at the time "Will pots ever be this cheap again?" Guess what. We've done it. They are now EVEN CHEAPER than August 1982!

FAR CHEAPER IN FACT!!

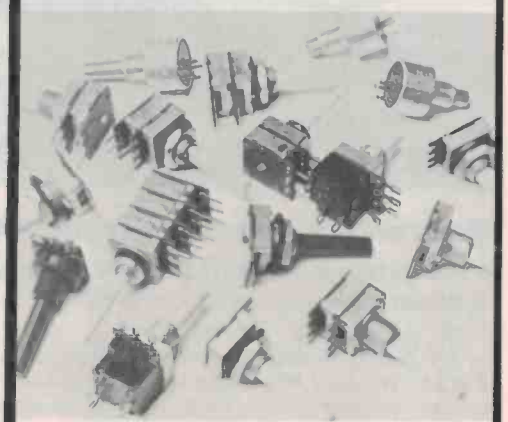
PACK No. 1 – Last year you got 50 assorted pots in this pack. This year you get over 75 pots for the same price. That works out at around 13 cents a potentiometer!

COST OF PACK – $9.95
Sorry p&p on this is $2.50

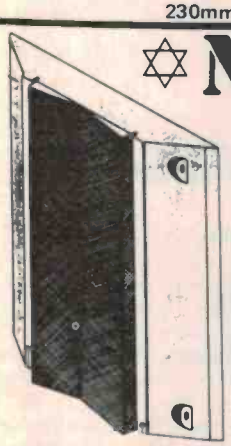
PACK No. 2 – This pack was selling fast when it contained 120 assorted pots. NOW it contains 200 potentiometers.

COST OF PACK – $19.95
WOW! Less than 10 cents per pot!
Sorry, p&p $4.50

NOTE: Each pack contains the same style of pot which includes: Single gang, dual gang, switched, unswitched, in log and linear. All pots have plain shafts to take grubscrew knob and most have a flat on the shaft. They have either PCB or solder eyelet terminals. They are brand new stock.



NEW



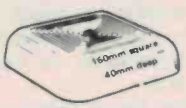
STAGGERING VALUE

$22

EACH
NORMALLY $2[illegible]

Motorola twin element, controlled dispersion High Performance Line Source Tweeter. Model KSN1071A.
• Designed for flush mounting. No large holes to bore. • Less than 19mm deep will fit behind most grille panels. • Great in hot cars (Guaranteed unaffected at 99 degees Centigrade!) • Sensitivity 98dB @ 2.8 volts ½ metre • No need for a cross-over network • Response 4 - 40kHz (± 3dB) • Attractive built-in grille.

Smoke Detector



GE SMOKE & BURGLAR ALARM
The response to these products has been staggering. As a result we have virtually ran out of stock. If you still want one of these units, ring first, we may still have a few left.

Jaycar

NUMBER 1 FOR KITS

125 YORK STREET, SYDNEY 2000
PHONE: 264 6688 TELEX: 72293
"NEVILLES CORNER"
Cnr. CARLINGFORD & PENNANT HILLS ROAD,
CARLINGFORD
PHONE: 872 4422 or 872 4444
MAIL ORDERS TO: 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 up ($8.00)

NEW SHOP HOURS
Mon – Fri 8.30 to 5.30pm
Sat 8.30 to 12.00pm
Thurs night to 8.30pm

Mail Order By BANKCARD
Via Your Phone

Professional engineering is a career for women

A vocational video program to promote career opportunities for women in professional engineering is now available for use as a part of careers education for young women from Year Nine onwards.

The program, called 'Women in Professional Engineering', features eight women who chose professional engineering as a career. They are working in chemical, acoustical, corrosion, traffic and electrical engineering.

Speaking at the launching of the program in Melbourne the Minister for Employment and Industrial Relations, Mr. Ian Macphee said, "Socially and economically it is unacceptable to modern Australian thinkers to allow segregation of the labour market."

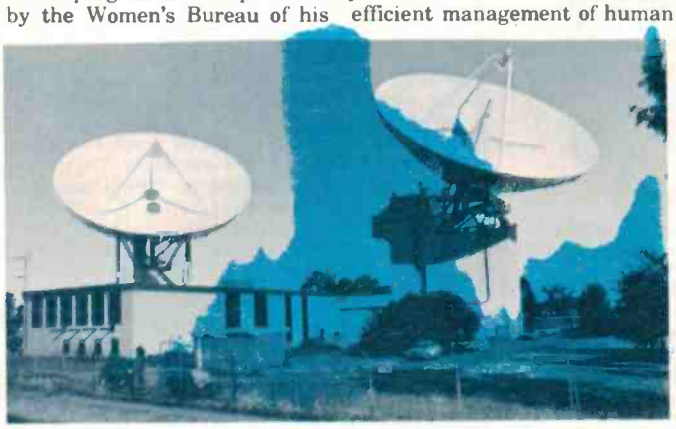
The programme was produced by the Women's Bureau of his Department, with sponsorship from ESSO Australia and Telecom.

"The concentration of women into a relatively narrow range of occupations is one reason why the unemployment rate of young women is higher than that of young men," said Mr. Macphee. He said that the federal government was firmly committed to equal opportunity in employment for all Australians and regarded the segregated labour market as unnecessary and undesirable.

"Equal employment opportunity is not just a matter of social justice. It is a matter of the efficient management of human resources. It is a matter of selecting the best person for the job, a task that will be harder if the pool of possible talent is restricted.

"Any profession is missing out if it is barring fifty percent of the population." Mr. Macphee pointed out that of the 36 000 members of the Institution of Engineers, only 242 were women.

Australia compared unfavourably with some other countries in this respect. In Australia only about 0.5 percent of our engineers are women while in the United Kingdom and the United States the figure is around ten percent, and in some eastern European countries it is 30 percent or more.



New satellite earth station at Moree

A new $11m satellite earth station antenna at Moree in northern NSW was opened on November 3, 1982.

The dish antenna, the second at OTC's Moree satellite earth station, provides telecommunications services via a Pacific Ocean satellite to North America, New Zealand, South East Asia, Japan and other destinations.

Called Moree 2, the antenna was built to cope with the increased demand for overseas telecommunications, which, in Australia, is growing at about 25% a year. Communications received by the new antenna are carried by co-axial cable and microwave links to OTC's international terminals at Paddington and Broadway in Sydney, from where they are distributed throughout Australia.

Moree 2 and Moree 1, by operating to separate INTELSAT satellites, will offer route diversity in the Pacific Ocean region. Further diversity is provided by OTC's cable links across the Pacific.

The new antenna has been designed to accommodate dual polarisation — a method of frequency re-use which makes more efficient use of the frequency spectrum by almost doubling its capacity. The latest INTELSAT satellites use this technology.

Vicom Sydney moves

Vicom's Sydney office is now located at Milsons Point.

The new location is 6th Floor, Eagle House, 118 Alfred Street, Milsons Point NSW 2061. (02)436-2766. Tlx AA70619.

Wrist strap eliminates static

Static discharge from the human body, the biggest static risk to electronic and computer parts, can be eliminated with a new wrist strap from 3M Australia.

People have the capacity to retain thousands of volts on their bodies and so are a big threat to static sensitive devices when they are handled during manufacture and service.

The 3M 2066 'Charge-Guard' wrist strap is a reliable way of earthing assemblers and technicians. It has a washable nylon band and coiled ground cord 1.5 m long. The lining of continuous stainless steel filaments, woven into the polyester, are in contact with the skin. The 2066 strap gives less than 10M resistance to ground.

For more information contact **3M Australia, P.O. Box 99, Pymble NSW 2073. (02)498-0033.**

Voice-controlled robots on the march

A new generation of at least six different types of robots able to respond to spoken orders are expected to be ready in Britain by July.

They will be the product of a major competition launched in London by the British Computer Society. Under its guidance, technicians taking diploma courses at UK colleges and polytechnics have produced plans for a crop of robots which can be both re-programmed and ordered to perform tasks by human voice control.

The design teams, which each consist of up to eight people, have already produced their plans and the six designs said to have the greatest potential have been chosen. These robots will be built and developed in readiness for the final in July.

In the final, to be judged by top experts, the robots will be required to carry out both placing and stacking duties in response to voice commands from their operators. The ability to get a robot to respond to the human voice is proving one of the biggest tests for scientists and engineers. No two voices are the same in pitch or volume and it is much easier to give the robot a voice through a synthesiser than to produce a robot 'brain' able to act on the voice of its operator.

Altec Lansing speakers to orbit

Altec Lansing is providing loudspeaker compression drivers as part of an upcoming NASA space shuttle mission.

The Altec loudspeakers are part of an experiment being conducted by researchers at the Jet Propulsion Laboratory in Pasadena, US. Three Altec Lansing 908-8A high frequency compression drivers will be used in an acoustic containerless processing experiment involving the melting and recooling of experimental glass under zero-gravity conditions on board the shuttle.

The three 30 W, 7/8" throat Altec loudspeaker drivers are mounted to specially designed sound waveguides attached to the sides of a small, rectangular heating chamber. Once the shuttle is in orbit, the glass to be melted will be 'levitated', or suspended, at the center of the chamber by sound waves generated by the drivers. As the chamber and glass sample are heated to over 600°C, a video camera will record the behavior of the sample throughout the two hour experiment.

The 2.5 to 5.5 kHz tones generated by each Altec driver will produce a sound pressure level of 140 dB within the chamber.

New satellite radio beacon

A new type of life-saver for ships at sea, a radio beacon that automatically beams its message via satellite to shore, is expected to emerge from tests nearing completion in Spain.

Several nations are working towards development of the device, known as a satellite Emergency Position-Indicating Radio Beacon (EPIRB), which would be built to internationally agreed specifications.

Experimenters from the USSR, US, UK, Norway and Federal Republic of Germany have developed satellite EPIRB systems in their own countries. They are now comparing and evaluating them in a demanding series of tests, using a channel simulator developed by the German Aerospace Research Establishment, at the European Space Agency tracking station near Madrid.

Most countries are expected to make it mandatory for all ocean-going vessels to carry such satellite EPIRBs in the 1990s. The radio beacon would send a distress message to the appropriate rescue authorities indicating where the signal orientated, the ship involved and the nature of the distress. Within a few minutes, rescue authorities would have the message processed so that they could direct other ships or aircraft to the vessel in distress.

Electromagnetic interference limits

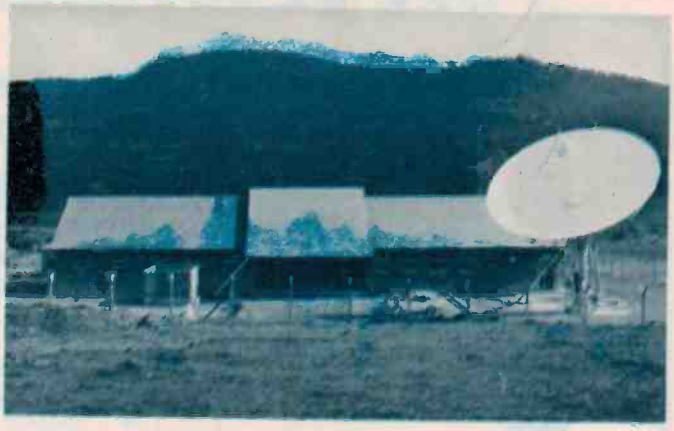
The Standards Association of Australia has published a standard dealing with electromagnetic interference limits related to motor vehicle ignition.

AS 2557 was requested by the Department of Communications, supported by Telecom and Road Transport Authorities. It covers only spark type ignition and not other sources of interference from motor vehicles and similar equipment.

The reason for the standard is to limit interference to motor vehicle-based communication systems and roadside vehicle control systems and to permit the detection from the roadside of offending vehicles.

The benefit of this standard to the average consumer will be less interference to communication systems such as land mobile radio and public automatic mobile telephone services, from motor vehicles. There will also be less interference to broadcast reception in dwellings and shops adjacent to heavy traffic concentrations.

Copies of AS 2557 can be purchased from any SAA office at a cost of $5.80 plus $1.25 postage and handling charge.



Satellite link for Nepal

The Sagarmatha Intelsat Earth Station near Kathmandu, Nepal, was built by Marconi Communication Systems to allow Nepal to develop its contacts with the outside world which, up to now, have been provided by HF radio through India.

The project took nearly two years to complete under difficult circumstances. Marconi was responsible for provision of the earth station buildings and antenna foundations, manufacture, installation and testing of the communications equipment, both at the earth station and at the International Telephone Exchange in Kathmundu and provision of the antenna and the microwave radio system linking the earth station with Kathmundu.

Marconi also provided a full training programme for the Nepalese engineers and technicians who will be responsible for running the site. A Marconi engineer will provide assistance to the local staff for the first year of the earth station operation.

Nepal now has a facility that can ultimately provide 60 channels for direct communication via telephone and telex and can be expanded to include TV.

Played golf with your watch lately?

I bet sometimes you've said to yourself, after an exhausting, frustrating day on the golf course, that life wasn't meant to be easy.

If the sun was too hot, the golf course too crowded, that new motorised buggy you want to buy is just too expensive and you still aren't a member of that exclusive club, then give it all up. Throw away that telescopic ball retriever, give up worrying about getting your new wet-weather gear wet, forget about sandy bunkers and watery hazzards ... and play golf with your own watch!

The watch you can play golf with, the Golf Game Cassio, or GG-9, is now available in Hong Kong, and they say you'll really feel like you're on the fairway.

The instructions take a bit of getting into and could be enough to send you back to a real fairway with rain and sandy bunkers a pleasure in comparison. '... When you start the game a display comes up reading '9H: P36' which means the game consists of 9 holes/36 strokes at par. Then the display changes to the highest score achieved by the previous player and next appears 'H1: 04' telling you that you are at the first hole par 4. And then you see '350 00' which means that you are 350 metres away from the first hole and no shot has yet been made ...'

And so it goes on. By the time you've waded through the instructions you'll be too exhausted to push the correct buttons. But once you've mastered the directions just think how practical this Golf Watch actually is. You can play it seven days a week, at any time of the day or night, and you will never get wet ... unless you play it in the bath and it doesn't say whether it is waterproof.

The GG-9 has an alarm and even tells the time so what more could you want for $20.

Tech-Sales to distribute Solartron products

Tech-Sales Pty Ltd, a fully owned subsidiary of Tech-Rentals, was recently formed to represent both Solartron and Weston products exclusively in Australia. Solartron, a UK based company, and Weston, based in the USA, are part of the Schlumberger Organisation.

Tech-Sales, with a team of specialist engineers, has a range of products which includes instrumentation for measurement in the fields of dynamic analysis, data logging, precision voltage measurement, logic test and spectrum analysis. It also has digital and analogue power meters and analogue temperature gauges.

The Solartron 7045 DMM offers 4½-digit measurements. It is a portable unit featuring ac voltage and current, dc voltage and current, resistance, temperature and range hold and display hold facilities.

The Solartron 7150, a 6½-digit systems voltmeter, is capable of measuring dc and ac volts, dc and ac current and two or four terminal resistance. It also features automatic null and selectable digital filter with an accuracy for dc volts of 0.002% and for ac volts of 0.004%. It retails at around $1600.

The Solartron 7201, a digital fault locator, offers signature and trace analysis, event/transition counting, period width and relative timing, frequency measurement and digital multimeter functions.

For further information on the products available contact **Nigel Gamblin, Applications Engineer, Tech-Sales, 83-87 Wellington St, Windsor Vic. 3181. (03)51-1306.**

Fully automatic distortion analyser from 5 Hz — 1 MHz

The new Krohn-Hite Model 6900 provides auto frequency nulling and auto level setting that lets you make fast and error free measurement of distortion or ac voltage over a frequency of 5 Hz to 1 MHz.

Total harmonic distortion (THD) is displayed on an auto-ranging digital display. THD measurements from 0.005% to 19.9% with resolution of 0.001% and input levels from 100 mV to 130 V RMS are as simple as connecting the signal to the input terminal.

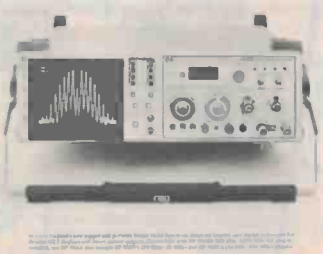
A distortion output is provided for visual inspection of the input signal after the fundamental frequency has been filtered out. An analogue output provides a dc voltage proportional to the percent distortion displayed. An ultra-low distortion sine wave (0.003%) output is provided for use as a standard to test linearity of components or system distortion characteristics.

Warburton Franki Ltd can be contacted at **372 Eastern Valley Way, Chatswood NSW 2067. (02)407-3261.**

Portable spectrum analyser display

New from Hewlett-Packard is the Model 853A spectrum analyser display. It is a robust, portable mainframe incorporating a digital display system for use with HP's series of spectrum analyser plug-ins covering from 10 kHz to 21 GHz.

The HP 853A provides two independent 480- by 800-point resolution traces offering the user flexibility to store trace data yet still monitor signal changes. It also includes 'Maximum Hold', which facilitates measurements such as signal drift, and 'Digital Averaging' to extract low-level signals from noise without sacrificing sweep speed.



'Normalisation' (or 'Trace Arithmetic') simplifies observation of signal changes within a crowded spectrum or removes system frequency response when using a tracking generator to make stimulus/response measurements. 'Direct Plotter Dump' capability permits both trace and graticule information to be plotted directly on an HP-IB digital plotter via push buttons on the HP 853A front panel.

Should a permanent record of many displays or a comparison and tabulation of data be required, the HP 853A's HP-IB port can be connected to a controller. In addition to trace data recording, other possibilities in this mode include drawing test limits and providing operator prompts on the analyser CRT.

HP offers three RF plug-ins for the HP 853A mainframe: HP 8557A, 10 kHz — 350 MHz; HP 8558B, 100 kHz — 1500 MHz; HP 8559A, 10 MHz — 21 GHz. Existing HP 8557/8558/8559 plug-ins require only a simple, field-installable modification for full compatibility with the new HP 853A mainframe.

For further information contact **Hewlett-Packard Australia Ltd, 31-41 Joseph St, Blackburn Vic. 3130. (03)890-6351.**

SEE PAGE 15

THE DIRECT IMPORTER SAVES

FREE MANUAL

WITH THE EVER POPULAR

OVER 2000 SOLD

SUPER 80 COMPUTER KIT Cat K-3600

NOW ONLY **$245**

A powerfull computer you build yourself - you are supplied with everything : including power-on monitor EPROM, 16k of RAM, cassette interface (relay activated), power supply including transformer, TV modulator and direct video output PLUS full size professional keyboard - not a 'feel less' toy.

● RAM expansion up to 48K on board ● S-100 expansion on board ● Room for further development on board ● Keyboard mounted on board – or fully detachable.

OPTIONAL EXTRAS

BASIC interpreter(tape)(K-3602)$12.50 • BASIC in EPROM (K-3604)$50.75 • IC Socket Set (K-3603) $13.25 • Lower Case Generator (K-3607)$50.50 • S-100 Expansion Unit (K-3606)$21.00 • Metal Case (H-3200)$41.25 • Debug/Disasembler for Super 80 (X-3790)$29.50 • Editor-Assembler for Super 80(X-(X-3791)$29.50

SUPER 80 TECHNICAL MANUAL

All the information of the 'works' available for all Super 80 builders. (B-3600) FREE with Super 80

MORE SCAN FOR YOUR DOLLAR!

The brilliant Dick Smith

PRO 40 SCANNER

Compare this superb Scanner with others of similar performance elsewhere, at nearly twice the price! The new PRO 40 Scanner from Dick Smith represents the state-of-the-art in computerised scanning receivers! Completely solid state computer – controlled circuitry – no expensive crystals to buy – complete with backup battery for stored frequencies.

YOU CAN HEAR . . .

Just about everything from harbour control nudging a supertanker into its berth, to telelphone conversations from cars speeding along city streets! All the emergency service, authorities and forces . . . And of course there are thousands of business radio stations, amateur and CB radio operators. Plus the thousands of stations in the band that we don't know about yet (we're waiting for you to tell us about them!) Cat D-2805

FOR ONLY $399

$9.27 per week for 12 months

TV GAME WITH INBUILT PERSONAL COMPUTER!

OVER 5000 SOLD!

& it's years ahead!

Yes – an absolutely up-to-date design. Most of the TV game consoles around were designed at least 2 years ago. And in electronics, that's an eternity!

Compare the quality

Amazing picture quality with over 49,000 dots – over twice as good as the largest selling TV game! You'll be amazed at the clarity, the detail – just like the screens NASA use in the space shuttle!

Space-Age Controllers

Not just simple sticks: full space-age guiding devices with 48 keys as well! Slide-In overlays so you can see exactly what to do! When the controllers are in the console, they form a standard typewriter-style keyboard – that's versatility!

the one with the inbuilt personal computer . . .

Just plug in the optional 'BASIC' cartridge (Cat Y-1605 $69.50) and the WIZZARD becomes a powerful personal computer, complete with 17K of memory. That's more than you get with many personal computers!

Compare the price

The best part of all: the Dick Smith WIZZARD is around $200 cheaper than the closest comparable computer! yes, you not only save a fortune by buying the Dick Smith WIZZARD – you get much greater flexibility and enjoyment!

Cat. Y-1600

$295

$6.85 weekly over 12 months to approved customers

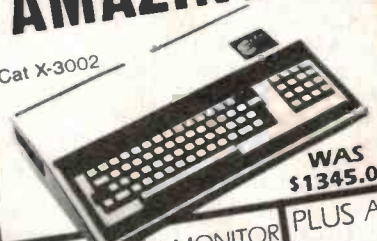
Great range of game Cartridges $39.95 ea

AMAZING SORCERER OFFER!

BUY NOW SORCERER COMPUTER FOR ONLY **$1195**

WAS $1345.00

Cat X-3002



AND GET THIS MONITOR FOR $10.00

Cat X-1196

WAS $149.00

A SAVING OF AROUND $240

PLUS ANY FOUR PROGRAMS FROM THIS LIST

X-3601 Air Traffic Controller 17.95
X-3606 Touch Type $24.50
X-3607 Basic Tutor Pack $17.95
X-3608 Machine Code Tutor $22.95
X-3614 Grotnic Wars $22.50
X-3616 Galaxians $17.95
X-3620 Magic Maze $15.95
X-3624 Tape Debug $24.50
X-3626 Martian Invaders $17.95
X-3627 Nike II $17.95
X-3628 Tank Trap $24.95
X-3631 Graphics $17.95

SAVE ON CASSETTES!

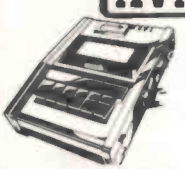
Why pay through the nose for those 'name' EDR tapes? Dick Smith EDR tapes are the highest quality, at the lowest prices! Compare the prices! Cat C-3354

WAS $2.75!

NOW ONLY **$1.99 each**

YOU REAP THE BENEFIT!

NOW AVAILABLE



Cassette Storage Module

Easy one plug connection to your Wizzard!
At last - now you can store your programs and replay them without re-keyboarding! Quality cassette unit connects to side of Wizzard, one plug supplies power and signal lines.

AND ONLY Cat Y-1607 $89.00

COMING SOON

MOVING KEYBOARD

One piece replacement typewriter style keyboard. Cat Y-1608 $49.50

YOU $$$

OUR MOST POPULAR KIT EVER!

Complete with professionally designed front panel

The Incredible PLAYMASTER Mosfet Amp Kit

This 'Top of the Line' amplifier features up to the minute circuitry as well as the new MOSFET output stage. With a huge 50W/channel output, it's got everything you'll ever need in an amplifier. All components fit a single PCB, which makes construction very easy. All parts are supplied right down to the last nut and bolt! What a bargain! Cat K-3515 See EA Jan '81.

Great value for only $175 WHY PAY MORE?

NEW DRIVE-WAY SENTRY

KIT ACTIVATES HOME LIGHTS FROM YOUR CAR! Turns on lights for pre-determined time. Water-tight diecast box. Cat K-3305 See EA Dec '82

KIT

ONLY $29.50

NEW STEREO KIT SYNTHESIZER

Enjoy benefits of stereo sound from your VCR, TV, or AM tuner. Cat K-3420 See ETI Sept '82.

ONLY $52.50

LCD PANEL METER KIT

ONLY $29.50

Versatile and accurate, LCD readout for low power consumption. Easy integration into panels makes it ideal for amateur and professional. Cat K-3450

LAST CHANCE! TO WIN IN DICK SMITH'S $50000 GIVE-AWAY

CONTEST CLOSES THIS MONTH

Thousands of prizes and winners... and everyone has a chance at the magnificent holiday for two to Fiji! NSW: Permit No TC82/1943 Issued under the lotteries & Art Unions Act. VIC: Raffles and Bingo Permit Board Permit No 82/207, Issued on Dec. 12th. SA: No purchase required. Simply send stamped, self-addressed envelope to 'Mighty Match Up Competition, PO Box 321, North Ryde NSW 2113 and we'll send you a ticket. A419/HCE

Experience the thrill of building your own speaker system & SAVE!

with the New Playmaster speaker kits.

Dick Smith brings you two superbly styled speaker systems to suit your room, your decor - and your pocket! Both are acoustically designed by Neville Williams, MIREE (Aust), Editor in Chief of Electronics Australia Magazine, and are manufactured under meticulous quality control to meet the exacting standards of the original EA specifications.

See how easy they are to build!

All it takes is a couple of hours and you save a fortune. They're as good looking as any speakers you'll find in the hi-fi showrooms.

FROM $329 A PAIR

Save $100s of dollars on equivalent built-up systems!

250mm SYSTEM

Enclosure plus Speaker & Grille Kits incl: Baffle boards, deluxe grilles, assoc. hardware, 250mm woofer, midrange, tweeter, crossovers, wiring harness & full instructions. Cat C-2634, C-2044 plus C-2608.

ONLY $329 PR.

300mm SYSTEM

Similar to above except for 300mm woofer plus deluxe high & midrange faders. Cat C-2632, C-2042 plus C-2612.

ONLY $360 PR.

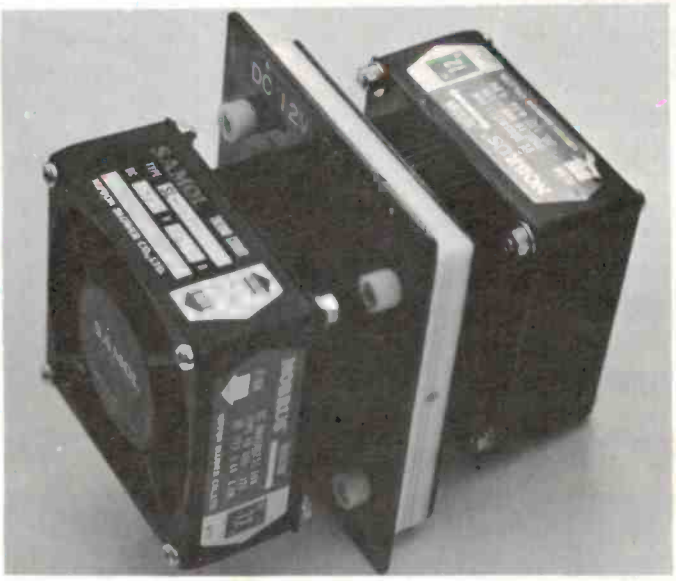
DICK SMITH Electronics

NSW Auburn 648 0558 – Bankstown Sq. 707 4888 – Blakehurst 546 7744 – Bondi Jct. 387 1444 – Broadway 211 3777 – Brookvale 93 0441 – Chullora 642 8922 – Gore Hill 439 5311 – Liverpool 600 9888 – North Ryde 888 3200 – Parramatta 689 2188 – Sydney (Bridge St) 27 5051 – Sydney (York St) 290 3377 – Tamworth 66 1961 – Tighes Hill 61 1896 – Wollongong 28 3800 ACT Fyshwick 80 4944 VIC Coburg 383 4455 – Frankston 783 9144 – Geelong 78 6766 – Melbourne 67 9834 – Richmond 428 1614 – Springvale 547 0522 QLD Brisbane 229 9377 – Buranda 391 6233 – Chermside 59 6255 SA Adelaide 212 1962 – Darlington 298 8977 – Enfield 260 6088 WA Perth (William St) 328 6944 – Perth (Hay Street) 321 4357 – Cannington 451 8666 TAS Hobart 31 0800

MAIL ORDER CENTRE: PO Box 321, North Ryde, NSW 2133. Phone: (02) 888 3200

HFC

bankcard welcome here



Just cool it

For applications where forced cooling is necessary, but an airconditioner is impractical, a new cooling unit is now available from Alfatron.

Designed to be used for cooling electronic equipment it features Peltier effect modules sandwiched between two blowers; its only moving parts are the fan blades.

These cooling units will find application where it is necessary to contain electronic or electrical equipment in dust or flame proof cabinets. As most such equipment will generate significant amounts of heat this must either be removed by heat exchangers or the use of overly large cabinets. The SL series thermo-coolers can be very useful in these situations to keep equipment cool.

Many new industrial control systems incorporate floppy disk or cassette drives as part of their data storage and gathering methods. These are usually at risk in industrial environments, but the SL thermo-coolers can help overcome this problem.

It is also claimed that by using a thermistor and temperature control circuit, these devices can be used to give highly precise temperature control suitable for laboratory situations.

Two models are currently available with 60 Kcal/h and 120 Kcal/h cooling capacity. They are powered from 12 Vdc and 24 Vdc respectively and can cool down to −15°C.

For more information contact **Alfatron Pty Ltd, 1761 Ferntree Gully Rd, Ferntree Gully Vic. 3156. (03)758-9551.**

Molex C-Grid range of connectors

Molex C-grid is a high density interconnection system which includes connectors, headers, 0.64 mm square pins, shunts and application tooling.

Serving as a switch, the 7859 shunt provides a very low resistance electrical path due to its two points of contact with each pin. One version has a closed top to prevent upside down matings. Shunts pressfit onto two 0.64 mm pins on 2.54 mm center spacing. No soldering is required. These fully stackable shunts utilise less board space than DIP switches and are not subject to accidental actuation or deactivation during board handling.

The 8676 connector mates with 0.64 mm square pins and all Molex dual row headers. The 8676 accepts discrete wire (1.2 mm max OD) or 2.54 mm center notched round conductor ribbon cable, 28 through 22 AWG, solid or stranded. It is end-to-end stackable for users dense packaging needs.

The Molex 7990 dual row female connector is designed to mate with 0.64 mm square pins on a 2.54 mm x 2.54 mm grid for mother-daughter board applications. The connector which is stackable end-to-end, is available in circuit sizes 4 through 130.

The unique 8878 Modular Socket consists of a shrouded carrier, designed to protect fragile IC chip leads, and a polarised socket with double cantilever terminals. This product provides a cost-efficient method for interchanging ICs, memory devices, PROMS, EPROMS and microprocessors.

The Molex 8624 header, with 0.64 mm selectively plated square pins, has a segmented body that can be cut into smaller circuit sizes to meet customer needs. Available in 4 through 80 circuits, the header mates with female connectors on a 2.54 mm x 2.54 mm grid and is stackable end-to-end.

These products are available from **Utilux Pty Ltd, 14 Commercial Rd, Kingsgrove NSW 2208. (02)50-0155.**

3½-DIGIT LCD DIGITAL MULTIMETER

by Univolt

SPECIAL ETI READER OFFER

- 8 FUNCTIONS 23 RANGES
- PUSHBUTTON OPERATION
- DC VOLTS TO 1 kV, AC VOLTS TO 750 V
- RESISTANCE FROM 200 OHMS TO 20M
- AUTO-RANGING ON AC/DC VOLTS & RESISTANCE
- AC & DC CURRENT TO TEN AMPS
- FINGER-GUARDS ON PROBES & SHROUDED PLUGS FOR MAXIMUM SAFETY
- TRANSISTOR GAIN MEASUREMENT
- TRANSISTOR CLIP LEAD INCLUDED
- PROTECTIVE CARRY CASE INCLUDED

Here is an opportunity to buy a versatile, top-line multimeter at a very good price, complete with carry case, special probes, leads and spare fuse.

OFFER PRICE
$97.50 tax paid
$84.38 tax exempt

This instrument would normally sell for about $130 retail.

This is an entirely new multimeter from Univolt and this offer is being made as a special promotion for the Model DT-860 which has only just been released here. It is a 3½-digit liquid crystal display instrument featuring 23 ranges in eight functions, three functions being auto-ranging. It is a handheld instrument but comes with a tilt stand to prop it up from the bench. The display features 12 mm high digits, plus value and function indicators (volts, ohms, ac, low battery, −ve, etc). The front panel is functional and well laid out. The test probes supplied have shrouded plugs to prevent accidental finger contact for safety when using the instrument on high voltage circuits, plus the probes have finger guards for further safety and convenience. A strong, synthetic leather carry case is included. The instrument is powered by two 1.5 V 'AA' cells. We have tested a sample DT-860 in the ETI Lab and found it met specifications, functioned well and was generally easy to use. It appears to be a robust, well-made device. Any technician, engineer, serviceman or hobbyist would find it a very useful instrument.

This offer is made by BENELEC PTY LTD (Incorporated in NSW). ETI is acting as a clearing house for orders. All mail orders will be despatched by certified post. Please allow up to four weeks for delivery. Offer closes 31 March 1983.

INSPECTION

You can inspect one of these multimeters during office hours at ETI's Sydney and Melbourne offices:

Sydney:
4th Floor, 15 Boundary St
Rushcutters Bay

Melbourne:
23rd Floor, 150 Lonsdale St
Melbourne

HOW TO ORDER YOUR MULTIMETER

Fill out the coupon below and enclose a cheque, bank cheque or money order for the amount required made out to **BENELEC PTY LTD.**

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

SEND completed coupon to:

UNIVOLT MULTIMETER OFFER
c/o ETI MAGAZINE, 140 Joynton Ave, Waterloo NSW 2017.

DT-860 UNIVOLT LCD DIGITAL MULTIMETER

SPECIFICATIONS

- **3½-digit** liquid crystal display; 12 mm high digits.
- **dc volts** — 200 mV-1000 V (max) **auto-ranging;** resolution: 0.1 mV @ 200 mV, 100 mV @ 200 V.
- **ac volts** — 2 V-750 V (max.) **auto-ranging;** resolution: 1 mV @ 2V, 100 mV @ 200 V.
- **resistance** — 200 ohms-20 M **auto-ranging;** resolution: 0R1 @ 200R, 10k @ 20M.
- **ac/dc current** — 2000 uA/200 mA/10 A; overload protected; resolution: 1 uA/100 uA/10 mA.
- **h_{FE}** — 0-1999 (±10%) with V_{ce} = 1.2 V, I_b = 1 uA.
- **continuity** — buzzer sounds at resistances under 20 ohms (±10R)
- **diode check** — reads forward drop in millivolts at 0.6 mA test current; 1 mV resolution.
- **warranty** — three months normal parts and labour warranty.
- **miscellaneous** — input impedance 10M minimum; input capacitance less than 50 pF; polarity: '−' indicated automatically; overrange indicated by '1' or '−1'; size: 145(D)x82(W)x28(H) mm; weight: 180 g excluding batteries; protection provided by 0.2 A, 250 V fast blow fuse.

ACCURACY

- **dc volts** — 200 mV; ±(0.5% of rdg + 2)
  2 V/20 V; ±(0.5% of rdg + 1)
  200 V/1 kV; ±(0.7% of rdg + 1)
- **ac volts** — 2 V/20 V; ±(0.5% of rdg + 5)
  200 V/750 V; ±(1.0% of rdg + 5)
- **dc current** — 2 mA/200 mA; ±(1.0% of rdg + 1)
  10 A; ±(1.2% of rdg + 1)
- **ac current** — 2 mA/200 mA; ±(1.2% of rdg + 5)
  10 A; ±(2.0% of rdg + 5)
- **ohms** — 200R; ±(0.75% of rdg + 3)
  2k/20k/200k; ±(0.5% of rdg + 2)
  2M; ±(1.0% of rdg + 2)
  20M; ±(2.0% of rdg + 3)

max. open circuit voltage = 1.5 V on 200R range
max. open circuit voltage on other ranges = 0.65 V

STOP PRESS
We will be moving premises sometime in February. Please phone 662-8888 if you want to inspect a DT-860 in Sydney to check which address we'll be at.

PLEASE SEND ME ..... Univolt Model DT-860 multimeter(s) @ $84.38 each, excl. tax or $97.50 each, inc. tax.

Post and handling $2.50 Sales Tax No ..... (if applicable) Offer closes 31 March 1983

I enclose $ ..... total Cheque or Money Order No. ..... Signature .....

Name .....

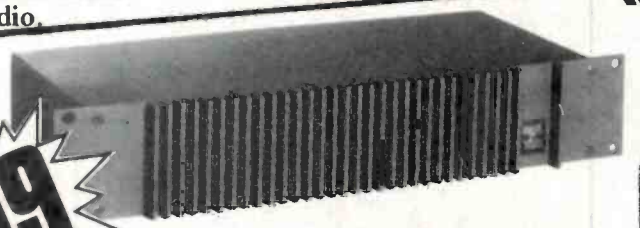
Address ..... Postcode .....

SO PURE, IT'S WICKED

The ETI 5000 System. Pristine. Pure. Cocaine for the ears.
And to think that they are Australian made and designed. They can stand comparison with any kit or ready-built available – anywhere. In fact we still think that they are the world's best amplifiers. We should be justifiably proud of this achievement in Audio.

"BLACK MONOLITH"

REF: ETI JAN/MARCH 1981



$319

The ultimate Hi-Fi power amplifier. We call our model the "Black Monolith" because we feel that the name symbolises the intelligence that went into the design.
The Jaycar "Black Monolith" is without doubt the best kit of the project available. If you have doubts ring our Managing Director, Gary Johnston and he will tell you! (Be prepared for a long conversation).
Several kit suppliers now have 'versions' of the original 5000 P.A. which claim to be similar to ours. This is simply not the case.
Space does not allow us to show EVERY refinement that has been made to the 5000 but notable ones are:

EXCLUSIVE FEATURES:
- Rear panel mains fuseholder
- 1% METAL FILM resistors used
- Flux-shorting strap on power transformers
- Original chassis bar design
- Beryllium Oxide (Space Age Ceramic) TO-3 washers. (NOT flimsy Mica)
- Jig drilled and extruded heavy gauge, anodised heatsink bracket
- SUPERFINISH front panel. STILL THE BEST now with blind tapped holes
- New heavy duty heatsinks for the driver transistors. 100% extra heatsink area and black anodised for greater efficiency (NOT in original design)
- Ventilation holes in metalwork at critical points (NOT in original design)
- Extra 3 pin DIN socket on rear panel (total 2) to power new 5000 components

IF YOU THINK THAT YOU CAN SAVE MONEY ON THESE KITS ASK YOUR SUPPLIER IF HE WILL GIVE YOU ALL OF THESE FEATURES AT THE PRICE. MAKE SURE THAT YOU GET IT IN WRITING!! (Write for new glossy leaflet (SAE))

We regret to advise that among other things, metal-work and sales tax increases have forced us to increase our prices slightly. Whilst we could have kept our costs down by using inferior components, we refused to take this course of action.

SPECIFICATIONS

POWER OUTPUT	Around 100W RMS into 8 ohms
FREQUENCY RESPONSE	8Hz to 20kHz, +0 – 0,4dB 2,8Hz to 65kHz, +0 – 3dB Note: these figures are determined soley by passive filters
INPUT SENSITIVITY	1V RMS for 100W output
HUM	– 100dB below full output (flat)
NOISE	– 116dB below full output (flat, 20kHz bandwidth)
2nd HARMONIC DISTORTION	<0,001% at 1kHz (0,0007% on prototypes) at 100W output using a ±56V supply rated at 4A continuous <0,003% at 10kHz and 100W
3rd HARMONIC DISTORTION	<0,0003% for all frequencies less than 10kHz and all powers below clipping
TOTAL HARMONIC DISTORTION	Determined by 2nd harmonic distortion (see above)
INTERMODULATION DISTORTION	<0,003% at 100W (50Hz and 7kHz mixed 4:1)
STABILITY	Unconditional

5000 SERIES GRAPHIC EQUALISERS

$299

Latest addition to the thoroughbred 5000 Series stable! David Tillbrook has once again produced a 'No Compromise' design. This new component, a 1/3 octave equaliser, gives you ABSOLUTE CONTROL over the acoustics of your particular listening enviroment. You get 3 SEPARATE CONTROLS for every octave of audio bandwidth to virtually eliminate the subtle nuances that are particular to your listening area.
1/3 octave equalisers have been used by professional engineers in Recording Studios and Live Concerts for over a decade now. It is no accident that the advent of the 1/3 octave equaliser and studio quality live sound have gone hand-in-hand. BUT THERE'S A CATCH. One of these equalisers is not enough. You will have to buy 2 (for stereo). Quite a lot of money – but worth it if you want the best. The Jaycar kit includes a fully pre-punched plated chassis, pre-punched heavy gauge front panel with silkscreened front panel to match the other 5000 components. It is absolutely original. You can purchase the kits one at a time for $199 each or, for two, $389 – a $10 saving. If you are one of the hundreds of happy 5000 users we are convinced that you will be just delighted with this unit.

SPECIFICATIONS:
Signal-to-Noise: –102dB with respect to 1 Volt
Frequency Response: 12Hz – 105kHz to –1dB
Boost/Cut: 14dB (28dB total)
Distortion: 100Hz-0.007%
1kHz-0.007%
10kHz-0.008%
(essentially irrepective of cut or boost)
Current consumption (DC) Approx 100mA @ ± 15V (Requires 30V AC CT)
Output short-circuit proof.

$179

BUY 2 AND SAVE $10 – ONLY $350

AUSTRALIAN (NOT HONG KONG) MADE – SPECIAL BUILT RACK CABINET – QUALITY!!!

ALL IC SOCKETS PROVIDED

"BLUEPRINT"

"One Swallow does not make a spring"
– Neither does a few gold RCA sockets!
Several of our competitors are imitating our "Blueprint" preamp by adding a few bits and pieces, notably gold plated RCA sockets to their standard kits. Unfortunately they have missed the point. We supply gold plated sockets in our "Blueprint" preamp but only where it makes sense to do this, i.e. on the inputs – NOT the outputs. 16 gold sockets are provided by us. This, however, does not make a "Blueprint". THIS DOES:
- Low capacitance screened cable - 12 metres of it. NOT Taiwanese cable as supplied in other kits. Our cable costs us NEARLY 5 TIMES MORE than the Taiwanese stuff.
- Original ETI designed front panel. Not an "ADAPTION". Our front panel is by far the nicest.
- Factory pre-tinned PCB's to reduce chances of dry or noisy solder joints.
- Quality LEDs, polished finish, multicoloured display.
- IC sockets on line amp board.
- Special rear panel.
- Special low noise selection LM394H NOT CH device in M.C. preamp.
- Thermalloy (U.S. made) heatsink on 7805 regulator.
- English Lorlin selector switches.
- Apart from the 16 gold RCA's we throw in a pair of gold plated line RCA plugs – worth $5.
- Special Nylon rear panel grommets.

So don't "Swallow" the facts before they are properly digested!!
You can't make a silk purse out of a sow's ear. Send SAE for full specs.

SPECIFICATIONS

Frequency Response	High-level input: 15Hz-130kHz, +0, –1dB Low-level input – conforms to RIAA equalisation, ±0.2dB (see detail on Phono specs.)		
Distortion	1kHz <0.003% on all inputs (limit of resolution on measuring equipment due to noise limitation)		
S/N noise	High-level input, master full, with respect to 300mV input signal at full output (1.2V): >92dB flat; >100dB A-weighted MM input, master full, with respect to full output (1.2V) at 5mV input, 500 ohm source resistance connected >86dB flat >92dB A-weighted MC input, master full, with respect to full output (1.2V) and 200uV input signal: >71dB flat >75dB A-weighted		
ETI-478MM MOVING MAGNET INPUT STAGE			
Gain	74, 1kHz		
Frequency Response	Conforms to RIAA Equalisation ±0.2dB		
Total Harmonic Distortion	<0.001%, 1kHz, 10mV RMS input		
Headroom	>28dB with respect to 5mV RMS input signal, i.e. 135mV RMS		
Noise	Total equivalent input noise, 122nV 'A', input shorted, 216nV flat, input shorted		
S/N ratio	1mV	5mV	10mV
Flat	73dB	87dB	93dB
A-weighted	78dB	92dB	98dB
ETI-478MC MOVING COIL INPUT STAGE			
Gain	24		
Frequency Response	7Hz – 135kHz +0, –1dB		
Total Harmonic Distortion	<0.003%, 1kHz, 30mV input		
Noise	Total equivalent input noise 83nV flat, input shorted 42nV 'A', input shorted 56nV flat, after RIAA Eq. input shorted 34nV 'A', after RIAA Eq. input shorted		

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

COMPLETELY BUILT AND TESTED – NOT A KIT!!

THE BEST CAR COMPUTER BELOW $200

Never before has such a comprehensive car performance computer been offered at such a low price!! Once again miracle microprocessor technology has enabled us to pass enormous savings on to you!!
But don't let the low cost fool you. The "Voyager" car computer IS THE MOST COMPREHENSIVE PRODUCT THAT WE HAVE SEEN. No other car computer matches this one AT EVEN TWICE THE PRICE! You could buy a $20,000 Holden and not get a better car computer!!
Just check the features. We are sure that you will calculate that the "Voyager" represents outstanding value!

FEATURES

- INSTANT FUEL CONSUMPTION IN LITRES/100KM AND MPG!! (MOST OTHERS HAVE ONLY ONE OF THE ABOVE) JUST SWITCH FROM ONE TO THE OTHER AS YOU DRIVE ALONG.
- INSTANT SPEED, TIME AND OTHER FUEL DATA.
- VISUAL AND AUDIBLE EXCESS SPEED ALARM.

INSTALLATION

The "Voyager" comes complete with an unbelievable array of mounting configurations, on dash, under dash or stalk mount. ALL installation hardware is supplied (even a roll of insulation tape!) as well, of course, as the speed and fuel sensors. A lavishly illustrated installation manual is provided as well as a comprehensive operators manual.

CONTAINS EQUIVALENT OF THOUSANDS OF TRANSISTORS – USES MASSIVE CUSTOM LSI CHIP TO ACHIEVE LOW PRICE

IDEAL RALLY COMPUTER!

only $199 Complete

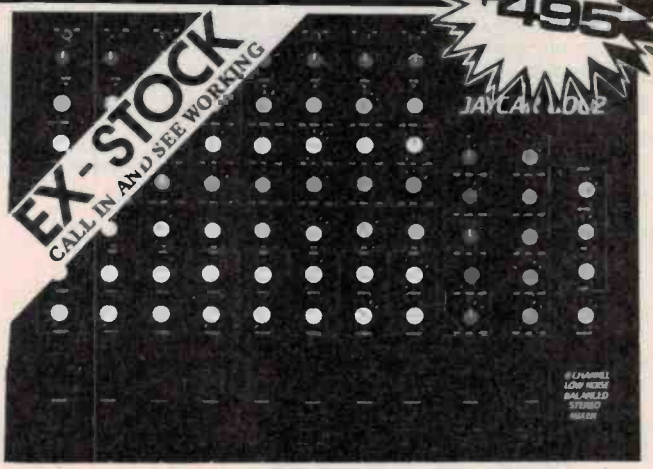
AVAILABLE FROM: ROD IRVING MELBOURNE, ALTRONICS PERTH, TOMORROW'S ELECTRONICS GOSFORD 247246

8 CHANNEL MIXER KIT

GREAT VALUE FOR MONEY

The Jaycar 8002 Mixer was originally conceived to be the successor to the very popular ETI414 Master Mixer. The 414 was basically configured as a "stage" mixer and suffered from a number of severe technical limitations – notably poor signal-to-noise figures. Enormous advances in Audio IC's have occurred since the 414 was designed. Jaycar engineers have taken advantage of this. The incredibly low noise and distortion figures of the 8002 are a testimony to the sound basic design of the mixer coupled with the performance capability of these IC's. Whilst the 8002 is the ideal 8 channel compact stage mixer, other applications have been kept in mind.
AS A "STUDIO" MIXER. The prime requirement of a studio mixer is that it must be quiet – i.e. have good S/N. Due to the fact that the "miracle" 5534 IC's are used in the 8002 studio applications are entirely feasible. In addition to this, metal film resistors are used in critical signal areas.
AS A DISCO MIXER. The balanced input feature of the 8002 is not really necessary for disco use. This section can easily be bypassed with either a moving magnet (Dynamic Cartridge) preamp, or a moving coil preamp. The sensible format of the 8002 and tremendous equalization facilities should make this mixer popular for disco use.

FROM $495



- Balanced (600 Ohm) Mic. Inputs/Line Inputs.
- Cannon Connectors included in the price.
- Bass, Mid & Treble Equalization on each Input.
- "Effects" (i.e. Echo etc.) capability.
- Foldback and Stereo Pan on ALL 8 Inputs.
- 60mm Slide Faders used throughout.
- 19" Rack Mount capability (or Console Mount).
- Professional Black Front Panel with Format borders & multi coloured knobs to assist function identification.
- VU Metering.

STEREO Synthesiser *

from $39.50

One of the most effective projects that we have seen. Creates an extremely realistic stereo effect from any line level mono signal! The effect on your signal is stagggering. The audio track on your VCR comes to life! Just like the movies! You can convert your T.V., AM tuner or anything now to wall-to-wall stereo sound. Jaycar has two versions of this kit; a short form which enables you to build the synthesiser inside other equipment and the full free standing unit.
SHORT FORM kit contains PCB and all electronics associated with board but not power transformer or case $39.50
FULL KIT contains everything including power transformer and case $49.50
Ref: EA September 1982

Jaycar NUMBER 1 FOR KITS

125 YORK STREET, SYDNEY 2000
PHONE: 264 6688 TELEX: 72293
"NEVILLES CORNER"
Cnr. CARLINGFORD & PENNANT HILLS ROAD
CARLINGFORD
PHONE: 872 3422 or 872 4444
MAIL ORDERS TO: 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 up ($8.00)
NEW SHOP HOURS
Mon – Fri 8.30 to 5.30pm
Sat 8.30 to 12.00pm
Thurs night to 8.30pm

Mail Order By BANKCARD Via Your Phone

Analogue delay lines

Analogue delay lines can be used to produce special audio effects such as echo, reverb, phasing, flanging, room expansion and predictive switching etc.

Ray Marston

SOLID STATE DELAY LINES are widely used in modern music and audio systems. They can be used to produce popular effects such as echo, reverb, chorus, phasing, flanging etc. in music systems, 'rare' effects such as ambience synthesis or 'room expansion' in expensive hi-fi systems and 'predictive' effects such as click/scratch elimination in record players or auto-switching in tape recorders etc.

Two basic types of solid state delay systems are available, analogue and digital. Digital delay systems tend to be more expensive and complex than analogue types, except where delay times are in excess of 250 ms, so we'll confine our present discussion to analogue systems only.

Delay line basics

Modern solid state analogue delay lines come in integrated circuit form and are almost universally known as CCD (Charge Coupled Device) or 'Bucket-Brigade' delay lines. In essence, these devices contain a stack of analogue memory (sample-and-hold) cells or 'buckets' (usually 512, 1024 or 4096), all wired in series. Analogue input signals are applied at the front of the bucket 'chain' and the delayed output is taken from the main's end.

Figure 1 illustrates the basic operating principle of an analogue delay line. Each bucket consists of a small capacitor and a tetrode MOSFET and acts like a sample-and-hold stage. An electronic switch is placed at the front of the chain which is externally biased to a preset voltage. Charges can be shifted down the chain, one step at a time, via an external two-phase clock signal; one phase of the clock is also used to activate the input sampling switch. The operating sequence is as follows.

On the first clock half-cycle, each existing bucket charge is shifted backwards one step to the next bucket in the chain and a sample of the instantaneous input signal is fed to the first bucket via SW1, where it is 'stored' as an analogue charge. On the second half-cycle, each existing charge (including the input one) is transferred backwards another step to the next bucket in the chain, but the input is NOT sampled via SW1. There is thus always an 'empty' bucket between each charged bucket in the chain. This double shifting process repeats on each clock cycle, with input samples repeatedly being taken and then clocked towards the back of the chain.

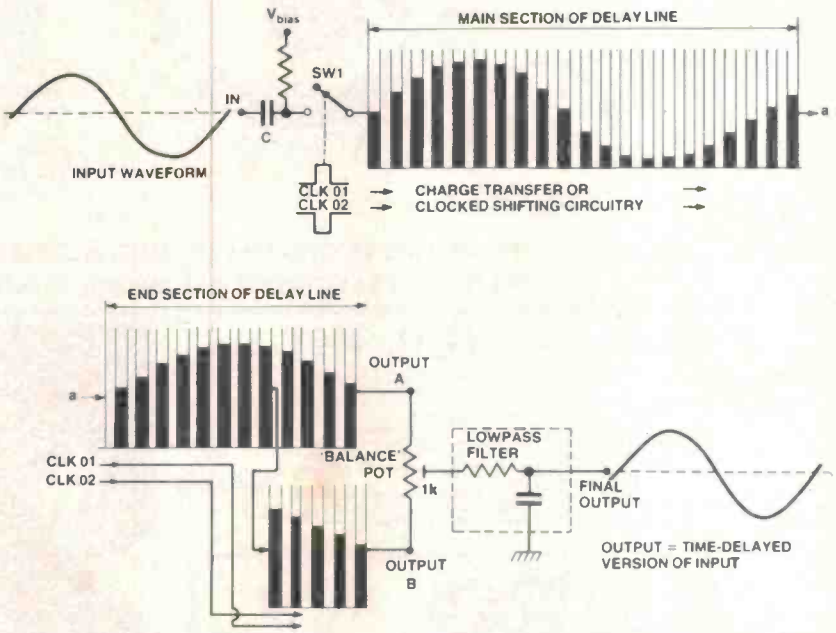


Figure 1. Basic operating principle of the 'bucket brigade' delay line.

In the final section of the delay line, a short section of buckets is wired in parallel with, and fed from, the main delay line, but has one bucket more than the corresponding section of the main line and is clocked in anti-phase. The IC thus has two outputs which, when added together, effectively fill in the 'gaps' in the main delay line bucket chain. The outputs can be 'added' either by shorting them directly together or preferably, by connecting them to a balance pot as shown in the diagram. The final output of the delay line is thus a quantised but time-delayed replica of the original input signal.

Figure 2 shows the essential 'usage' elements of an analogue delay line chip. The delay line MOSFETs use a tetrode structure, so the IC needs two supply lines (V_{DD} and V_{BB}), plus a ground or common connection. The input terminal must be biased into the linear mode by voltage V_{bias}. The two outputs of the device must be added together, as already described; in Figure 2 we've shown addition by direct-shorting. Finally, the IC must be provided with a two-phase clock

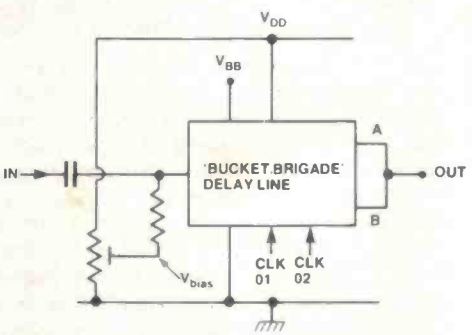


Figure 2. Essential 'usage' elements of an analogue delay line chip.

signal, normally consisting of a pair of anti-phase square waves that switch fully between the V_{DD} and GND (or 0 V) potentials.

How much delay?

We've already seen that the buckets of the analogue delay line are alternately 'empty' and 'charged' and that each complete clock cycle shifts a charge two stages along the bucket chain. Thus, the maximum number of samples taken by a line is equal to half the number of bucket stages (a 1024 stage line can take only 512 samples) and the actual time-delay available from a line is given by:

$$\text{Time Delay} = \frac{S.p}{2} \text{ or } \frac{S}{2.f},$$

where S = number of bucket stages, p = clock period, and f = clock frequency.

Thus, a 1024-stage line using a 10 kHz (100 us) clock gives a delay of 51.2 ms. A 4096-stage line gives a 204.8 ms delay at the same clock frequency. This seems pretty good, but there are two major snags. The first is that the maximum useful signal frequency of the delay line is equal to one third of the clock frequency, so a delay line clocked at 10 kHz has a useful bandwidth of only 3.3 kHz. The second snag concerns costs. Analogue delay lines are rather expensive. A 512-stage device will set you back around $30!

Figure 3 shows the block diagram of a basic, real-life analogue delay line system. The input signal is applied to the input of the delay line via a low-pass filter which has a cut-off frequency that is one third (or less) of the operating frequency of the clock generator, and is used to overcome 'aliasing' or intermodulation problems. The output of the delay line is passed through a second low-pass filter which also has a cut-off frequency one third (or less) of that of the clock. This serves the multiple purposes of rejecting clock break-through signals and integrating the delay line output pulses so that the final analogue output signal is a faithful (but time-delayed) copy of the original input signal.

We'll take a closer look at some of the elements of the Figure 3 circuit and at some practical delay line chips later in this article. In the meantime, let's digress slightly and look at the subject known as psycho-acoustics.

Psycho-acoustics

Many of the special effects that are obtainable with delay lines depend heavily on the human brain's idiosyncratic behaviour when interpreting sounds. Basically, the brain does not always perceive sounds as they truly are, but actually 'interprets' them so that they conform to a pre-conceived pattern. The brain can sometimes be tricked into misinterpreting the sounds. The study of this particular subject is known as psycho-acoustics. Here are some psycho-acoustic 'laws' that are worth knowing:-

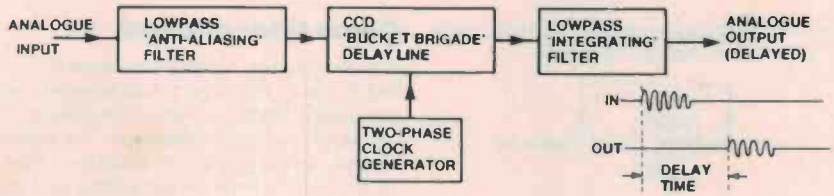


Figure 3. Block diagram of a basic analogue delay line system.

(1) If the ears receive two sounds that are identical in form but time-displaced by less than 10 ms, the brain integrates them and perceives them as a single (undisplaced) sound.

(2) If the ears receive two sounds that are identical in form but time-displaced by 10-50 ms, the brain perceives them as two independent sounds but integrates their information content into a single easily recognisable pattern, with no loss of information fidelity.

(3) If the ears receive two signals that are identical in form but time-displaced by greater than 50 ms, the brain perceives them as two independent sounds but may be unable to integrate them into a recognisable pattern.

(4) If the ears receive two sounds that are identical in basic form but not in magnitude, and which are time-displaced by more than 10 ms, the brain interprets them as two sound sources (primary and secondary) and draws conclusions concerning (a) the location of the primary sound source and (b) the relative distances apart of the two sources.

Regarding 'location' identification, the brain identifies the first perceived signal as the prime sound source, even if its magnitude is substantially lower than that of the second perceived signal (the Hass effect). Delay lines can thus be used to trick the brain into wrongly identifying the location of a sound source.

Regarding 'distance' identification, the brain correlates distance and time-delay in terms of roughly 0.3 metres per millisecond of delay. Delay lines can thus be used to trick the brain about distance information.

(5) The brain uses echo and reverberation (repeating echoes of diminishing amplitude) information to construct an image of environmental conditions, e.g: if echo times are 50 ms but reverb time is two seconds, the brain may interpret its environment as being a 15 m cave or similar hard-faced structure, but if the reverberation time is only 150 ms it may interpret its environment as being a 15 m wide softly-furnished room. Delay lines can thus be used to trick the brain into drawing false conclusions concerning its environment, as with ambience synthesisers or 'room expanders'.

(6) The brain is highly sensitive to sudden increases in sound intensity (transients of millisecond duration), such as clicks and scratches on discs, but is insensitive to transient decreases in intensity. Delay lines can be used to take advantage of this effect in record players where they can be used (in conjunction with other circuitry) to effectively predict the arrival of a click/scratch and replace it with a neutral or negative transient.

APPLICATIONS

Simple musical effects

Figures 4 to 15 illustrate a variety of analogue delay line applications. In these diagrams we have, for the sake of simplicity, ignored the presence of the usual input/output low-pass filters. Let's start by looking at some simple musical effects circuits.

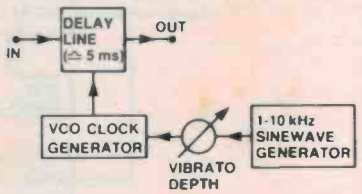


Figure 4. True vibrato circuit which applies slow frequency-modulation to all input signals.

Figure 4 shows how the delay line can be used to apply vibrato (frequency modulation) to any input signal. The low-frequency sinewave generator modulates the clock generator frequency and thus causes the output signals to be similarly time-delay modulated. Simple.

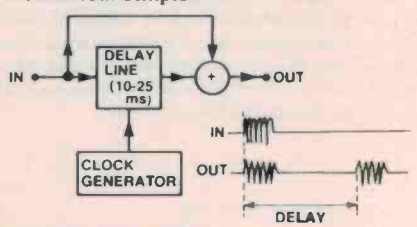


Figure 5. Double-tracking circuit.

Figure 5 shows the delay line used to give a double-tracking effect. The delay time is in the 'perceptible' range 10-25 ms and the delayed and direct signals are added in an audio mixer to give the composite 'two signals' output shown in the diagram. If a solo singer's voice is played through the unit it sounds like a pair of singers in very close ▶

harmony. Alternative names for this circuit are 'mini-echo' and 'micro-chorus'.

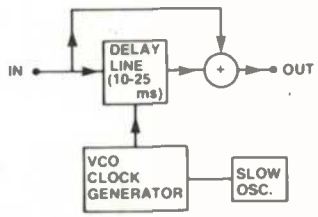


Figure 6. Auto-Double-Tracking (ADT) or mini-chorus circuit.

Figure 6 shows how the above circuit can be modified to act as an Auto-Double-Tracking (ADT) or mini-chorus unit. Clock signals are derived from a VCO that is modulated by a slow oscillator so that the delay times slowly vary. The effect is that when a solo singer's voice is played through the unit it sounds like a pair of singers in loose or natural harmony.

Comb filter circuits

Figure 8 shows a delay line used to make a comb filter. The direct and delayed signals are added together; signal components that are in-phase when added give an increased output signal amplitude and those that are in anti-phase tend to self-cancel and give a reduced output level. Consequently, the frequency response shows a series of notches, the notch spacing being the reciprocal of the line delay time (1 kHz spacing at 1 ms delay, 250 Hz spacing at 4 ms delay).

These phase-induced notches are typically only 20-30 dB deep.

The two most popular musical applications of the comb filter are in 'phasers' and 'flangers'. In the phaser (Figure 9) the notches are simply swept slowly up and down the audio band via a slow-scan oscillator, introducing a pleasant acoustic effect on music signals.

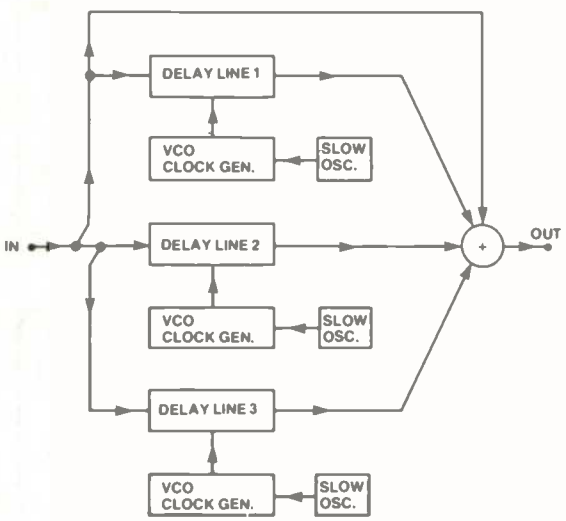


Figure 7. 'Chorus' generator.

Figure 7 shows how three ADT circuits can be wired together to make a 'chorus' machine. All three lines have slightly different delay times. The original input and the three delay signals are all added together, the net effect being that a solo singer sounds like a quartet, or a duet sounds like an octet, etc.

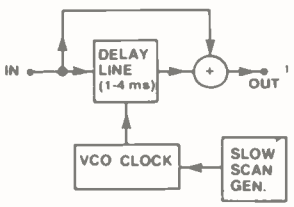


Figure 9. A phaser is a variable comb filter in which the notches are slowly swept up and down the audio band.

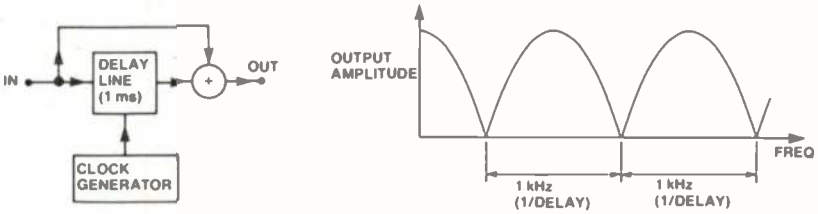


Figure 8. CCD comb filter. Notches are about 20-30 dB deep, 1 kHz apart.

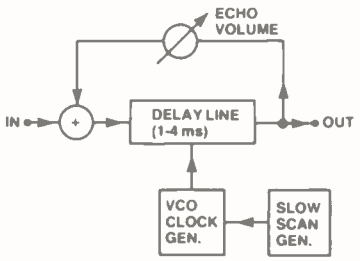


Figure 10. A flanger is a phaser with accentuated and variable notch depth.

The flanger circuit (Figure 10) differs from the phaser in that the mixer is placed ahead of the delay line and part of the delayed signal is fed back to one input of the mixer so that in-phase signals add together regeneratively. Amplitudes of the peaks depends on the degree of feedback and can be made very steep. These phase-induced peaks introduce very powerful acoustic effects as they are swept up and down through music signals via the slow-scan oscillator.

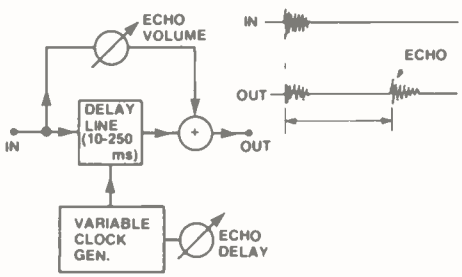
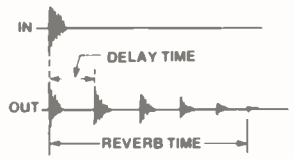


Figure 11. An echo unit.

Echo/reverb circuits

Figure 11 shows the basic circuit of an echo unit. The delay (echo) may vary from 10 ms to 250 ms and is usually adjustable, as is the echo amplitude. Note that this circuit produces only a single echo.



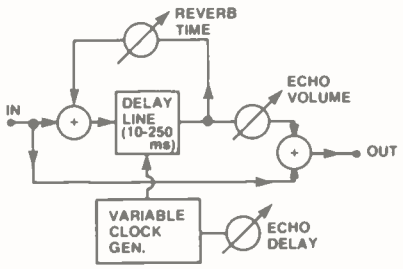


Figure 12. Echo/reverb unit.

The echo/reverb circuit of Figure 12 produces multiple or repeating echoes (reverberation). It uses two mixers, one ahead of the delay line and the other at the output. Part of the delay output is fed back to the input mixer so that the circuit gives echoes of echoes of echoes, etc. The reverb time is defined as the time taken for the repeating echo to fall by 60 dB relative to the original input signal and depends on the delay time and the overall attenuation of the feedback signals. Each delay time, echo volume and reverb time are all independently variable.

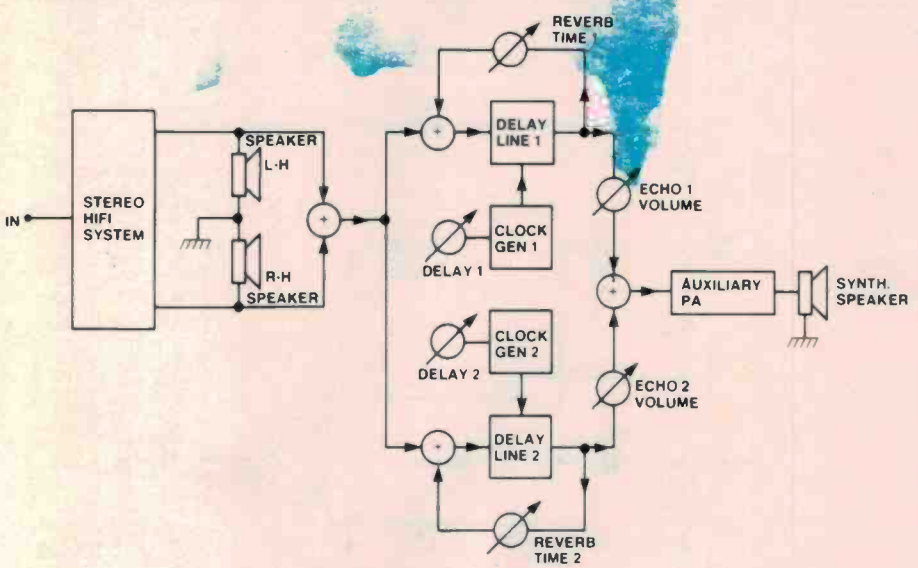


Figure 13. Ambience synthesiser or 'room expander'.

Figure 13 shows the basic circuit of an ambience synthesiser or room expander. Here, the outputs of a conventional stereo hi-fi system are summed to give a mono aural image. The resulting signal is then passed to a pair of semi-independent reverb units which produce repeating echoes but not the original signal. The reverb outputs are then summed and passed to a mono PA system and speaker which is usually placed behind the listener. The system effectively synthesises the echo and reverb characteristics of a chamber of any desired size so that the listener can be given the impression of sitting in a cathedral, concert hall or small club house etc, while in fact sitting in his own living room. Such units produce very impressive results.

There are lots of possible variations on the basic Figure 13 circuit. In some cases the mono signal is derived by differencing (rather than summing) the stereo signals, thereby cancelling centre-stage signals and overcoming a rather disconcerting 'announcer-in-a-cave' effect that occurs in 'summing' systems. The number of delay (reverb) stages may vary from one in the cheapest units to four in the more expensive units.

Predictive switching circuits

Delay lines are particularly useful in helping to solve 'predictive' or 'anticipatory' switching problems in which a switching action is required to occur slightly *before* some random event occurs.

Suppose, for example, that you need to make recordings of random or intermittent sounds (thunder, speech, etc). To have the recorder running continuously would be inefficient and expensive. It would not be practical to try activating the recorder automatically via a sound switch since part of the sound will already have occured by the time the recorder turns on.

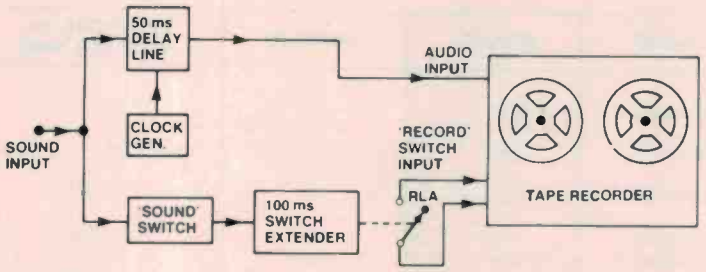


Figure 14. Automatic tape recorder with 'predictive' switching.

Figure 14 shows the solution to this problem. The sound input activates a sound switch which, because of mechanical inertia, turns the recorder's motor on within 20 ms or so. In the meantime, the sound travels through the 50 ms delay line towards the recorder's audio input terminal, so that the recorder has already been turned on for 30 ms by the time the first part of the sound reaches it. When the original sound ceases the sound switch turns off, but the switch extender maintains the motor drive for another 100 ms or so, enabling the entire 'delayed' signal to be recorded.

Finally, to conclude this 'applications' section, Figure 15 shows how 'predictive' switching can be used to help eliminate the sounds of clicks and scratches from a record player. Such sounds can easily be detected by using stereo phase-comparison techniques.

In Figure 15 the disc signals are fed to the audio amplifier via a 3 ms delay line, a bilateral switch and a track-and-hold circuit. Normally, the bilateral switch is closed and the signal reaching the audio amplifier is a delayed but otherwise unmodified replica of the disc signal. When a click or scratch occurs on the disc the detector/extender circuit opens the bilateral switch for a minimum of 3 ms, momentarily blanking the audio signal to the amplifier. Because of the presence of the delay line, the blanking period effectively straddles the 'click' period, enabling its sound effects to be completely eliminated from the system (see 'Psycho Acoustics'). ▶

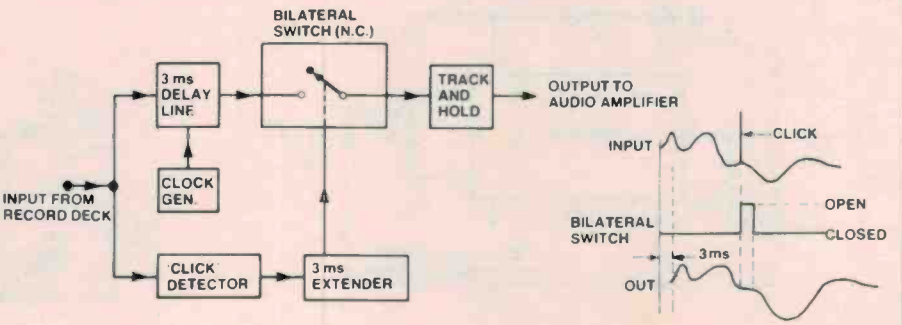


Figure 15. Record 'click' eliminator.

DEVICE NO.	STAGES	SAMPLES	DELAY TIME, ms, VS. CLOCK FREQ.	DELAY AT 7 kHz BANDWIDTH	NOTES
TDA1022	512	256	256/f	12 8 ms	Very popular low-cost delay line
SAD512	512	256	256/f	12.8 ms	512-stage delay line (obsolescent)
SAD512D	512	256	256/2xf	12 8 ms	Built-in clock divider uses single-phase clock
SAD1024A	1024	512	2 x 256/f	25 6 ms	Dual SAD512 delay line
SAD4096	4096	2048	8 x 256/f	102 4 ms	4096-stage delay line
					Clock-terminal input Capacitance = 1000 pF

Figure 16. Basic details of five popular CCD delay lines.

PRACTICAL CIRCUITS

Delay lines

Figure 16 shows basic details of five popular CCD delay lines. The TDA1022 and the SAD512 are general-purpose 512-stage delay lines requiring two-phase clock inputs. They give 12.8 ms delay at 7 kHz bandwidth when driven at 20 kHz clock frequency.

The SAD512D is an 'updated' version of the SAD512 and incorporates built-in output drivers and a clock input divider. It requires a single-phase clock input.

The SAD1024A is a dual version of the SAD512. The two halves can be used independently or can be wired in series to give a delay of 25.6 ms at 7 kHz bandwidth.

The SAD4096 gives a performance equal to eight SAD512s in series. It provides a delay of 102.4 ms at 7 kHz bandwidth or 250 ms at 3 kHz bandwidth. The device requires a low-impedance two-phase clock drive, since its clock terminal input capacitance is about 1000 pF.

Figures 17 and 18 show a couple of practical delay line circuits using TDA1022 and SAD512D devices. Both circuits use a preset to adjust the input dc bias so that symmetrical clipping occurs under overdrive conditions and another preset to balance the two outputs for minimum clock breakthrough.

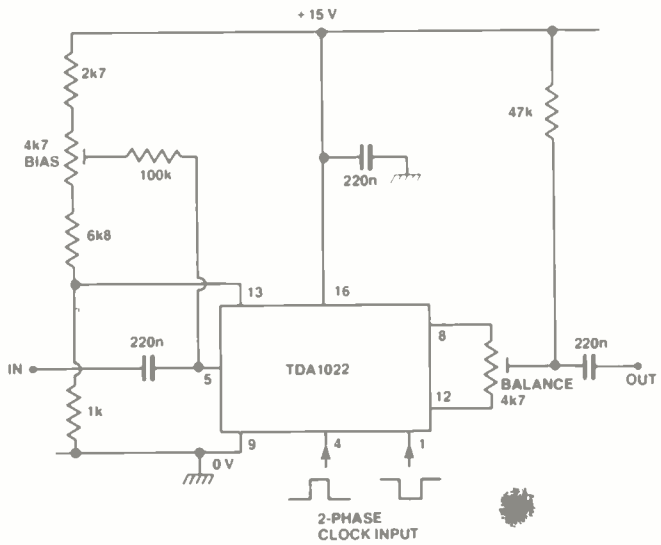


Figure 17. Delay line using the TDA1022.

Clock generators

The clock signals to a CCD delay line should be reasonably symmetrical, should have fairly fast rise and fall times and should switch fully between the supply rail voltages. CMOS devices make ideal clock generators and Figures 19 to 21 show three practical circuits.

The general-purpose two-phase generator of Figure 19 is inexpensive and can be used in most applications where a fixed or manually-variable frequency is needed. The frequency can be swept over a 100:1 range via RV1 and the centre frequency can be altered by changing the C1 value.

The high-performance two-phase generator of Figure 20 is based on the VCO section of a

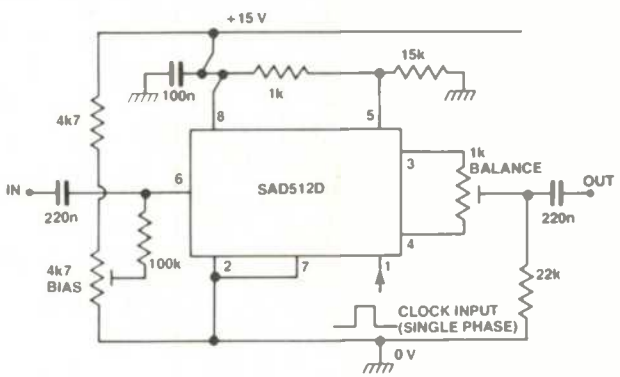


Figure 18. Delay line using the SAD512D.

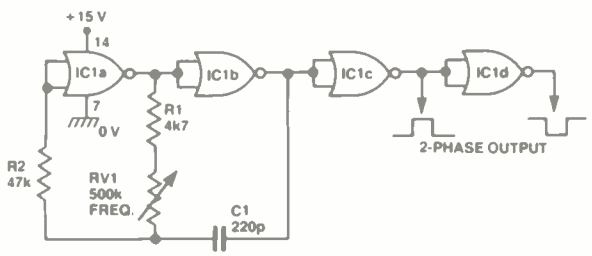


Figure 19. Variable-frequency general-purpose two-phase CMOS clock generator.

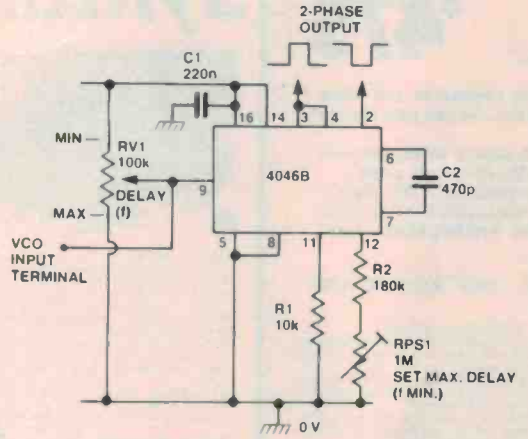


Figure 20. High-performance voltage-controlled two-phase CMOS clock generator.

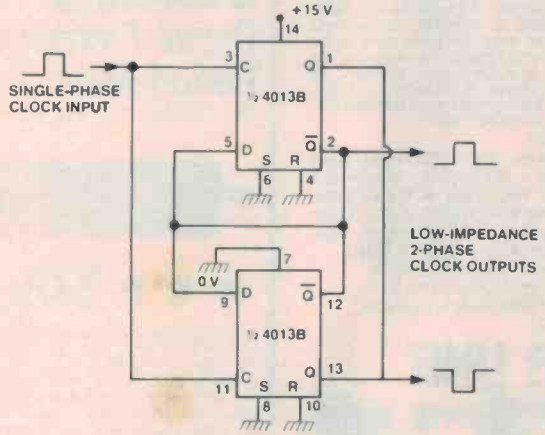


Figure 21. Single-phase to two-phase converter, with low impedance output.

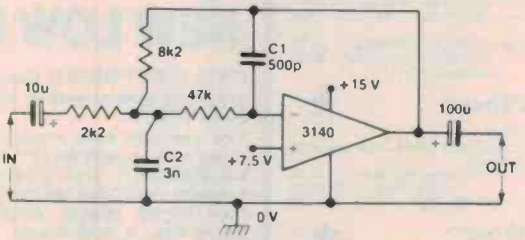


Figure 22. 25 kHz second-order maximally-flat low-pass filter.

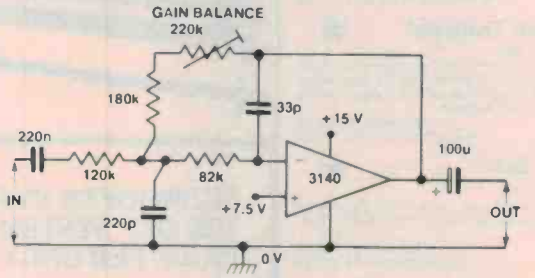


Figure 23. Adjustable-gain second-order low-pass output filter.

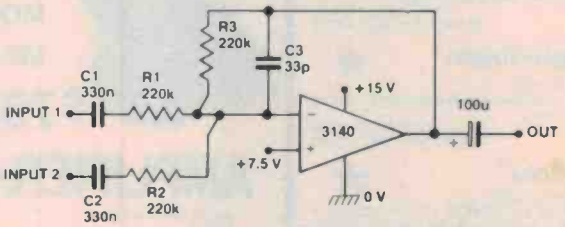


Figure 24. Combined two-input mixer/first-order low-pass filter.

4046B phase-locked loop chip and is useful in applications where the frequency needs to be swept over a very wide range, or needs to be voltage controlled. The frequency is controlled by the voltage on pin 9, being at maximum (minimum delay) when pin 9 is high and minimum (maximum delay) when pin 9 is low. Maximum frequency is determined by the C2-R1 value and minimum frequency by the value of C2 and the series values of R2-RPS1.

The Figures 19 and 20 circuits can be used to directly clock all CCD delay lines except the SAD4096, which has a clock terminal capacitance of 1000 pF (1n) and needs low-impedance clock drive. The SAD4096 is best driven by the circuit shown in Figure 21 which uses the two halves of a 4013 divider wired in parallel to give the required low-impedance two-phase output; the circuit is driven by a single-phase clock signal which can be obtained from either of the Figure 19 or 20 circuits.

Filter circuits

In most applications a low-pass filter must be inserted between the actual input signal and the input of the delay line, to prevent aliasing problems. Another must be inserted in series with the output of the line to provide clock-signal rejection and integration of the 'sample' signals. For maximum bandwidth both filters usually have a cut-off frequency that is one third (or less) of the maximum clock frequency used; the input filter usually has a first-order or better response and the output filter has a second-order or better response.

Figure 22 shows the practical circuit of a 25 kHz second-order low-pass filter with ac-coupled input and output. The non-inverting terminal of the op-amp is biased at half-supply volts, usually by a simple potential divider network. The cut-off frequency can be varied by giving C1 and C2 alternative values, but in the same ratio as shown in the diagram, e.g: cut-off can be reduced to 12.5 kHz by giving C1 and C2 values of 1n and 6n respectively.

All delay lines suffer from a certain amount of 'insertion' loss. Typically, if 100 mV is put in at the front of the delay line, only 70 mV or so appears at the output. Often the output low-pass filter is given a degree of compensatory gain to give zero overall signal loss. Figure 23 shows such a circuit. This circuit has a nominal cut-off frequency of about 12 kHz, depending on the setting of the GAIN BALANCE control.

Finally, to complete this look at CCD delay line circuits, Figure 24 shows how a two-input unity-gain 'mixer' (adder) can also be made to act as a first-order low-pass filter by simply wiring a roll-off capacitor (C3) between the output and the terminal of the op-amp. This type of circuit is often used at the front end of CCD flanger and reverberation designs. ●

JAYCAR 10%★OFF ITEMS MARKED BELOW WITH

"LED Head" ★

Ref: EA Jan 1983
Be the first in your block with an electronic sweatband. John McEnroe – eat your heart out!
All components for project NORMALLY $9.95
FEB ONLY – 10% ONLY $8.95
(sweatband extra)

"Super Siren" ★

Ref: EA Nov 1982
Earsplitting sound from a CMOS circuit that only draws 5mA on average!
Complete set of electronics NORMALLY $5.00
FEB ONLY – 10% $4.50
KSN1038 or KSN1005 Piezo horn to suit $16

"Vox Relay" ★

Ref: EA April 1982
Universal circuit for any application where a voice or noise must be used to switch current on and off.
All electronics & PCB NORMALLY $14.50
LESS 10% FOR FEB ONLY $13.05

"Photon Torpedo" ★

Ref: EA Sept 1981
Sophisticated game in which you must shoot down the alien with your LED torpedo. All components go onto PCB except sound effects speaker. Box & special front panel included.
NORMALLY $29.50
LESS 10% FOR FEB $26.55

"Fuzz Box" ★

Ref: EA Jan 1981
Great effects for your guitar! Our kit includes a heavy gauge die-cast box and heavy duty foot-switch.
NORMALLY $19.50
FEBRUARY PRICE $17.55

"Guitar Booster" ★

Ref: EA June 1982
Use your electric guitar at home and save the expense of a practice amp. Features treble boost & volume. Includes case and front panel.
NORMALLY $14.50
FEBRUARY ONLY $13.05

"Boggle-Goggles" ★

Ref: EA Dec 1982
Wire your sunglasses with flashing lights! Great for disco's or parties.
NORMALLY $9.50
FEBRUARY ONLY $8.55

"Le Gong" ★

Ref: EA March 1981
Built around the SAB0600 IC. This doorbell is on its own! It produces a rich sounding polyphonic (i.e. chords) tune when the doorbell is pressed. A great present when built.
NORMALLY $13.95
FEB ONLY $12.55

"P.C. Birdies" ★

Ref: EA Feb 1982
Unbelievable!! Two realistic sounding canaries chirping away! They will chirp as long as you "feed" them on a 9V battery!
NORMALLY $14.95
FEB ONLY $13.45

"Cudlipp Cricket" ★

Ref: EA Feb 1982
Cudlipp, the electronic chirping cricket that talks when you talk. Crazy! USES a VOX switching circuit to detect noise.
NORMALLY $12.50
FEB ONLY $11.25

"Metronome" ★

Ref: EA Jan 1982
This clever design uses the unique 2N6027 (D13T1) PUT. Rate can be varied between 30 & 160 beat/minute. Even at maximum volume the current drain is less than one milliamp!
Complete with case NORMALLY $16.95
FEB ONLY $15.25

"Fluoro Starter" ★

Ref: EA Oct 1982
One of our most popular kits. Enables you to replace the electromechanical starter with an electronic one! The Fluoro starts up instantly without a flicker!
All electronic components supplied including high quality mains cap. (Fluoro starter case required)
NORMALLY $5.00
FEB ONLY $4.50

SIMPLE EA KITS

Lyrebird Piano Kit NEW LOW PRICE...

6 OCTAVE $475

NEW LOW PRICE!! Because we are shipping keyboards and other expensive components in bulk due to high demand, we can pass savings on to YOU.
You can now have a magnificent "Lyrebird" 6 octave touch sensitive piano now for only $475!! That's a staggering $50 off the old price.
REMEMBER!! THE LYREBIRD OUTPERFORMS READY BUILT PIANOS COSTING UP TO THOUSANDS OF DOLLARS MORE. WHY PAY MORE WHEN YOUR CONSTRUCTION KNOWLEDGE CAN SAVE YOU A FORTUNE?

7½ OCTAVE (88 NOTE) VERSION $589

REF: EA 11/81-1/82

GREAT NEW FEATURES!!
FREE! A stand (like the one illustrated but not exactly same). Worth around $50 but yours at no extra charge h each 73 or 88 note kit.
FREE! A soldering iron (worth around $19). Yours to ep to give years of faithful service after you have comted your Lyrebird. (88 note only)
FREE! A 200g roll of solder. You will need some to ild the Lyrebird but there will be plenty left over for ier projects. (73 & 88 note versions).
FREE! Quality IC sockets provided in both kits.

SUBWOOFER SYSTEM 10% OFF SYSTEM PRICE FEB ONLY ★

THE SUB-WOOFER

MODEL SW 250

$79.50

This unit has been extremely popular with audio enthusiasts right across Australia! EA have designed a special crossover/booster amp just for this unit. Now you have no excuse to build a subwoofer system to enjoy those thrilling low notes from pipe organs, synthesisers, 1812 cannons etc!!

SPECS:
Diameter 10" (250mm) Cast Frame. QT=0.39. VAS=631
Power Handling = 100WRMS.
Free-air Resonance 32Hz ±1Hz
Voice Coil = 2" (51mm). Dia.
Magnet Assy = 3kg (6.6lbs).
A FREE SUB-WOOFER CABINET DESIGN IS PROVIDED WITH EACH UNIT!!

AMPLIFIER/FILTER UNIT

AMPLIFIER/FILTER UNIT.
Amplifier Module $79
Transformer to suit $39.50
Metal case specially made to suit including front panel, hardware etc.(not a twin 25 case). Only $29.50
$148.00
Buy the lot for only $125.00 if you purchase the enclosure and woofer at the same time.

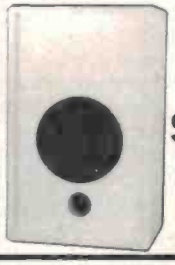
REF. EA JULY 1982

State-of-the-art power Mosfet technology combined with an active low pass filter results in a sub-woofer amp without equal anywhere!!
FEATURES: Around 100WRMS Drive capability.
Low pass (sub-woofer) filters on board.
Can hook-up to pre-amp out or power-amp out.
Power supply on board.
(Transformer needed. ONLY $39.50)

ONLY $79

THE ENCLOSURE

This compact 63 litre vented enclosure was specifically designed around the parameters of the SW250 Sub-Woofer. It follows the theory pioneered by the work of Thiele, Small and Snyder. The Jaycar enclosure is easy to build and is made of high quality durable materials. The heavy walled cabinet is covered with an attractive black vinyl veneer. All timber is pre-cut and the black grille is already made. Assembly takes less than one hour.
NB. The photo shows the prototype which was finished in white. The production units are only available in black
Freight anywhere in Australia only $10.00.



ONLY $79.50

syntom

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

ONLY $36.50 – 10%

500MHz Digital Frequency Period Meter

REF: EA Dec '81 – Feb '82

★ ★ ★ ONLY $119

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

EXCLUSIVE
Gold plated BNC Input Connectors
500MHz option only $26 extra
50MHz version $119
Tilting bail to suit ONLY $4.95

Function Generator

FREE! TILTING BAIL WORTH $4.95 included

Ref: EA April 1982

$99

"Pigeon Pair" companion to the new 500MHz DFM. Low distortion generator of sine, square and triangular waveforms. From below 20Hz to over 160kHz. Inbuilt 4 digit frequency counter in de-luxe Pac-Tec case. Only $85
JAYCAR EXCLUSIVE – 1% 50ppm metal film resistors used for stability

BOTH OF THE ABOVE NORMALLY $244 FEB ONLY $220!!

KITS SALE ★★★★★

A (★) ARE 10% OFF FOR THE MONTH OF FEBRUARY ONLY. HURRY!

Digital Thermometer

$69

EA2/82

Read the temperature in your room (or outside) from 0 degrees C to 100 degrees C in fact to within 0.1 degree C. Fantastic resolution on a bright easy-to-read display. Includes case.

DIGITAL CAPACITANCE METER

Ref: EA 3/82

This kit once again uses the amazing DPM 200 LCD /driver module. Capable of measuring capacitance from 1pF to 19.99uF. It is a must in every workshop or lab.

$69

HEART RATE MONITOR

Ref: EA 7/82

WAS $79
SAVE $10

This unit enables you to measure your own pulse instantly and accurately. It is light enough even for joggers to carry. A must for people who may have heart problems. Complete kit including LCD Display.

NOW **$69**

DIGITAL pH METER KIT

10% OFF FEB ONLY
NORMALLY $69.00
NOW $62.10 ★

EA CAR COMPUTER KIT ★

$143.10

Ref: August EA 1982

We've said enough about this kit. No details here — read our previous ads!
At present (time of ad going to press) our price is the lowest for the complete kit, at $159.00 (including both sensors).

February ONLY $143.10

(sorry only tailshaft sensor at this price!) (+ fuel sensor of course)
If you require the Speedo Cable sensor we have them at $29.50 ea.

TRANSISTOR ASSISTED IGNITION

Ref: EA January 1983. Latest version of this fantastically popular kit!! The Jaycar kit comes with a genuine DIE CAST box — as used in the EA prototype. Beware of others that use flimsy sheet metal boxes!! Ask us about the OPTO option.

ONLY **$35**

0-30V 1amp power supply

Ref: ETI December 1982

$49.50 complete

'Power UP'

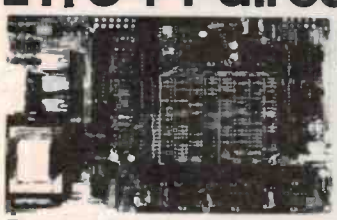
Ref: EA 11/82 ★

NO ROOM FOR DETAILS

$39.50-10%

ETI 644 direct connect modem

Ref: ETI October 1982



SHORTFORM KIT **$169**

FULL KIT **$189**

Two models (i) Short form which contains ALL PCB components as specified by ETI (BEWARE!!). The genuine ETI PCB with plated-thru holes, solder mask and component overlay is supplied. We also supply at NO EXTRA CHARGE a full set of quality I.C. sockets. A must with plated-thru PCB's. Remember this when making comparisons.
(ii) Full kit. Includes: all of above plus 12V plugpack, case, front panel, switch and LED bezel and Cannon DB-25 RS-232 connector. Makes a complete stand alonemodem.

* Capable of a range of Answer/Originate operating modes * Selectable Baud rate * Software controlled * Uses new patented technique * More reliable and faster than most acoustic modems.

EA Dual Tracking Power Supply

Ref: EA March 1982
One of our most popular kits!! Can provide dual voltages (±) from 1.3V to 22V at up to 2 AMPS. In addition the supply features a fixed +5V @ 0.9A The output is protected against short circuits, overloads and thermal runaway.

ONLY $89 COMPLETE

ETI 330 Car Alarm ★

Ref: ETI July 1981
This unique design detects the voltage drop that occurs across the strap that connects the engine block to the chassis. It does not use wiring inside the car where false triggering can take place. Kit comes complete with all components and metal-work (die cast box)
NORMALLY $29.50 FEB ONLY $26.55

ETI 492 Sound Bender ★

Ref: ETI Feb 1982
Short form kit of a device to give either your voice, musical instrument or other source that Dalek, metallic sound – as well as other sounds!
NORMALLY $24.50
FEB ONLY $22.05

ETI 445 General Purpose Preamp ★

Universal Stereo pre-amp. Flexible configuration allows you to use it as RIAA (Disc), NAB (Tape) or as a 'flat' pre-amp with fixed gain!
One day you will need one of these!
NORMALLY $7.99
NOW IN FEB $7.19 WOW!

ETI 446 Audio Limiter ★

Great little circuit that volume compresses when audio level reaches a pre-determined set. Ideal for P.A.
NORMALLY $12.00
FEB ONLY $10.80

ETI 760 RF Modulator ★

Ref: ETI Sept 1981
High quality, stable RF modulator. Less tendency to drift than cheap Hong Kong 'Tin Box' types. Will accept composite video signal and will supply modulated (video) RF on VHF channel 1 (tunable)
NORMALLY $12.99
FEB ONLY $11.69

ETI 499 150W Mosfet PA Module ★

Ref: ETI March 1982
150 RMS watts of pristine Mosfet power. At last a really stable high-power P.A. "Brick" at a realistic price!
NORMALLY $79.50
FEB ONLY $71.55 HURRY!

ETI 498 Preamp for above ★

What can we say? It's on special too!
NORMALLY $39.50
NOW (FOR FEB) $35.55

ETI 479 Bridging Adaptor ★

Ref: ETI March 1982
This clever little circuit will convert your 5000 Stereo 100W Power Amp - say a "Black Monolith" to a 300W RMS Mono P.A.! Is nothing sacred?
NORMALLY $9.95
FEB ONLY $8.95

SIMPLE ETI KITS

Train Controller ETI December 1982

Sorry no room for pics! ETI1508 Model Train Controller.
Sorry also. Our kit does not include the metal-work but we have reduced the price to $59 per controller.

Polyphonic Organ

Ref: ETI Jan 1983
Here at last! This very popular kit is now in stock.
* "Touch Sensitive" P.C.B. keyboard * Fully Polyphonic * Two voices * 25 notes, 2 octaves * Can operate from battery or plupack.
(Case not included)

ONLY $49.50

Jaycar NUMBER 1 FOR KITS

125 YORK STREET, SYDNEY 2000
PHONE: 264 6688 TELEX: 72293
"NEVILLES CORNER"
Cnr. CARLINGFORD & PENNANT HILLS ROAD, CARLINGFORD
PHONE: 872 4422 or 872 4444
MAIL ORDERS TO: BOX K-39 HAYMARKET, SYDNEY 2000

POST AND PACKING CHARGES
$5 – $9.99 ($1.50) $10 – $24.99 ($3.20)
$25 – $49.99 ($4.80) $50 – $99.99 ($6.50)
$100 up ($8.00)

NEW SHOP HOURS
Mon – Fri 8.30 to 5.30pm
Sat 8.30 to 12.00pm
Thurs night to 8.30pm

Mail Order By BANKCARD Via Your Phone

SHERIDAN'S NEW YEAR PARADE OF GOODIES

MONSTER COMPONENT PACK

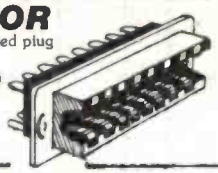
2lbs of useful components: switches, capacitors, slide pots rotary pots, relays, tag strips etc. Worth over $20.00!!

only $4.00

CONNECTOR SELLOUT

16 WAY 'BLUE RIBBON' CONNECTOR

Top quality barrier polarized plug and socket pair.



only $6.50 (the pair)

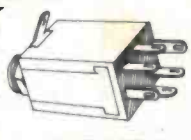
MICRO RIBBON CONNECTOR 57 SERIES

24 WAY(pair) **$7.50**
50 way(pair) **$9.00**

1/3 NORMAL PRICE

6.5mm STEREO JACK PACK

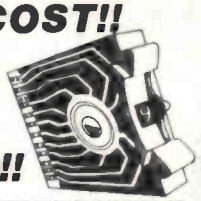
Pack of 5 stereo **switching** jacks, as used on amplifiers for headphone socket. Normally you would pay around $1.00 for these. We are selling a pack of 5 for only $2.50. That's around half price!!



5 JACKS for $2.50

THUMBWHEELS FOR 1/3 NORMAL COST!!

High quality UK STOLEC 10 position single pole thumbwheel switches slashed for this month only. These precision switches are in grey Dimensions 57mm (height) x 70mm deep x 15mm wide. Scoop price!!



5 FOR $10.00!!

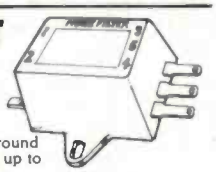
8 POLE DIL SWITCH

These top quality 8 pole DIL switches are fully coloured coded and numbered. Other are asking $2.75. We have made a special purchase. Look at the savings!!

$1.90 10up $1.99

MAINS LINE FILTERS.

If you have trouble with mains interference on your computer, calculator etc, this is the answer. Reduces line to line and line to ground interference dramatically. Current up to 5A. Fully D.O.T approved.



PLF-2V-3RA-501(3A) $10.50
PLF-2V-5RA-501(5A) $11.50

SOLID STATE RELAY

Save on these superb Solid State relays from Gordos USA. Designed for commercial and industrial applications, they are able to switch inductive loads with ease. Optical isolation for safety.

Control voltage	3 to 32 volts DC
Max Line Voltage	280V AC
Max Load current	10A
Max 1 sec. surge	40A
Max 1 cycle surge	100A

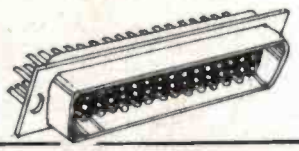
Further details available.
These superb SS relays sell for $27.00 around town. But look at our price!!

$21.00

'D' CONNECTORS AT UNBEATABLE PRICES

We are selling these brand new, top quality 'D' connectors at prices well below any known competitor. Best value in Australia!

50 way (plug and socket pair)	**$10.00**
37 way (plug and socket pair)	**$8.00**
9 way (plug and socket pair)	**$5.00**
25 way (plug only)	**$2.00**



LOOK WHAT WE FOUND BEHIND THE KITCHEN SINK!!

2102 MEMORY ICs !!!!

Bet you pulled your hair out looking for these! Brand new, still in the tubes, 2102A-4 memory chips. Fix that old computer today!!

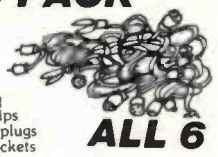
$2.00 each **10 for $17.00**

AUDIO LEAD PACK

We've put together these super audio lead packs at a fraction of normal cost. Pack includes:

PART NO	DESCRIPTION
A	5 pin DIN to 5 pin DIN plug
D	3.5mm plug to 2 alligator clips
F	5 pin DIN plug to 4x6.5mm plugs
I	6.5mm plug to 2x6.5mm sockets
K	5 pin DIN plug to 3.5mm plug
M	5 pin DIN plug to 4 x RCA plugs

Others are charging $2.00 to $3.00 each!!



ALL 6 for $5

MONSTER RESISTOR PACK - INCREDIBLE!!!

At least 400 per bag in ¼, ½, 1 and 2 watt types. 10%, 5% 2% and 1% types. Carbon and wirewound types!! What a knockout!!

A must at only $4.00!!

MONSTER CAPACITOR PACK

Half a kilogram of brand new unused capacitors (electos, polyesters, ceramic and styro types. Well over 100 per bag. Crazy!!

GRAB EM only $5.00!! **Retail value over $25.00!!!!!!!!!!!!!!!!**

MONSTER POT PACK

Huge selection of pots including single, dual, switch, slider etc. 30 in all. Wow!!!!

VALUE!! only $5.00

MONSTER RELAY PACK

20 brand new unused relays. Huge selection. 12, 24 and 48 volt types. Worth at least $50.00 But look at the monster saving!!!!

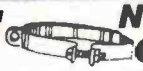
only $5.00!!

TAG TANTALUM PACK. WOW!!!!!

We all know just how expensive tantalum caps are. So look at our price!! 4 each of the following values (12 in all) 3.3µF 16V, 4.7µF 25V, 100µF 6.3V. Normally you would pay around $5.50. Look at our price.

12 tantalums $1.95
Normal cost approx $5.50!!!

ELECTRO SALE

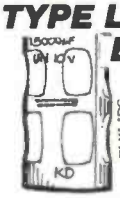


NOW ALL 10% OFF ON ANY TYPE LISTED BELOW

1/2 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
8700	40	SPRAGUE	35	110	$7.50
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
70000	50	SNGAMO	75	225	$26.00
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	10	SNGAMO	65	120	$15.00
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

SHERIDAN ELECTRONICS

164-166 Redfern St., Redfern NSW 2016. Phone (02)699 6912, (02)699 5922
Mail Orders to Dept ET, 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

bankcard welcome here

SEAL OF SATISFACTION

MAGRATHS

WORLD OF ELECTRONICS

TI CALCULALATORS FROM MAGRATH'S

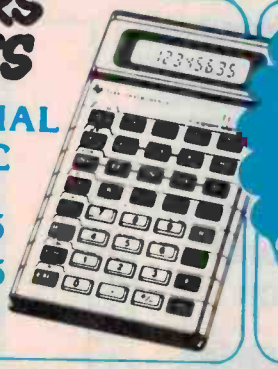
- FINANCIAL
- SCIENTIFIC
- STUDENT

TI-35 Student math kit $27.15

TI-54 Engineers & Science $44.95

TI Business Analyst II $49.90

PRICES INCLUDE SALES TAX



MEMORY BARGAINS

HM6116P-3 (HITACHI) 2K×8 CMOSRAM $7.50

MB2716 (FUJITSU) 2K×8 EPROM $3.00

MB2764 (FUJITSU) 64K EPROM $12.00

MB8118 (FUJITSU) 16K DYNAMIC RAM (Intel 2118) 120ns $4.00

SPEAK & SPELL as featured in E.T.™

$110.00 INCLUDES SALES TAX

E.T.PACK INCLUDES

- One Speak & Spell learning aid
- The new E.T. Fantasy Module
- New photo-filled activity book
- Colorful movie poster
- T-shirt decal with E.T. and Elliot

TI PERSONAL HOME COMPUTER TI-99/4A

$499.00 INCLUDES SALES TAX

You can buy just a video game — or you can get a full colour Home Computer

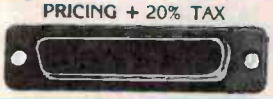
- Typewriter Keyboard
- 16K bytes RAM
- Expandable to 52K bytes RAM
- Easy to follow instructions
- Extensive range of programmes
- Educational
- Add-on expandability

SUPER LOW PRICES

AMPHENOL 17 SERIES DB25 PLUGS & SOCKETS

Plugs $1.85 Sockets $2.45

PRICING + 20% TAX



6 PACK SPECIALS

LM 340T-5	$2.55
LM 340KC-12	$6.00
74 LS 90	$2.10
74 LS 14	$2.00
74 LS 00	$1.00
4520 B	$3.70
4511 B	$3.45
4066 B	$2.40
4016 B	$1.50
KBP 602	$5.00
MU 5053	$10.35

PRICING + 20% TAX

COMPUTER CLEANING PRODUCTS

Safekit

SAFEKIT is also supplied without FLOPPICLENE.

SAFEKIT 8 inch $72.65

SAFEKIT 5¼ inch $70.80

FLOPPY CLENE® 8 inch $50.25

FLOPPY CLENE® 5¼ inch $49.50

PRICING + 20% TAX

SAFEKIT Computer Cleaning Kit is a compact, durable, vacuum-formed book kit specially designed to contain the items required for basic maintenance of a mini or micro computer. The products included in this kit are SAFECLENE, FOAMCLENE, SAFEWIPES 10 cm., SAFEBUDS, SAFECLOTHS and FLOPPICLENE 8" or 5¼".

ASK FOR OUR GREAT DEAL ON MICROLINE & NORTH STAR.

NORTH STAR ADVANTAGE

The ADVANTAGE contains a 4 MHz Z80A® CPU with 64Kb of 200 nsec Dynamic RAM (with parity) for program storage, a separate 20Kb 200 nsec RAM to drive the bit-mapped display, a 2Kb bootstrap PROM and an auxiliary Intel 8035 microprocessor to control the keyboard and floppy disks. The display can be operated as a 1920 (24 lines by 80 characters) character display or as a bit-mapped display (240x640 pixels), where each pixel is controlled by one bit in the 20Kb display RAM. The two integrated 5¼ inch floppy disks are double-sided, double-density providing storage of 360Kb per drive for a total of 720Kb.

$5250 + 20% TAX

PRICING INCLUDES GDOS or GCPM

MICROLINE 84 DOT MATRIX PRINTER

200 cps BIDIRECTIONAL 136 COLUMN

Standard Features

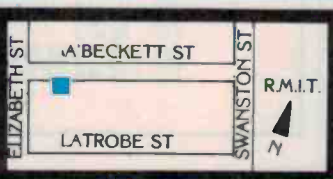
- Bidirectional
- Short line seeking
- Graphics APA Graphics 72 x 72
- Operates with TRS-80, Apple, others
- Double width and condensed characters
- Near Letter Quality Printing 50cps
- Subscript Printing
- Superscipt Printing
- Emphasised Printing
- Incremental Printing
- Tractor Feed
- 9 x 9 Dot Matrix
- Optional 2K buffer & RS232C Serial Interface

SERIAL $1695+ 20% TAX

PARALLEL $1495+ 20% TAX

SUPER BARGAINS AT MAGRATHS

VISIT US AT OUR NEW ADDRESS

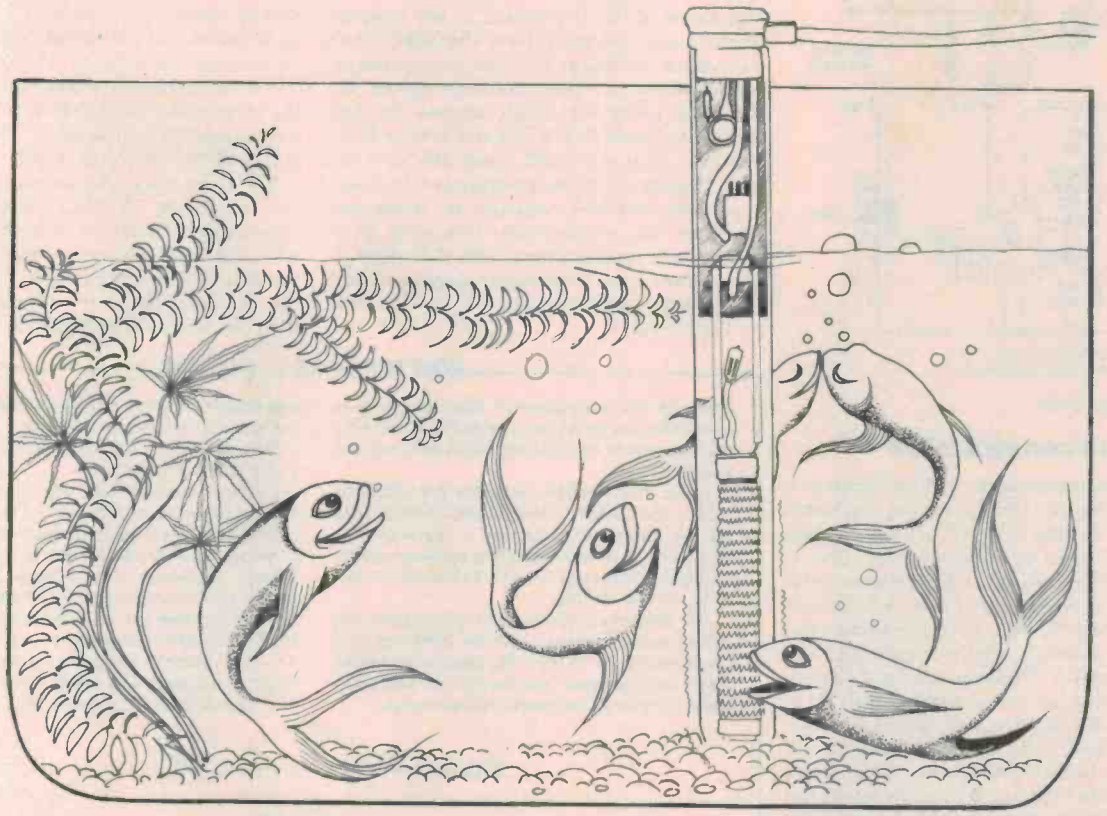


55 A'BECKETT STREET
MELBOURNE, 3000.
Tel (03) 347 1122

welcome here

Add Sales Tax if applicable

Prices subject to alteration Prices valid until stock sold.



Immersible temperature controller features zero-crossing ac control

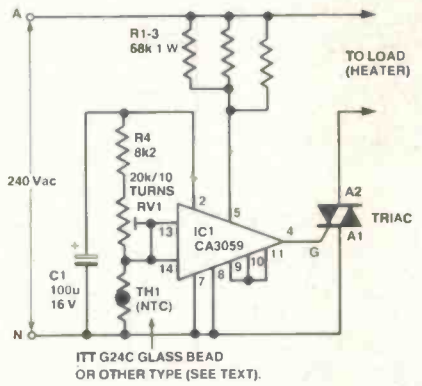
This simple to construct project has done sterling service as a temperature controller in a common fish tank heater but has wide application. It features a zero-crossing switch type controller to prevent RF interference to other appliances.

Jonathan Scott

IF THIS PROJECT did not run directly on 240 volts we would call it a simple project. It contains only one IC, a triac and very little else, yet it is a full zero-crossing switch system capable of controlling up to 1500 watts of heating power that may be employed to regulate the temperature of a room, a fish tank or a bowl of yoghurt-in-the-making. The latter two tasks are those for which it was first dreamed-up, but more ideas come to the mind the longer you think about it. The fact that it is a zero-crossing switch (see the panel on page 31) rather than a proportional phase control means that it will not generate any RF noise — no clicks or pops in the hi-fi, no buzzes or hums in radios.

The fact that it is quite small (it requires no heatsink for loads of 200 watts or less) makes it possible to include it in the innards of the heating device. For instance, we built one inside the narrow glass tube of an aquarium heater. It is cheap to build as it requires no transformer or mechanical relay mechanism. It can be adjusted to regulate to any temperature that the sensor can stand. In our case we wanted to regulate to a temperature in the 25-30°C region, but the unit will regulate over quite a wide range of temperatures with the correct resistor values, provided the pc board is not cooked along with the thing you are heating. This means of course, that the pc board and triac must be separated if you want to go over about 50°C or so. Varying things is covered later.

At this point, let us stress that the pc board *is operating at live mains potential* as the IC is designed to run directly on the mains without transformer isolation, so *be careful*. You should never touch any of the components while the circuit is plugged in, nor try to adjust the setpoint preset pot. Exercise extreme care when installing the circuit and ensure that it is mounted securely in a place where it is sealed away from prying fingers and poking utensils. While no less safe than the ordinary mains connection in whatever appliance you are using it with, it is significantly more tempting to approach this little fellow with a screwdriver or pair of pliers, so do try not to cost ETI any readers, especially yourself or your family. ▶



Circuit. Simple, what?

Parts and construction

Three of the components in this circuit are worth delving into briefly, so that you know what they do and how the choice of type affects the circuit performance. The first is the triac. This must be of 400 or more volts rating, and it must be of at least 4 A current rating as the pc board is designed to take the type which comes in a bolt-on package, and these start at 4 A. This over-rating, if you are only planning to have around 150 W of heater, as I did, allows you to dispense with a heatsink. There is no reason why you should not have a higher rating still if the thing physically fits in place. With a heatsink, the type we found most common at the suppliers (and used) is rated at 6 A and will thus run up to 1500 watts (6 A x 250 volts) of load.

The IC we have specified is a type CA3059, from RCA (distributed by AWA Microelectronics). There are three ZCS ICs available, one slightly more expensive which offers tighter specifications, of no use to us here. The other one, a CA3079, lacks a facility which is incorporated in the 3059, the device specified. This device has an 'automatic switch-off' facility for the heating element in the event that the temperature sensing thermistor goes either open circuit or short circuit. This means that if the connections to the sensor or the sensor itself fail, the system will not turn the heater on and overheat the controlled object. This adds a dollar or two to the price, but is quite worthwhile. The 3079 device must not be used in this circuit.

The thermistor you use will depend upon how much you wish to pay, how robust a component you need, and how you wish to connect it thermally to the load, as well as the temperature you are going for. We used both a cheap bead type, and an ITT G24CW. The latter is a small, but strong, glass bead type with a wide temperature range — but a $10-plus price tag! The G24CW is a professional type, but reliable and predictable. As we pointed out above, a failure of the thermistor is not likely to cause anything but a cooling of the load, so unless you are willing to pay the price and need the reliability, use a cheap type. It is only necessary to have a resistance of 10k to 60k at the regulated temperature. We used a type having a resistance of 47k at 20°C, costing $1 to $2 at a local supplier.

Once you have obtained the thermistor, it is necessary to select R4 and RV1 to suit. These must together be able to equal the resistance of the thermistor at the temperature you are going for. Now, the G24CW has a resistance of 20k at 20°C and a temperature coefficient of so many ohms-per-degree. As we were going for 20-25 degrees in that model, we chose 8k2 for R4 and 20k for RV1, ensuring that we could reach 20k or a bit less. In general, if the thermistor is a cheap type, you had best measure its resistance while at the temperature you need. If it comes with specifications, say of X ohms at 20 degrees and Y ohms-per-degree, it will have a total resistance of (X+Y (20−T)) ohms at T degrees.

So, having selected these components, you should assemble them on the pc board in accordance with the overlay diagram. Take care to get the polarity of the IC, capacitor and triac correct. Note that the metal flag of the triac is the A2 (anode 2) connection, and the lead to the load is taken via a lug on the bolt holding it to the pc board.

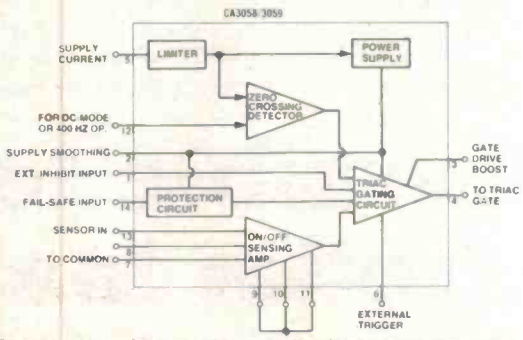
The final piece of constructional detail is the mounting of the thermistor. It is important to have it in close thermal contact with the item you are trying to heat. In our constructional example we are regulating the temperature of the liquid surrounding the tube within which the controller and the

HOW IT WORKS — ETI-1511

Most of the functions of this temperature controller are contained inside the IC, so let's take a look at the CA3058/3059 zero-voltage switch IC first.

Three zero-voltage switches are made by RCA — the CA3058, CA3059 and CA3079. They are all designed to control a thyristor in a variety of ac power switching applications for ac input voltages of 24, 120, 230 and 277 volts at 50, 60 and 400 Hz.

The 3058 is supplied in a 14 lead dual-in-line (DIL) ceramic package and the 3059 and 3079 are supplied in 14 lead DIL plastic packages. Each incorporates four functional blocks as follows (refer to the block diagram here):



1. Limiter-Power Supply — permits operation directly from an ac line.
2. Directional On/Off Sensing Amplifier — tests the condition of external sensors or command signals. Hysteresis or proportional-control capability may easily be implemented in this section.
3. Zero-Crossing Detector — synchronises the output pulses of the circuit at the time when the ac cycle is at zero voltage point; thereby eliminating radio-frequency interference (RFI) when used with resistive loads.
4. Triac Gating Circuit — provides high-current pulses to the gate of the power controlling thyristor.

In addition, the CA3058 and CA3059 provide the following important auxiliary functions:

1. A built-in protection circuit that may be actuated to remove drive from the triac if the sensor opens or shorts.
2. Thyristor firing may be inhibited through the action of an internal diode gate connected to Terminal 1.
3. High power dc comparator operation is provided by overriding the action of the zero-crossing detector. This is accomplished by connecting Terminal 12 to Terminal 7. Gate current to the thyristor is continuous when Terminal 13 is positive with respect to Terminal 9.

Because the CA3079 does not incorporate the built-in protection circuit, the CA3058 or CA3059 have been specified for this project. If the project is used to control a fish tank heater, one doesn't want to boil one's finny friends in the event of a thermistor failure!

Now we know what's inside the IC, how is it put to work in the circuit?

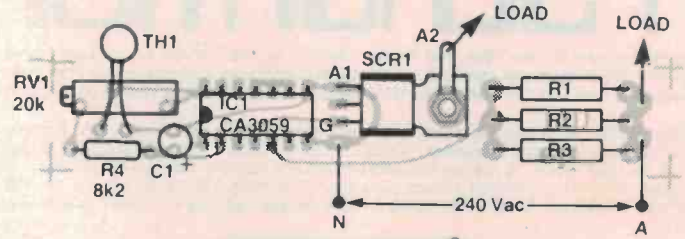
Initially, consider the Triac to be turned off. Some current flows into pin 5 of the IC and this is limited by R1-3 and rectified within the IC to provide about 8 Vdc for the operation of the circuit. Capacitor C1 smooths this supply. Inside the IC are a number of separate sub-circuits centered on a comparator ('ON/OFF SENSING AMP'). Connection of pins 9, 10 and 11 uses internal resistors to establish half supply rail (about 4 V) as one of the levels to be compared. When the voltage on pin 13 exceeds half rail potential the comparator activates a circuit which turns the triac on at the next supply zero, and each subsequent zero until the voltage falls below half rail.

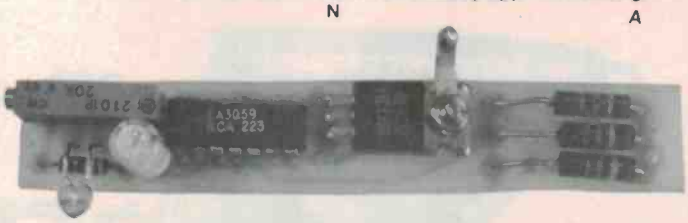
Clearly then, RV1/R4 must be selected so that they add up to the resistance of the sensing thermistor at the temperature for which it is desired to regulate. Thus, when the temperature reaches the preset point, the voltage across TH1 corresponds to half rail potential on pin 13.

Pin 14 allows the protection circuit to detect when TH1 goes either open circuit or short circuit by looking at the voltage at the junction of R4 and TH1. If this voltage nears the dc supply rail or the local common (N), there has been a failure, and the firing of the triac is inhibited until the condition is removed.

The supply dropping resistors R1-3 are used instead of a single resistor purely for size considerations. All that is required is that they deliver 10 to 50 milliamps to the IC's rectifier-regulator.

The sensing thermistor must be a negative temperature coefficient type (NTC), as its resistance must drop with increasing temperature in order to reduce the voltage on pin 13 as the temperature is brought towards the setpoint. There is sufficient excess supply current to allow it to draw at least one milliamp if necessary. Thus, any of the common small bead types with a few kilohms of resistance at the setpoint may be used. The total permissable sensor resistance range is 2k to 100k.





PARTS LIST — ETI-1511

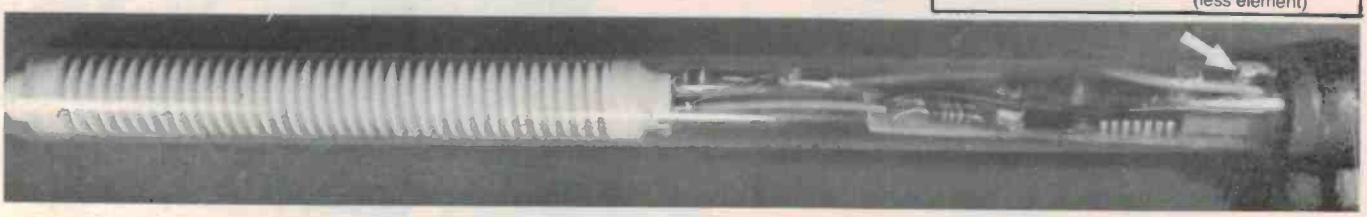
Resistors ..... all ½ W, 5% unless noted
R1, 2, 3 ..... 68k, 1 W
R4 ..... 8k2 (see text)
RV1 ..... 20k, 10-turn trimpot

Capacitors
C1 ..... 100u/16 V tant.

Semiconductors
IC1 ..... CA3059
SCR1 ..... 6A/400 V triac, e.g: TIC226D or similar

Miscellaneous
TH1 .. thermistor to suit application, e.g: ITT G24C glass bead type (see text)
ETI-1511 pc board; solder lug; hookup wire; heating element, etc.

Price estimate **$14 — $16** (less element)



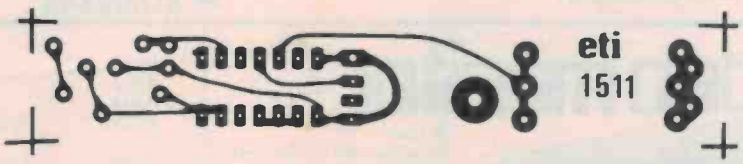
Naked and clothed. At top is the naked pc board (approx. life size) to compare with the component overlay. The lower picture shows the completed immersible temperature controller made from a common fish tank heater. The arrow shows the positioning of the thermistor sensor.

heater are immersed. It is thus only possible to regulate the tube temperature, as we cannot put the (live) sensor in the liquid. The sensor was pressed against the tube and seated in a blob of thermal compound of the type used for mounting transistors on their heatsinks. This meant that it was held at the temperature of the outside as much as possible, rather than at the temperature of the heater and controller themselves. In general, the limitation of keeping the sensor in the same container as the rest of the controller is the one responsible for the accuracy of the system. This method, used in small appliances and ordinary aquarium heaters, gives about two degrees accuracy if the liquid is well mixed and convects freely past the tube. Our controller, limited by the same problem, gives little improvement: the only advantage comes from the fact that the sensor is a small piece of solid which can be pressed to the glass firmly, whereas the mechanical (bi-metallic strip) type of temperature sensor cannot be so positioned. In a larger container it can be separated by some distance and placed wherever you need, and it will give fractional degree accuracy.

As the design of the housing is largely up to the individual constructor, there is very little to say about the physical makeup of the project. If you are copying the format shown in the pictures, assembly is rather straightforward. The only point to note is that you will have to take particular care to see that the tube is sealed against the accidental entry of liquid. Here, Silastic or a similar silicone sealant comes in very useful.

It is necessary to set the preset pot before sealing up the immersible tube. This is done by carefully setting the system up with water coming up to the point on the tube above where the sensor is located. Then, allow a couple hours of undisturbed operation and measure the liquid temperature with a thermometer. Adjust the preset pot (mains unplugged!) and repeat. If you measured the thermistor beforehand, while at the correct temperature, you can adjust the pot/R4 combination to give you that resistance straight away and there should be no need to make a second adjustment of the pot. If at some later stage you wish to change the set point, Silastic is easy to peel away and you can reseal the tube when the adjustment is made and checked.

We do not advise you to leave an access hole to permit adjustment of the pot because, firstly, someone might try and do that with the power on *(poof!)* or more likely the liquid will find a way of invading the tube and quietly ruining the components. ●



THE ZERO CROSSING SWITCH (ZCS) TECHNIQUE

In normal phase control switching the switching element, an SCR or Triac, is triggered into conduction at some time during each half cycle. The moment of switching is varied, so that the duration of the applied voltage pulse, which corresponds to the fraction of the cycle left at the point of triggering, is varied. This is a simple and direct method which does vary the applied power fairly smoothly (see Figure 1). Unfortunately, the sudden application of voltage tends to produce a lot of electromagnetic radiation due to the sudden current change in the load circuit. This is responsible for a lot of radio frequency interference, or RFI.

In ZCS the switching element is only allowed to change to the conducting state when the supply voltage is crossing the zero-voltage point — hence the name. This means that there are no sharp voltage transitions across the load, and so no RFI. The penalty paid is that only whole half cycles are applied to the load. The system is thus not readily applicable to lighting applications as the lights flicker badly due to the relatively long periods between conduction and isolation (see Figure 2).

For applications where the system has sufficient inertia, such as heating, this system is by far the superior technique. As the required functions are available within a single, relatively cheap, IC it is practicable to build a ZCS system with almost the same ease as a proportional system.

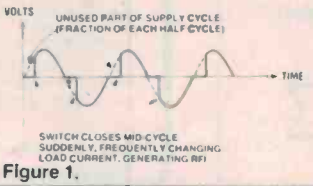


Figure 1.

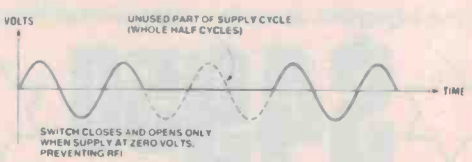


Figure 2.

COMPUTER SENSATION!!

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!!

- 64K OF RAM SUPPLIED STANDARD all that you are ever likely to need!!
- Text, lo and high resolution graphics STANDARD
- Video AND TV (RF) output STANDARD
- 6 COLOURS

Only $598

- Centronics printer interface STANDARD
- Multitech BASIC is compatible with APPLE II BASIC. Most APPLE software will run on the Micro Professor Mk II
- Easy-to-use manual included in the price (over 248 pages)
- Power supply included as STANDARD

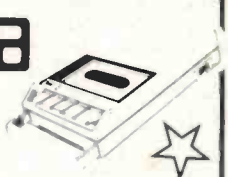
video monitor

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

$199

green screen

Micon data cassette



Micron adjustable azimuth — data compatible cassette

$49.50

SPECIFICATIONS

Paddle Optional

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	6 colors
Keyboard		49 alphanumeric and function keys
Cassette	Interface	Use various cassette tapes and cartridges
Software	Cartridge Interface	as data storage units
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

Jaycar NUMBER 1 FOR KITS

125 YORK STREET, SYDNEY 2000
PHONE: 264 6688 TELEX: 72293
"NEVILLES CORNER"
Cnr. CARLINGFORD & PENNANT HILLS ROAD, CARLINGFORD
PHONE: 872 4422 or 872 4444
MAIL ORDERS TO: 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 up ($8.00)

NEW SHOP HOURS
Mon - Fri 8.30 to 5.30pm
Sat 8.30 to 12.00pm
Thurs night to 8.30pm

Mail Order By BANKCARD
Via Your Phone

Electric fence tester

This project was developed to take some of the guesswork out of testing or checking an electric fence. Many factors can influence the operation of an electric fence energiser and fence, reducing its effectiveness. A common method of testing a fence is to hold a blade of grass near the wire and get the 'feel'. Get it wrong and you'll find yourself dusting off the seat of your pants!

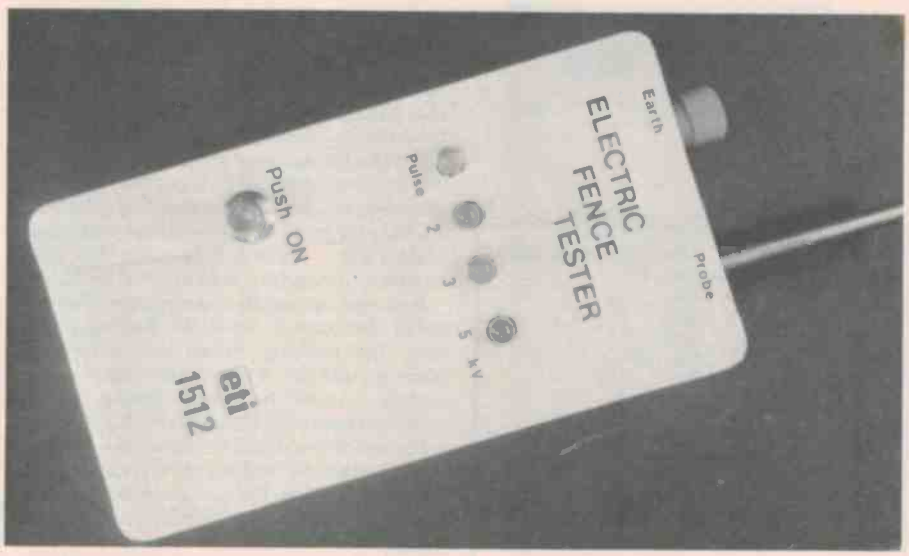
Graeme Teesdale

ELECTRIC FENCES are now a common 'tool' of farm management. Cattle which escape from an enclosure can cause considerable injury to themselves and other property. An electric fence is an effective, non-injurious barrier when properly erected and maintained. But they have to be maintained! Checking if an electric fence is operating by grabbing it is one method to prove it's working — but few relish the substantial 'jolt' delivered. Another method is to hold a blade of grass near the fence wire. At a few centimetres distant, you should feel a 'tickle'. But, that's dependent on the moisture in the grass, your contact with the ground, etc. If you fail to feel the tickle and approach more closely, you're liable to receive quite a jolt! None of these methods is quantitive, nor can results be compared day-to-day or along the length of a fence.

This project was devised to provide a more quantitive indication of fence/energiser operation and avoid the pitfalls of the 'grass roots' methods.

The unit indicates the presence of each pulse from the energiser and shows when the pulse voltage on the fence wire exceeds an amplitude of 2 kV, 3 kV and 5 kV, once calibrated. If used in an uncalibrated mode, the unit will indicate pulse amplitudes on the fence of 40%, 60% and 100% of energiser output.

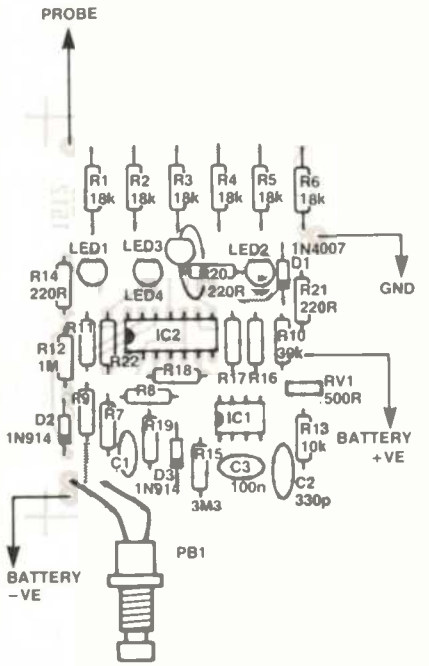
The electronics for this project has been deliberately kept simple, so that the cost is low and reliability good. Construction, too, is simplified. Only two ICs, a handful of resistors and capacitors, four LEDs and very little else is used. The LEDs are used as indicators. So that they can be readily seen in sunlight, we recommend you use the common yellow LEDs or the recently introduced 'high brightness' types.

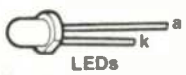


Our tester was housed in an all-plastic case — so that you can't possibly come in contact with anything carrying the high voltage pulses! The case is held in one hand and the probe protruding from the end touched on the live wire from the fence after the 'ground' probe or lead is literally 'earthed'. Pressing the pushbutton on the front panel turns the unit on. One LED indicates the presence of a pulse. The '2 kV' LED lights to indicate the unit is on and goes out when a voltage pulse exceeding 2 kV is present. When the voltage pulse exceeds 5 kV, the 2 kV LED goes out and the '3 kV' and '5 kV' LEDs flash on. If there is a problem with the fence or the energiser, and the voltage does not exceed 2 kV, the 'pulse' LED only will flash, indicating that the energiser is working but that the voltage is low. More details on checking out a fence are given later.

Construction

For ease of assembly and reliability, it is recommended you use our pc board design. This board will fit in a standard, commonly stocked plastic case measuring at least 60 mm wide by 30 mm deep by 110 mm long. A number of models have been made, but the one shown in the photograph measured 65 x 36 x 121 mm (w-d-l). The front panel was dressed up with a *plastic* Scotchcal label. Don't use a metal type as pulses from the fence probe may 'track' across the case to the panel and you may receive a little surprise. You can make your own pc board using our artwork or buy one ready made, that's up to you. ▶





LEDs

ICs


diodes

PARTS LIST — ETI-1512

Resistors ..... all ½ W, 5% unless noted
- R1-6 ..... 18k, 1 W
- R7, R12 ..... 1M
- R8, R15 ..... 3M3
- R9 ..... 100k
- R10 ..... 39k 1 W
- R11 ..... 2M2
- R13 ..... 10k
- R14, 20, 21, 22 .... 220R
- R16 ..... 4k7
- R17, R19 ..... 2k2
- R18 ..... 1k2
- RV1 ..... 500R min. vertical mount trimpot.

Capacitors
- C1, C3 ..... 100n greencap
- C2 ..... 330p ceramic

Semiconductors
- D1 ..... 1N4007
- D2, D3 ..... 1N914, 1N4148
- IC1 ..... CA3140
- IC2 ..... LM324, uA324
- LED1-4 ..... TIL220Y yellow LEDs

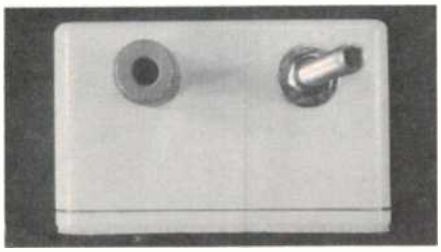
Miscellaneous
- PB1 ..... pushbutton

ETI-1512 pc board; all plastic zippy box 121 x 65 x 36 mm or similar; No. 216 9 V battery and clip lead; Scotchcal front panel; wire, alligator clip etc.

Price estimate
$18 — $22

When you've gathered all the components together, first thing to do is check the pc board. See that all the holes are drilled the correct size and that there are no broken tracks or shorts between tracks — particularly between the IC pins. Commercially made boards don't suffer such problems in general, but do check the hole sizes. If you mount the pushbutton switch on the pc board, like I did, then see that the holes where it mounts are of the right diameter. Leads on the LEDs on the trimpot are usually of greater thickness than most other components and their mounting holes should be checked too.

At the 'top' of the case, mark out and drill two holes for the fence and ground probes. The fence probe shown on the model in the photographs was a 50 mm long 2 BA bolt. The ground probe was plugged into a standard 'banana' socket.


Top. Fence probe and ground socket.

If, or when, all's well with the pc board, mark out and drill the case. Tackle the front panel first. You can use the Scotchcal artwork as a template to mark out the front panel, pricking through the artwork with a sharp-pointed instrument such as a scriber. Drill the holes carefully. It's easier to use the lid of the plastic case as the front panel. No clip holders for the LEDs were used as they're unnecessary, really. Just drill the LED holes slightly larger than the diameter of the body of the LED — 5 mm will do nicely. The pushbutton will require a 6.25 mm (¼") hole.

Now you can put the Scotchcal on the front panel. Position it carefully, having peeled away the backing. When you've got it in position, smooth it down rubbing from the middle toward the edges, taking care to avoid getting bubbles under it. If you do get some bubbles or small wrinkles, these can be smoothed out by rubbing them away towards the nearest edge. Using a modeller's scalpel or other sharp blade, carefully cut out the holes in the Scotchcal.

With the case prepared, you can tackle the pc board assembly. Refer to the accompanying overlay. Solder all the resistors and capacitors in place first, including RV1. Then solder all the diodes in place, making sure you get them the right way round. Note that D1 is a 1N4007 and D2, D3 are 1N914s or 1N4148s. Solder the two ICs in place next, taking care to orient them correctly. Solder the pushbutton to the board next, making sure it sits perpendicular to the board. Last of all come the LEDs. Place them in their positions, making sure you get them the right way round, but don't solder the leads yet. Temporarily mount the board to the panel using the pushbutton. Then, pushing each LED into place in turn, solder their leads to the board. Disassemble the board from the front panel and solder flying leads of adequate length from the fence probe and ground probe pads on the board and attach the battery clip lead. Use heavily insulated wire for the probe leads and space them well away from each other.

Assemble the board to the panel once again and terminate the two probe leads from the board. Plug in a No. 216 9 V battery and you're ready to test and calibrate the unit.

Testing it

This method is guaranteed non-dangerous as you don't get anywhere near an electric fence or fence energiser! For this test you will need one 470 ohm resistor. Solder one lead to the battery positive pad on the board. Set RV1 so that its wiper is at the R10 end of its travel (toward IC1). Press the pushbutton. The '2 kV' LED should come on. Now touch the other end of the 470 ohm resistor to the junction of R10 and RV1. The '2 kV' LED should go out, the '3 kV — 5 kV' LEDs should light and the 'pulse' LED should give a flash. When you disconnect the 470 ohm resistor, the '3 kV — 5 kV' LEDs should go out in reverse order (5 kV LED first) and the 2 kV LED light briefly. If you don't get these indications, look for an error in component orientation or placement. Check that you're getting the supply to the circuit when you press the pushbutton, too.

Correct any errors and try again.

Calibration

You can go about this in several ways. The display can be calibrated to read fence voltage as a percentage of energiser voltage output or it can be calibrated to read directly in volts.

If you're going to calibrate the display to show percentage of energiser output then this should be done with the energiser connected to either a 'known good' fence or to a ▶

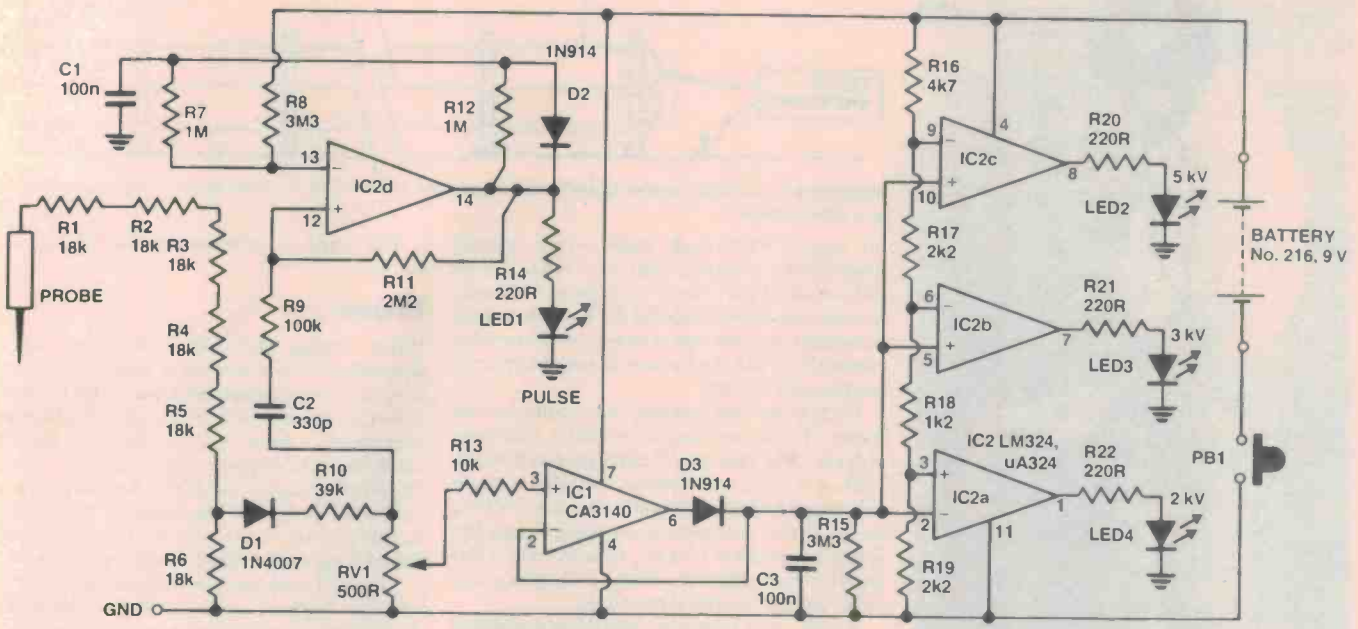
RESISTORS R1 TO R6 AND R10

These seven resistors require special mention. In use, they will experience a pulse voltage across them of around 800 to 1000 volts. Power dissipation will never be a problem as the pulse duration is too short and pulse timing too long to cause any significant dissipation.

However, all resistors have a voltage stress rating for both continuous operation (max. dc working voltage) and for pulse operation. The reaction of resistors to voltage stresses is almost instantaneous. Carbon film resistors — commonly stocked by component suppliers — can withstand about twice to 2.5 times their rated dc working voltage under pulse conditions. A 1 W carbon film resistor generally has a dc working voltage of 500 V and thus will withstand 1 kV to 1.25 kV under pulse conditions. Thus, we recommend resistors of 1 W rating for R1 to R6 and R10.

At a pinch, ½ W resistors could be used. These generally have a dc working voltage rating of 350 V and, at best, will withstand 875 V under pulse conditions.

(For more information, see *Resistors* and *Film Resistors*, by Roger Harrison, ETI September '76 page 90 and November '76 page 15, respectively.)



HOW IT WORKS — ETI 1512

The circuit can be divided into four sections: the input divider, the peak voltage detector, the display and the pulse indicator.

INPUT DIVIDER

The input divider comprises R1 to R6, plus R10 and RV1. Diode D1 is for protection, and I'll get around to that shortly. Assuming a positive-going input pulse of 5 kV peak, the voltage appearing across R6 will be about 830 V. This will be conducted to R10/RV1 via D1 and a pulse of about 10 V peak will appear across RV1. When calibrated to indicate voltage on the display LEDs, RV1 will be set to about mid-travel and a pulse of about 5 V peak will appear on the wiper of RV1. What happens to that, I'll get around to in a minute, but first, what's the reason for D1?

Should the input pulse on the fence probe be negative-going, as it sometimes is, then D1 will not conduct as it will be reverse-biased. This prevents a large negative-going pulse being conducted to the rest of the circuit. If the peak pulse voltage developed across R6 in this situation should be greater than 1000 volts, D1, which is rated at 1 kV PIV, will likely go into reverse, or 'zener', breakdown the current passed through it being limited by R10. The voltage across RV1 will be very low, thus ensuring the rest of the circuit is still protected.

PEAK VOLTAGE DETECTOR

IC1 and D3 are arranged as a peak voltage detector. The positive-going input pulse from RV1 is applied to the non-inverting input of IC1, pin 3, via R13. As the input impedance of IC1 is very high, R13 does not drop the input voltage and simply provides input current limiting. The output of IC1 will be driven toward the positive supply rail and D3 will conduct. Negative feedback from the cathode of D3 to the inverting input of IC1, pin 2, ensures that IC1 has only unity gain (x1). The output of IC1 charges C3 to the same value as the peak voltage applied to the input. If the peak pulse voltage on the fence probe is 5 kV, and the voltage on the wiper of RV1, when calibrated, is 5 V then C3 will be charged to 5 V.

When the input pulse falls to zero, C3 will discharge slowly via R15 and the combined input impedance of op-amps IC2a, b and c.

THE DISPLAY

The display circuitry consists of IC2a, b and c arranged as voltage comparators, LEDs 2, 3 and 4 and resistors R16 to R22.

The resistive divider formed by R16, 17, 18 and 19 provides three fixed voltage points. The junction of R16-17 will be at 5 V (with respect to the common rail), the junction of R17-18 will be at 3 V and the junction of R18-19 will be at 2 V. Thus the inverting input of IC2c will be held at 5 V, the inverting input of IC2b will be held at 3 V, but the non-inverting input of IC2a will be held at 2 V.

With the non-inverting input of IC2a (pin 3) held at 2 V, the output, pin 1, will be driven high (toward +9 V) and LED4 will light, the current through it being limited by R22. That is, assuming PB1 is pressed! LED4 thus acts as an 'ON' indicator, one part of its dual role.

If the voltage on C3 reaches a little over 2 V, the inverting input (pin 2) of IC2a will cause the output to go low and LED4 will go out, indicating that the peak pulse voltage on the fence probe has reached 2 kV.

As the inverting inputs of IC2b and c are held at a lower voltage than their non-inverting inputs, the outputs of these two op-amps will be low and LEDs 3 and 4 will be off.

When the voltage on C3 reaches a little over 3 V, the non-inverting input of IC2b will be at a higher voltage than its inverting input and its output, pin 7, will be driven high, lighting LED3. Note that LED4 will remain off. Thus, LED3 lighting indicates that the peak pulse voltage on the fence probe has reached 3 kV.

When the voltage on C3 reaches a little over 5 V, the non-inverting input of IC2c will be higher than its inverting input and LED2 will be turned on, in the same way as LED3 was turned on. Thus, when LED2 lights, you know the peak pulse voltage on the fence is at least 5 kV. Note that, in this case, LED4 will be out and LEDs 2 and 3 will be lit.

The pulse from the fence falls to zero very rapidly, but the charge on C3 will be maintained, slowly leaking away via R15 and the combined input impedances of the op-amps IC2a, b and c. Thus, the display will 'hold' for longer than the duration of the fence energiser pulse, allowing you to see the action more readily.

THE PULSE INDICATOR

This circuit comprises IC2d, LED1 and associated components. The input pulse is used to trigger IC2d which is connected as a one-shot multivibrator. The output of IC2d drives LED1 which will flash, indicating the presence of a pulse, regardless of the amplitude, so that if the pulse has insufficient amplitude to drive LED4 off, you can still check that the energiser is supplying pulses to the fence.

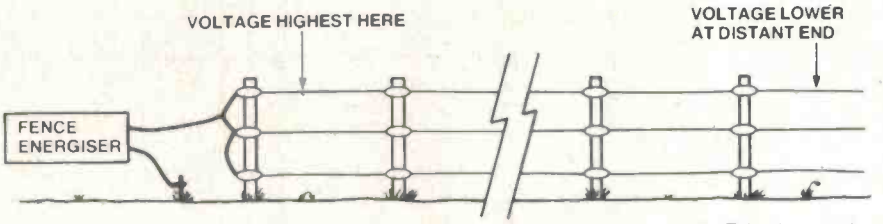
In the absence of an input pulse, resistor R8 keeps the output of IC2d in a low state (0 V) as it holds the inverting input (pin 13) at a higher voltage than its non-inverting input (pin 12). Thus, LED1 will be off.

When an input pulse arrives, it is coupled to the one-shot via C2, and R9. The positive-going pulse drives the non-inverting input of IC2d (pin 12) more positive than its inverting input (pin 13), driving the output (pin 14) high. LED1 will turn on and positive feedback via R11 will cause IC2d to 'latch' in this state. At this time, C1 will charge from virtually zero volts towards the supply rail, via R7-R8. When the voltage across C1 reaches the value on pin 12, the op-amp will switch back to its previous state with the output low. LED1 will then go out. This action takes a few hundred milliseconds, time enough for you to see LED1 light.

So that the one-shot reacts to rapid pulses, diode D2 is included to discharge C1 quickly, so that IC2d rapidly resets to its quiescent state, ready to receive the next incoming pulse.

If the energiser provides a negative-going pulse to the fence, reverse the energiser connections, NOT the Fence Tester connections or you'll be applying the fence pulse to the common rail of the Tester and you might get a wee surprise via PB1 when you try to test the fence.

Shock. Horror. Probe! Gentleman about to receive shock from incorrectly connected Fence Tester (note ground lead going to live fence wire!).



Indications. An electric fence doesn't deliver the same 'punch' over its entire length. This diagram shows you what to expect.

dummy fence'. A dummy fence can be made up quite simply. You'll need two 10n/3 kV ceramic capacitors, which are widely available. These should be connected in series and then connected directly across the energiser output along with the Fence Tester, thus placing a load of about 5 nF on the energiser. Nothing else should be connected across the energiser output. Make sure all the connections are well above the bench top, or whatever. Set the energiser going, then press the pushbutton on the Fence Tester. Adjust RV1 back until the '5 kV/100%' LED just goes out, then advance it until it comes on again with each pulse. This doesn't necessarily indicate that the energiser is delivering 5 kV. Some energisers will only provide an output around 4 kV on load. This procedure assumes your energiser is working correctly in the first place, so you'd better be pretty sure of that!

By far the best method is to calibrate the Fence Tester so that it actually indicates voltage. For this you'll need an oscilloscope with a x10 or x100 probe. Set the Y-input attenuator to read 200 volts/div. (i.e: 2 V/div. or 20 V/div., depending on what range the input attenuator covers). Connect the CRO input across R6 and set the sweep to a low rate. Set the Y-amp input to 'dc'.

Again, your energiser should be connected either to a known good fence or a dummy fence. Connect the Fence Tester to the energiser's output, set the energiser going, and measure the pulse amplitude directly from the oscilloscope's face. At 200 V/div., multiply by six to give the energiser's output directly in volts. Say you get a pulse amplitude of 4½ divisions on the CRO. The energiser's output is 4.5 x 200 x 6 = 5400 volts.

Note the polarity of the pulse. Generally, it will be positive-going. However, some energisers give a negative-going pulse. If such is the case, you'll need to reverse the energiser output leads for the next step.

This time, connect the oscilloscope across C3. (Don't use a x1 probe or you'll upset the C3-R15 time constant.) Set the Y-input to read, say, 1 V/div. on the screen (taking the probe division into account). Turn on the energiser and adjust RV1 so that the peak pulse voltage on the screen is 1000th that previously determined. If the energiser output was determined to be 5400 volts, then the peak pulse amplitude across C3 should be 5.4 volts when RV1 is correctly adjusted.

The unit is now calibrated and ready to use.

In use

When using the Fence Tester, *always* remember to *connect the ground probe first.* You can use a pointed metal stake to drive into the ground or a large, strong alligator clip to get a good 'bite' on the star pickets often used to support elecric fences. Touch the fence probe on one of the 'live' fence wires and then press the pushbutton. Keep your hands and the Tester dry and keep your big fat pinkies away from the top end of the box.

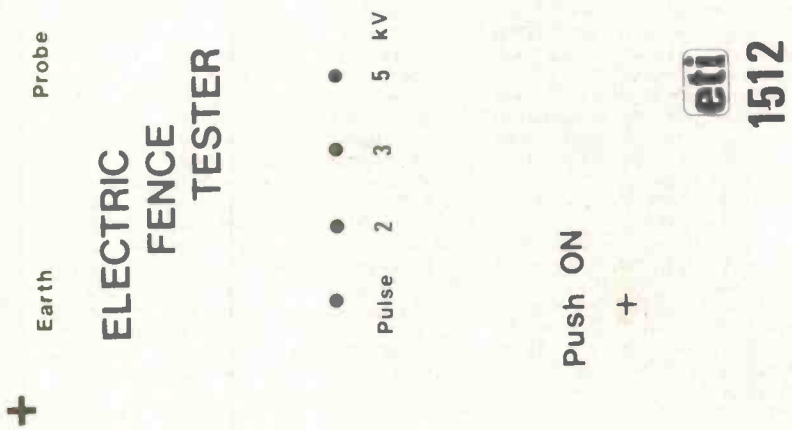
You will find that the voltage on the fence will be highest closest to the energiser, decreasing the further down the fence you move from the energiser end. If the fence is 'shorting to ground' somewhere, then the voltage will fall off rapidly as you approach the fault. If the live wire is open (i.e: broken) at some point, the voltage will remain high within the vicinity of the break, but disappear on the side of the break away from the energiser.

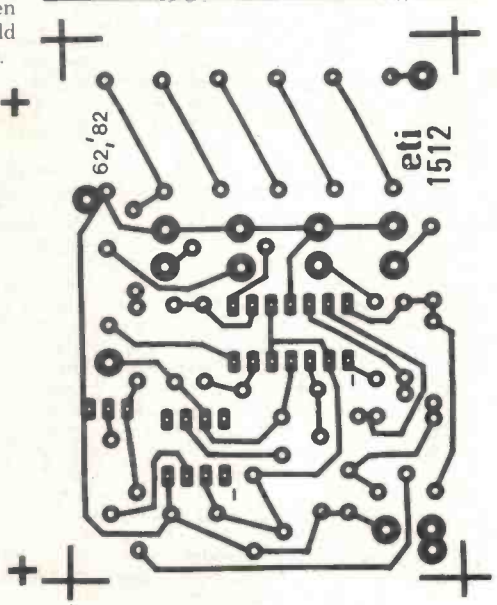
To be effective, the fence voltage should be generally no lower than 3 kV at its distant end. ●

BATTERY CHOICE

As this project will probably experience considerable periods of idleness, a battery having a long shelf life is recommended. Alkaline batteries have by far the longest shelf life, being about two years, and are thus recommended. Standard carbon-zinc batteries have a shelf life somewhat less than half that of Alkaline types and would need replacing at six to eight month intervals — if you could remember!

Artwork. Full size reproductions of panel and pc board artwork.





ETI BOOK SALES

Save time and trouble with mail order. Just fill out the coupon on page 44.

electronics textbooks

ELECTRONICS — IT'S EASY VOL. 1 $5.95
Meters, resistance, capacitance and inductance, emitter followers, op amps, power supplies and electronic filters.

ELECTRONICS — IT'S EASY VOL. 1 $12.95
Same content in a hard-cover form.

ELECTRONICS — IT'S EASY VOL. 2 $5.95
Digital sub-systems counters and shift registers, A-D and D-A conversion, digital instruments and test equipment, computers, transmission links and oscilloscopes.

ELECTRONICS — IT'S EASY VOL. 2 $12.95
Same content in a hard-cover form.

ELEMENTS OF ELECTRONICS
This series is an introduction to modern electronics. All the maths is taught as the reader progresses. The course concentrates on the understanding of concepts central to electronics, rather than digressing over the whole field. The author anticipates where difficulties lie and guides the reader through them.

BOOK 1
BP62 $7.52
All fundamental theory necessary to full understanding of simple electronic circuits and components.

BOOK 2
BP63 $7.52
Alternating current theory.

BOOK 3
BP64 $7.52
Semiconductors technology leading to transistors and ICs.

BOOK 4
BP77 $9.76
Microprocessing systems and circuits.

BOOK 5
BP89 $9.76
Communications.

ESSENTIAL THEORY FOR THE ELECTRONICS HOBBYIST
228B $4.32
This book supplies the electronics hobbyist with the background knowledge which will exactly suit their specific requirements. Minimum maths.

BEGINNER'S GUIDE TO DIGITAL ELECTRONICS
BP61 $3.36
Covers all essential areas including number systems, codes, constructional and sequential logic, analogue/digital/analogue conversion.

A MICROPROCESSOR PRIMER
BP72 $5.92
Learning about microprocessors is easy with this book, written in a style that is easy to follow. The shortcomings of this basic machine are discussed and the reader is shown how these are overcome by changes to the instruction set. Relative addressing, index registers follow as logical progressions.

reference and data handbooks

AUDIO CYCLOPEDIA
20675P $66.00
A complete, in-depth look at the art of audio — from the basic principles of sound to solid-state and integrated circuits. Over 3000 entries and hundreds of illustrations and circuit diagrams cover acoustics, amplifiers, recording, reproduction, test equipment, audio measurements, and much more.

REFERENCE DATA FOR RADIO ENGINEERS
21218P $21.95
The largest and most comprehensive collection of equations, graphs, tables, and other reference data needed in general radio engineering and design. Contains hundreds of charts, monographs, diagrams, curves, tables and illustrations.

TUBE SUBSTITUTION HANDBOOK
21746P $8.75
Complete, accurate, up-to-date guide to direct substitutes for receiving and picture tubes. Contains over 6000 receiving tube substitutes, over 4000 monochrome and colour picture tube substitutes, and 600 communications substitutes. Also includes pinouts for quick operational checks.

CONTEMPORARY MATHEMATICS FOR ELECTRONICS
70274P $29.75
This book is split into three sections. Direct current maths introduces the student to the calculator, fractions and dimensional analysis. Alternating current maths covers phasors, quadratics and RMS in both sine and digital waveforms. Active device maths introduces number systems and boolean.

AUSTRALIAN MICROCOMPUTER HANDBOOK
72505 NOW $15.00
Normally $25.00. A detailed buyer's guide to microcomputer systems and application packages in commercial, industrial, scientific, educational and home/hobby areas.

TRANSISTOR SUBSTITUTION HANDBOOK
21515P $8.75
17th edition — Accurate transistor substitution in a matter of seconds with this replacement listing of over 19 000 American and foreign bipolar transistors.

THE CP/M HANDBOOK WITH MP/M
88048A $19.95
Shows you how to use CP/M (control program for microprocessors) and its resources. No prior knowledge of computers is assumed. CP/M is available on nearly all computers using the 8080, 8085 or Z80 microprocessors.

HANDBOOK OF ICS EQUIVALENTS AND SUBSTITUTES
202B $5.76
Contains full interchangeability data on more than 9500 ICs with possible alternatives and equivalents shown. Covers many types of digital and linear ICs.

HANDBOOK OF RADIO, TV, INDUSTRIAL & TRANSMITTING TUBE & VALVE EQUIVALENTS
BP2 $2.25
Equivalents book for amateurs and servicemen. More than 18 000 old and new valves from UK, USA, Europe, Japan et al. CV (military) listings with commercial equivalents included.

RADIO AND ELECTRONIC COLOUR CODES AND DATA CHART
BP7 $1.60
This large wall chart covers all colour codes in use throughout the world. For all radio and electronic components made in UK, USA, Europe and Japan.

FIRST BOOK OF TRANSISTOR EQUIVALENTS AND SUBSTITUTES
BP1 $3.36
This guide covers many thousands of transistors showing possible alternatives and equivalents. Covers transistors made in UK, Japan, USA, Germany, France, Europe, Hong Kong and includes types produced by more than 120 different manufacturers.

SECOND BOOK OF TRANSISTOR EQUIVALENTS AND SUBSTITUTES
BP14 $5.92
Interchangeability data covers semiconductors manufactured all over the world. Immediate equivalents are shown and possible substitutes are included.

GIANT CHART — RADIO, ELECTRONICS, SEMI-CONDUCTORS & LOGIC SYMBOLS
BP27 $1.92
Identify those symbols at a glance. A must for beginners and advanced enthusiasts alike. Professionals can always hide it in their desks!

RESISTOR SELECTION HANDBOOK
BP28 $2.24
Shows how to combine two preferred values of resistor to obtain virtually any required value of resistance. Includes information about fixed resistors, standard ranges, colour codes and markings, power ratings and resistor calculations.

ELECTRONIC CALCULATOR USERS' HANDBOOK
BP33 $5.12
Presents formulae, data, methods of calculation, conversion factors, etc, for use with the simplest or most sophisticated calculators. Includes the way to calculate using only a simple four-function calculator: trigonometric functions, hyperbolic functions, logarithms, square roots and powers.

DIGITAL IC EQUIVALENTS AND PIN CONNECTIONS
BP40 $12.32
Revised edition showing Japanese, American and European equivalents and pin connections of a popular user-orientated selection of digital ICs (available mid 1983).

LINEAR EQUIVALENTS AND PIN CONNECTIONS
BP41 $9.12
Shows equivalents and pin connections of a selection of popular linear ICs, with details of families, functions, country of origin and manufacture. Includes devices from Analog Devices, Advance Micro Devices, Fairchild, Harris, ITT, Motorola, Philips, RCA, Raytheon, Signetics, Sescocrem, SGS-ATES, Siemens, AEG-Telefunken, Teledyne, Texas Instruments.

PRACTICAL ELECTRONIC CALCULATIONS & FORMULAE
BP53 $9.76
For the practical person's workbench. Bridges gap between technical theory and cut-and-dried methods which work but leave the experimenter unfulfilled. There's a strong practical bias. Tedious and higher maths avoided where possible.

INTERNATIONAL TRANSISTOR EQUIVALENTS GUIDE
BP85 $9.76
Companion to BP1 and BP14 equivalents books, but contains a huge amount of information on modern transistors produced by over 100 manufacturers. Wherever possible, equivalents are subdivided into European, American and Japanese types. Also shown are the material type, polarity, manufacturer and indication of use or application.

HOW TO IDENTIFY UNMARKED ICS
BP101 $2.46
This chart shows the reader how, with just a test-meter, to go about recording the particular 'signature' of an unmarked IC which should enable the IC to be identified with reference to manufacturers or other data.

electronics for beginners

BEGINNERS HANDBOOK OF IC PROJECTS
74286P $19.25
The novice is guided in mastering the fundamentals of building, troubleshooting and testing electronic projects. In addition to many elementary projects, more advanced ones are included concerning bipolar integrated circuits and medium and large-scale integrated circuits.

HI-FI LOUDSPEAKER ENCLOSURES
205B $3.36
Data for building corner reflex, bass reflex, exponential horn, folded horn, tuned port, Klipschorn labyrinth, tuned column, loaded port and multi speaker panoramics. Clear dimensioned diagrams included.

SOLID STATE NOVELTY PROJECTS
219B $3.04
A number of novelty projects using modern ICs and transistors. Includes 'Optomin' — a musical instrument played by reflecting a light beam with your hand, water warbler for pot plants, music tone generator, LEDs and ladders game, touch switch, electronic roulette wheel, etc.

SOLID STATE SHORTWAVE RECEIVERS FOR BEGINNERS
222B $4.32
Design and construction of several solid-state shortwave receivers giving high level of performance yet utilising relatively few inexpensive components.

BEGINNERS' GUIDE TO BUILDING ELECTRONIC PROJECTS
227B $5.12
Enables total beginners to tackle electronic projects. Includes component identification, tools, soldering, building methods, cases, legends, etc, etc. Practical basic projects are included.

ESSENTIAL THEORY FOR THE ELECTRONICS HOBBYIST
228B $4.32
This book supplies the electronics hobbyist with the background knowledge which will exactly suit their specific requirements. Minimum maths.

RADIO AND ELECTRONIC COLOUR CODES AND DATA CHART
BP7 $1.60
This large wall chart covers all colour codes in use throughout the world. For all radio and electronic components made in UK, USA, Europe and Japan.

FIRST BOOK OF PRACTICAL ELECTRONIC PROJECTS
BP23 $2.72
Full constructional data, circuits, components lists for many practical projects including audio distortion meter, superFET receiver, guitar amp, metronome, etc.

RESISTOR SELECTION HANDBOOK
BP28 $2.24
Shows how to combine two preferred values of resistor to obtain virtually any required value of resistance. Includes information about fixed resistors, standard ranges, colour codes and markings, power ratings and resistor calculations.

HOW TO BUILD YOUR OWN METAL AND TREASURE LOCATORS
BP32 $5.92
Electronic and practical details on the simple and inexpensive construction of heterodyne metal locators.

ELECTRONIC PROJECTS FOR BEGINNERS
BP48 $4.64
This book gives the newcomer to electronics a wide range of easily built projects. Actual components and wiring layouts aid the beginner. Some of the projects may be built without using soldering techniques.

POPULAR ELECTRONIC PROJECTS
BP49 $4.96
A collection of the most popular types of circuits and projects to interest most electronics constructors. The projects cover a wide range and are divided into four basic types: radio, audio, household and test equipment.

BEGINNERS GUIDE TO DIGITAL ELECTRONICS
BP61 $3.36
Covers all essential areas including number systems, codes, constructional and sequential logic, analogue/digital/analogue conversion.

ELECTRONIC GAMES
BP69 $5.92
How to build many interesting electronic games using modern ICs. Covers both simple and complex circuits for beginner and advanced builder alike.

RADIO CONTROL FOR BEGINNERS
BP79 $5.92
How complete systems work with constructional details of solid state transmitters and receivers. Also included — antennas, field strength meter, crystal controlled superhet, electro-mechanical controls. Section dealing with licensing etc. not applicable to Australia.

EASY ELECTRONICS-CRYSTAL SET CONSTRUCTION
BP92 $6.56
For those who wish to participate in the intricacies of electronics more through practical construction than by theoretical study. The circuits are based on those from earlier publications but have been modified to use modern inexpensive components and home wound coils.

IC PROJECTS FOR BEGINNERS
BP97 $6.56
Especially written for the less experienced hobbyist, and offers a range of fairly simple projects based around a number of popular and inexpensive linear and digital ICs. Complete layout and point-to-point wiring diagrams included.

ELECTRONICS — IT'S EASY VOL. 1 $5.95
Meters, resistance, capacitance and inductance, emitter followers, op amps, power supplies and electronic filters.

ELECTRONICS — IT'S EASY VOL. 1 $12.95
Same content in a hard-cover form.

ELECTRONICS — IT'S EASY VOL. 2 $5.95
Digital sub-systems counters and shift registers, A-D and D-A conversion, digital instruments and test equipment, computers, transmission links and oscilloscopes.

ELECTRONICS — IT'S EASY VOL. 2 $12.95
Same content in a hard-cover form.

SIMPLE PROJECTS FROM ETI $2.95
Two volumes containing easy projects plus chapters on construction techniques and useful information on components.

HOBBY ELECTRONICS PROJECT BOOK $4.95
Fifty projects ranging from very simple ones for complete beginners to more elaborate ones for those with more experience. There's a complete guide to soldering and instructions on how to make your own pc boards.

HOW TO BUILD ELECTRONIC GAMES $3.95
Alien invaders, electronic die, sound effects, two slot car controllers, electronic poker machine, the family ferry and lots more.

HOW TO BUILD GOLD AND TREASURE DETECTORS $3.95
Tells you how metal detectors work and how to construct the different types of detectors: discriminating, BFO, induction balance and a professional deep-seeking unit. How to build a geiger counter.

constructional projects general

DESIGN OF TRANSISTOR CIRCUITS, WITH EXPERIMENTS
21626P $20.75
A self-teaching course in transistor circuits — seven chapters explore the fundamentals of active semiconductors and their operating principles and procedures. Experiments in design and semiconductor testing provide hands-on experience.

UNIQUE ELECTRONIC WEATHER PROJECTS
21484P $13.25
Fun and easy-to-build projects include an IC barometer to serve as a tornado warning and a 'thermostat with a brain' to help conserve energy.

BUILD YOUR OWN HI-FI & AUDIO ACCESSORIES
220B $3.04
Essential for keen hi-fi and audio enthusiasts. Projects include stereo decoder, three-channel mixer, FET preamp for ceramic pick-ups, mic preamp with adj. bass, stereo dynamic noise limiter, loudspeaker protector, voice-operated relay, etc.

28 TESTED TRANSISTOR PROJECTS
221B $4.32
Some circuits are new, others are familiar designs. Projects can be split and/or combined for specialised needs.

50 CMOS PROJECTS
224B $4.64
Many interesting and useful projects — multivibrators, amplifiers and oscillators; trigger devices; special devices.

MAJOR SOLID STATE AUDIO HI-FI PROJECTS
BP29 $3.04
Three projects for the more experienced constructor: 12.5 W/ch stereo amplifier, eight input stereo/mono mixer and 4x14 W quadraphonic amplifier. Full constructional details provided.

HOW TO BUILD YOUR OWN METAL AND TREASURE LOCATORS
BP32 $5.92
Electronic and practical details on the simple and inexpensive construction of heterodyne metal locators.

HOW TO MAKE WALKIE-TALKIES
BP43 $5.12
This treatise on low power transmitter-receivers (walkie-talkies) covers many aspects from licensing requirements and bands, through practical circuitry and construction to the various types of aerials that may be used.

PROJECTS IN OPTO-ELECTRONICS
BP45 $5.92
Included are simple circuits using ordinary LEDs as well as more sophisticated designs such as infra red transmitters and detectors, modulated light transmission and also photographic projects etc.

RADIO CIRCUITS USING ICS
BP46 $4.64
This book describes ICs and how they can be employed in receivers for the reception of either amplitude or frequency modulated signals. Also discussed are stereo decoder circuits, quadrophonic circuits and voltage regulator devices.

POPULAR ELECTRONIC PROJECTS
BP49 $4.96
Includes a collection of the most popular types of circuits and projects which cover radio, audio, household projects and test equipment.

HOW TO BUILD YOUR OWN SOLID-STATE DSCILLOSCOPE
BP57 $5.12
Project divided into sections for builder individually to construct and test — then assemble into complete instrument. Includes short section on scope usage.

SINGLE IC PROJECTS
BP65 $5.12
Simple to build projects based on a single IC. A few projects use one or two transistors as well. A strip board layout is given for each project plus special constructional and setting up info. Contents include low level audio circuits, audio power amps, timers, op-amps and miscellaneous circuits.

ELECTRONIC GAMES
BP69 $5.92
A number of interesting electronic games projects using ICs for both the beginner and advanced enthusiast.

ELECTRONIC HOUSEHOLD PROJECTS
BP71 $5.92
Most useful and popular projects for use around the home. Includes two-tone buzzer, intercom, smoke and gas detectors, baby alarm, freezer alarm etc. etc.

REMOTE CONTROL PROJECTS
BP73 $6.56
Covers radio, infra-red, visible light, ultrasonic controls. Full explanations are provided so that the reader can adapt the projects for domestic and industrial as well as model use.

POWER SUPPLY PROJECTS
BP76 $5.92
This book gives a number of power supply designs, including simple unstabilised types, fixed voltage regulated types and variable voltage stabilised designs. The designs are all low voltage types for semiconductor circuits.

POPULAR ELECTRONIC CIRCUITS — BOOK 1
BP80 $6.56
Yet more circuits from Mr. Penfold! Includes audio, radio, test gear, music projects, household projects and many more. An extremely useful book for all hobbyists, offering remarkable value for the designs it contains.

ELECTRONIC PROJECTS USING SOLAR CELLS
BP82 $6.56
Includes a number of projects that benefit from solar power and obviate the problems encountered with batteries, such as weight and bulk, frequency of replacement, and failure when batteries are exhausted.

DIGITAL IC PROJECTS
BP84 $6.56
Companion to No. 225 Practical Introduction to Digital ICs and BP61 Beginner's Guide to Digital Electronics. The projects included in this book range from simple to more advanced projects — some board layouts and wiring diagrams are included.

AUDIO PROJECTS
BP90 $6.56
Covers a wide range of audio projects including pre-amplifiers and mixers, power amplifiers, tone controls and matching etc. A number of board layouts and wiring diagrams are included.

LOOK! More books!

Mail order coupon on page 44

ELECTRONIC TIMER PROJECTS
BP93 $6.56
These may have a high degree of accuracy with quartz control or they may be quite simple designs, using only a few components. A number of specialist timer projects are car windscreen wiper delay unit, darkroom timer, metronome etc.

ELECTRONIC PROJECTS FOR CARS AND BOATS
BP94 $6.56
Fifteen fairly simple projects designed for use with 12 V electrical systems but in some cases can also be employed with 6 V and/or positive earth systems as well.

MODEL RAILWAY PROJECTS
BP95 $6.56
Projects include such things as controllers, signals and sound effects units. Construction stripboard layouts are provided for each project.

CB PROJECTS
BP96 $6.56
A number of useful designs include a speech processor, interference filters and a simple CB radio receiver. Stripboard layouts, wiring diagrams and notes on construction are provided.

POPULAR ELECTRONICS CIRCUITS — BOOK 2
BP98 $7.52
A companion for BP80, this book provides a wide range of designs for electronics enthusiasts who are capable of producing working projects from just a circuit diagram without the aid of detailed constructional information.

MINI-MATRIX BOARD PROJECTS
BP99 $6.56
This book provides a selection of 20 useful circuits which can all be built on a mini-matrix board which is just 24 holes by 10 copper strips in size. Simple and easy for those with not much experience in electronics.

MULTI-CIRCUIT BOARD PROJECTS
BP103 $6.56
All circuits are based on one specially designed pc board. Recommended to the less experienced hobbyist.

ELECTRONIC SCIENCE PROJECTS
BP104 $7.52
These projects range in complexity from a simple colour temperature meter to an infra-red laser. There is an electronic clock regulated by a resonating spring and an oscilloscope with a solid-state display. How to build them and use them is fully explained.

AERIAL PROJECTS
BP105 $6.56
Practical aerial designs including active, loop and ferrite which are relatively simple and inexpensive to build. The complex theory and mathematics of aerial design have been avoided.

MODERN OP-AMP CIRCUITS
BP106 $6.56
A collection of widely varying circuits and projects based on the op-amp ICs.

HOW TO GET YOUR ELECTRONIC PROJECTS WORKING
BP110 $6.56
Helps you to overcome the problems of a circuit that doesn't work by indicating how and where to start looking for many of the common faults that can occur when building up a project.

circuit techniques and design

TTL COOKBOOK
21035P $17.50
A complete look at TTL logic circuits — what TTL is, how it works, and how to use it. Many kinds of practical TTL are included, such as digital counters, electronic stopwatches, digital voltmeters, etc.

ACTIVE-FILTER COOKBOOK
21168P $21.95
Learn how to construct filters of all kinds — highpass, lowpass, bandpass. The book is easy to understand — no advanced maths or obscure theory is used.

ELECTRONIC CIRCUITBOOK 1: PROJECT CONSTRUCTION
21241P $7.50
Your basic guide to project construction, covering component identification, power supplies, proper tool selection, troubleshooting techniques, oscilloscope use, custom-made enclosures, and more.

CMOS COOKBOOK
21398P $19.25
This book explains CMOS technology and its application to 'real world' circuitry. A mini-catalogue is included, which lists over 100 devices, giving their pinouts and application notes.

IC TIMER COOKBOOK
21416P $15.95
Gives you a look at the hundreds of ways IC timers are used in electronic instrumentation.

IC CONVERTER COOKBOOK
21527P $20.75
Written for the practising engineer, technician, hobbyist or student, this book will be an invaluable working guide to the understanding and use of IC analogue/digital and digital/analogue converters.

DESIGN OF OP-AMP CIRCUITS, WITH EXPERIMENTS
21537P $16.50
The design of the fundamental circuits that are the basic building blocks of more sophisticated systems. A series of 35 experiments illustrates the design and operation of linear amps, differentiators and integrators, voltage and current converters, active filters, and lots more.

555 TIMER APPLICATIONS SOURCE BOOK, WITH EXPERIMENTS
21538P $11.25
This book describes the construction of the 555 timer and gives numerous practical examples of its applications in all areas of electrical and computer engineering, including 17 simple experiments.

DESIGN OF ACTIVE FILTERS WITH EXPERIMENTS
21539P $15.95
Introduction to the theory, implementation and design of active filters using the 741 op-amp.

DESIGN OF PHASE-LOCKED LOOP CIRCUITS, WITH EXPERIMENTS
21545P $15.95
An excellent introduction to the theory, design and implementation of phase-locked loop circuits using various TTL and CMOS devices. Includes manufacturers' data sheets and describes the use of breadboarding aids in the wide range of laboratory-type experiments.

AUDIO IC OP-AMP APPLICATIONS
21558P $13.25
This book discusses IC op-amps and their application in audio systems, and describes the numerous advantages of using op-amps, including small spatial needs, low power consumption, reliable performance and low cost. Assumes a basic understanding of op-amp theory.

UNDERSTANDING CMOS INTEGRATED CIRCUITS
21598P $9.95
This book tells you what CMOS ICs are, how they work, and how they can be used in electronic circuit designs. Many practical circuits, complete with parts values, are included.

DESIGN OF TRANSISTOR CIRCUITS WITH EXPERIMENTS
21626P $20.75
A self-teaching course to provide the background and explanations necessary to teach the reader the art of designing transistor circuits.

GUIDE TO CMOS BASICS, CIRCUITS, AND EXPERIMENTS
21654P $14.95
If you are already familiar with TTL devices and are ready to examine the benefits of CMOS, this book is your complete source. It tells you what CMOS devices are, their characteristics and design rules. 22 experiments demonstrate the concepts discussed.

PRACTICAL TRANSFORMER DESIGN HANDBOOK
21657P $35.50
An easy to understand, illustration-filled guide to designing and constructing transformers. Reviews the fundamentals of electricity, magnetism and algebra needed to understand transformer theory, and covers general design considerations, transformer types, power losses and transformer use in converters and inverters.

Z80 MICROCOMPUTER DESIGN PROJECTS
21682P $20.75
This book provides a complete look at the internal architecture of the Z80, the heart of many microcomputers, and even shows how to build a microcomputer, the EX80, using this powerful chip.

DESIGN OF VMOS CIRCUITS, WITH EXPERIMENTS
21686P $17.50
The authors look at the technology which makes dramatic advancements possible with VMOS, and show how these components can easily and effectively be integrated into common circuit designs to enhance their responses.

IC OP-AMP COOKBOOK
21695P $23.75
Basic op-amp theory in detail, with 200 practical, illustrated circuit applications: JFET and MOSFET units are featured, plus manufacturers' data sheets and company addresses.

EXPERIMENTS IN ARTIFICIAL INTELLIGENCE FOR SMALL COMPUTERS
21785P $13.25
Artificial intelligence is the capability of a device to perform functions normally associated with human intelligence. With this book, a small computer with extended BASIC and some knowledge of BASIC language, you can conduct interesting and exciting experiments in artificial intelligence.

PRACTICAL SOLID-STATE CIRCUIT DESIGN
21787P $14.95
An introductory course in practical solid-state circuit design for the experimenter, designer or technician who is interested in constructing tailor-made circuits.

SCRS AND RELATED THYRISTOR DEVICES
21806P $19.25
Written for experimenters, technicians and engineers, this book is a practical and comprehensive guide to theory, operation, specifications and applications of silicon-controlled rectifiers (SCRs) and related thyristor devices.

REGULATED POWER SUPPLIES
21808P $29.75
Comprehensive discussion of the internal architecture and operation of the latest solid-state regulators. Explains when regulated supplies are needed and how to incorporate them in your projects, and discusses modern circuitry including linear and switching circuits and late ICs.

ANALOG INSTRUMENTATION FUNDAMENTALS
21835P $29.75
Numerous practical, hands-on lab experiments and solved problems are included, plus discussions of movements, dc ammeters, voltmeters, ohmmeters, bridges, filters and attenuators. No calculus is required.

RF CIRCUIT DESIGN
21868P $33.95
A practical approach to the design of RF amplifiers, impedance-matching networks and filters. Uses a minimum of complex maths.

SOLAR CELLS
22270P $37.95
In-depth description of the basic operating principles and design of solar cells. It also covers the techniques currently used to produce solar cells and reviews system applications.

ELECTRONIC DESIGN WITH OFF-THE-SHELF ICS
50274P $14.70
It contains virtually all the information you need to design and build electronic circuits, systems and subsystems with readily available ICs. Shows how to interface them into highly complex systems.

MODERN FILTER DESIGN
94663P $49.95
This book details the advances in active RC filters, both from a practical standpoint and from a state-of-the-art point of view. It is the first book that gives detailed analysis and design procedures for switched capacitor filters.

COIL DESIGN AND CONSTRUCTION MANUAL
160B $6.56
How to make RF, IF, audio and power coils, chokes and transformers. Maths is simplified.

50 PROJECTS USING CA3130 ICS
223B $4.32
The CA3130 is an advanced operational amplifier capable of higher performance than many others: circuits often need fewer ancillary components. Audio projects. RF projects. Test equipment. Household projects. Misc. projects.

PRACTICAL INTRO TO DIGITAL ICS
225B $4.32
Introduction to digital ICs (mainly TTL 7400). Besides simple projects, includes logic test set to identify and test digital ICs. Also includes digital counter-timer.

50 CIRCUITS USING GERMANIUM, SILICON AND ZENER DIODES
BP36 $3.36
50 interesting and useful circuits and applications using the germanium and silicon signal diodes, silicon rectifier diodes and zener diodes etc.

50 PROJECTS USING RELAYS, SCRS AND TRIACS
BP37 **$5.92**
Practical working circuits using silicon controlled rectifiers, relays and bi-directional triodes. With a minimum of difficulty you can use them in motor control, dimming and heating control, timing and light sensitive circuits, warning devices and many others.

50 FET PROJECTS
BP39 **$5.92**
Projects include amplifiers and converters, test equipment, tuners, receivers and receiver aids, mixers and tone controls etc etc. The FET used is not critical. This book is of interest and value to SW listeners, radio amateurs, hi-fi enthusiasts and general experimenters.

50 SIMPLE LED CIRCUITS
BP42 **$3.36**
50 interesting and useful circuits and applications using the LED. Also includes circuits for the 707 Common Anode Display for the beginner and advanced enthusiast.

IC555 PROJECTS
BP44 **$6.56**
One wonders how life went on before the 555! Included are basic and general circuits, motor car and model railway circuits, alarms and noise makers plus section on subsequent 556, 558 and 559s.

PROJECTS IN OPTO-ELECTRONICS
BP45 **$5.92**
Included are simple circuits using ordinary LEDs as well as more sophisticated designs such as infra-red transmitters and detectors, modulated light transmission and also photographic projects etc.

RADIO CIRCUITS USING ICS
BP46 **$4.64**
This book describes ICs and how they can be employed in receivers for the reception of either amplitude or frequency modulated signals. Also discussed are stereo decoder circuits, quadrophonic circuits and voltage regulator devices.

LM 3900 IC PROJECTS
BP50 **$4.64**
Unlike conventional op-amps, the LM 3900 can be used for all the usual applications as well as many new ones. It's one of the most versatile, freely obtainable and inexpensive devices around. This book provides the groundwork for simple and advanced uses — it's much more than a collection of projects. Very thoroughly recommended.

50 CIRCUITS USING 7400 SERIES ICS
BP58 **$5.12**
50 interesting and useful circuits and applications using these inexpensive and versatile devices.

50 CMOS IC PROJECTS
224B **$4.64**
Projects include multivibrators, amplifiers and oscillators, trigger devices and other special devices.

SECOND BOOK OF CMOS IC PROJECTS
BP59 **$5.12**
Leading on from book number 224 '50 CMOS IC PROJECTS', this second book provides a further selection of useful circuits mainly of a fairly simple nature. Contents have been selected to ensure minimum overlap between the two books.

COUNTER DRIVER AND NUMERAL DISPLAY PROJECTS
BP67 **$5.92**
Well-known author F.G. Rayer features applications and projects using various types of numerical displays, popular counter and driver ICs, etc.

VMOS PROJECTS
BP83 **$6.56**
Though primarily concerned with VMOS power FETs and their applications, power MOSFETs are dealt with too, in a chapter on audio circuits. Projects include audio circuits sound generator circuits, dc control circuits and signa circuits.

DIGITAL IC PROJECTS
BP84 **$6.56**
Helps the reader to develop a knowledge of the workings of digital circuits. Board layouts and wiring diagrams are included.

HOW TO USE OP-AMPS
BP88 **$7.52**
Design notes and applications on many topics including basic theory, amplifiers, power supplies, audio circuits, oscillators, filters, computers and control engineering. It's written around the 741 IC but includes design notes for most of the common op-amps.

ELECTRONIC TIMER PROJECTS
BP93 **$6.56**
These may have a high degree of accuracy with quartz control or they may be quite simple designs, using only a few components. A number of specialist timer projects are car windscreen wiper delay unit, darkroom timer, metronome etc.

ETI CIRCUITS BOOKS 1/2/3 **$2.95 ea**
Many of these circuits have been published in the 'Ideas for Experimenters' section in ETI.

ETI CIRCUIT TECHNIQUES VOLS 1/2 **$4.75 ea**
The how, what, which, where, why and how much anthology of electronic components, circuits and techniques.

test equipment and fault finding

AUTOMOTIVE TUNE-UP AND EMISSION CONTROL SERVICE
21712P **$20.75**
Car owners who wish to save money and maintain their cars at peak performance will learn from this book how to adjust, repair and maintain the systems that ensure best operation.

TROUBLESHOOTING WITH THE OSCILLOSCOPE
21738P **$15.95**
Excellent for the professional service technician or the serious hobbyist, as it combines step-by-step procedures for using the scope with the specific nuts and bolts of TV receiver troubleshooting.

EFFECTIVELY USING THE OSCILLOSCOPE
21794P **$14.95**
Excellent for the professional service technician or the serious do-it-yourself, as it combines the correct step-by-step procedures for using a scope with the specific nuts and bolts of TV receiver troubleshooting.

MICROCOMPUTER DESIGN AND TROUBLESHOOTING
21819P **$26.75**
Tells you how to design microcomputer systems and make them work without an expensive commercial development system or the need for costly test instrumentation. The author also provides a complete description of two popular microprocessors — the 8085 and the 6502.

USE OF THE DUAL-TRACE OSCILLOSCOPE
40023P **$23.75**
This programmed text breaks down the process of operating a scope into a series of logical steps starting with the deflection of the electron beam and continuing through proper use of the triggering controls to measure the phase difference between two waveforms.

ELECTRONIC TROUBLESHOOTING HANDBOOK
52585P **$10.50**
This workbench guide shows you how to pinpoint transistor troubles in minutes, how to test almost everything electronic and how to get the most out of low cost test equipment.

PRACTICAL REPAIR AND RENOVATION OF COLOUR TVS
BP34 **$4.32**
This book shows how to obtain a working colour TV for very little outlay by repairing and renovating a set that has been 'written off' by a dealer. Includes practical details of how to construct your own CRT tester/rejuvenator and cross hatch generator.

HOW TO BUILD YOUR OWN SOLID STATE OSCILLOSCOPE
BP57 **$5.12**
The oscilloscope is divided into various sections which can be individually constructed and tested and then assembled together to complete the whole instrument. Also tells you how to use the instrument.

TRANSISTOR RADIO FAULT-FINDING CHART
BP70 **$1.92**
Used properly, this chart should enable the reader to trace most common faults quickly. Across the top of the chart are four rectangles containing brief descriptions of the faults. Selecting the appropriate fault, the reader simply follows the arrows and carries out the suggested checks in sequence until the fault is cleared.

ELECTRONIC TEST EQUIPMENT CONSTRUCTION
BP75 **$5.92**
Describes construction of wide range of test gear including FET amplified voltmeter, resistance bridge, field strength indicator, heterodyne frequency meter etc.

POWER SUPPLY PROJECTS
BP76 **$5.92**
Includes simple unstabilised types, fixed voltage regulator types and variable voltage stabilised designs. The designs are all low voltage types for semiconductor circuits.

HOW TO GET YOUR ELECTRONIC PROJECTS WORKING
BP110 **$6.56**
Helps you to overcome the problems of a circuit that doesn't work by indicating how and where to start looking for many of the common faults that can occur when building up a project.

TEST GEAR — METERING AND POWER SUPPLY PROJECTS **$3.00**
Includes many types of meters, audio noise and signal generators, simple CMOS tester, oscilloscope calibrator etc.

TEST GEAR — VOL. 2 **$3.95**
Projects include audio oscillator, transistor tester, true RMS voltmeter, RF signal generator, versatile logic test probe, microwave oven leak detector etc.

ELECTRONIC PROJECTS FOR YOUNG SCIENTISTS **$3.95**
PH meter, geiger counter, helium-neon laser, sound level meter, solar cells, negative ion generator and much more.

electronic music/audio/video

AUDIO CYCLOPEDIA
20675P **$66.00**
A complete in-depth look at the art of audio — from the basic principles of sound to solid-state and integrated circuits. Over 3000 entries and hundreds of illustrations and circuit diagrams cover acoustics, amplifiers, recording, reproduction, test equipment, audio measurements, and much more.

ELECTRONIC MUSIC CIRCUITS
21833P **$24.95**
How to build a custom electronic music synthesiser, outlines numerous other circuit designs and then shows you how to modify them to achieve particular responses. Many of the circuits can be used as special-effects boxes for guitars and other musical instruments.

INTRODUCTION TO ELECTRO-ACOUSTIC MUSIC
81515P **$15.95**
This book assumes no previous technical knowledge. It discusses the relationship between the technology and the composition of electro-acoustic music.

MODERN RECORDING TECHNIQUES
21037P **$19.25**
Explains the equipment controls and techniques found in a modern recording studio and how to use them creatively and correctly to produce a desired result. Numerous photographs, diagrams and charts.

SOUND SYSTEM ENGINEERING
21156P **$32.50**
Dealing with audio systems as a whole, it includes installing and equalising the sound system and interfacing the electrical and acoustic systems. Instrumentation, the acoustic environment and designing for acoustic gain are covered.

TUBE SUBSTITUTION HANDBOOK
21746P **$8.75**
Complete, accurate, up-to-date guide to direct substitutes for receiving and picture tubes. Contains over 6000 receiving tube substitutes, over 4000 monochrome and colour picture tube substitutes, and 600 communications substitutes. Also includes pinouts for quick operational checks.

HOW TO BUILD SPEAKER ENCLOSURES
20520P **$8.75**
A practical guide to the 'whys' and 'hows' of constructing high-quality top-performance loudspeaker enclosures.

ACTIVE-FILTER COOKBOOK
21168P **$21.95**
Learn how to construct filters of all kinds — highpass, lowpass, bandpass. The book is easy to understand — no advanced maths or obscure theory is used.

DESIGN OF ACTIVE FILTERS WITH EXPERIMENTS
21539P **$15.95**
Introduction to the theory, implementation and design of active filters using the 741 op-amp.

AUDIO IC OP-AMP APPLICATIONS
21558P **$13.25**
This book discusses IC op-amps and their application in audio systems, and describes the numerous advantages of using op-amps, including small spatial needs, low power consumption, reliable performance and low cost. Assumes a basic understanding of op-amp theory.

VIDEO TAPE RECORDERS
21521P **$17.50**
In this completely revised second edition, the author tells in simple language how helical VTRs work and how to operate and service them. Includes numerous examples of circuits and mechanical systems.

OOPS! More books!

Mail order coupon on page 44

CHEAP VIDEO COOKBOOK
21524P $11.75
Complete discussion of a new, low-cost way to get words, pictures and opcode out of your computer and onto any ordinary TV screen, using a seven-IC easy-to-build circuit which you can build for less than $20.

AN INTRODUCTION TO VIDEO
BP100 $6.56
This book is written in layman's language and is for anyone who is thinking about buying or renting or who has just bought or rented a video recorder and wants to get the best out of the machine.

MOBILE OISCO HANOBOOK
BP47 $4.64
Most people who start mobile discos know little about equipment or what to buy. This book assumes no preliminary knowledge and gives enough info to enable you to have a reasonable understanding of disco gear.

ELECTRONIC MUSIC AND CREATIVE TAPE RECORDING
BP51 $5.92
Shows how electronic music can be made at home with the simplest and most inexpensive of equipment. Describes how the sounds are generated and how these may be recorded to build up the final composition.

PRACTICAL CONSTRUCTION OR PREAMPS, TONE CONTROLS, FILTERS, ATTENUATORS
BP60 $4.96
This book shows the enthusiast how to construct a variety of magnetic tape recording, microphone and disc preamplifiers, and also a number of tone control circuits, rumble and scratch filters, attenuators and pads.

ELECTRONIC SYNTHESISER PROJECTS
BP81 $5.92
For the electronic music enthusiast, an invaluable reference. This book is full of circuits and information on how to build analogue delay lines, sequencers, VCOs, envelope shapers, etc. etc. The author takes a clear and logical approach to the subject that should enable the average enthusiast to understand and build up what appears to be a quite complex instrument.

AUDIO PROJECTS
BP90 $6.56
Covers a wide range of audio projects including preamplifiers and mixers, power amplifiers, tone controls and matching etc. A number of board layouts and wiring diagrams are included.

ELECTRONIC MUSIC PROJECTS
BP74 $5.92
Provides constructors with practical circuits for the less complex music equipment including fuzz box, waa-waa pedal, sustain unit, reverb and phaser, tremolo generator etc. Text covers guitar effects, general effects, sound generators, accessories.

SONICS 1982 YEARBOOK $5.35
An interview with Kraftwerk, how to cope with recording, lighting, rock acoustics, guitars, equipment reviews and more.

SONICS MAGAZINE $2.35 ea
The Australian music magazine dedicated to the art and craft of sound. Published April, July, October, Yearbook in December. $15 for one year subscription. Please indicate starting issue.

computers for beginners

COBOL FOR BEGINNERS
39378P $21.95
It is a solid text for introductory programming courses in Cobol, using a format that is easy to understand, yet comprehensive enough to make supplementary readings unnecessary.

THE PET PERSONAL COMPUTER FOR BEGINNERS
61827P $20.95
This handy guide is written for use with all varieties of PET computer, from the original 2001 to the new 8032 Super PET. It is suited to novices with no practical experience and provides advice and practical examples.

BIG THINGS FROM LITTLE COMPUTERS
77859P $19.25
A layperson's guide to personal computing with all the basic information and lots of examples of how personal computers can be used.

BEGINNER'S GUIDE TO DIGITAL ELECTRONICS
BP61 $3.36
Covers all essential areas including number systems, codes, constructional and sequential logic, analogue/digital/analogue conversion.

BEGINNER'S GUIDE TO MICROPROCESSORS & COMPUTING
BP66 $5.92
Introduction to basic theory and concepts of binary arithmetic, microprocessor operation and machine language programming. Only prior knowledege assumed is very basic arithmetic and an understanding of indices.

A MICROPROCESSOR PRIMER
BP72 $5.92
Learning about microprocessors is easy with this book, written in a style that is easy to follow. The shortcomings of this basic machine are discussed and the reader is shown how these are overcome by changes to the instruction set. Relative addressing, index registers follow as logical progressions.

AN INTRO TO BASIC PROGRAMMING TECHNIQUES
BP86 $6.56
Ideal for beginners seeking to understand and program in BASIC. Book includes program library for biorhythms, graphing Y against X, standard deviations, regressions, generating musical note sequences, and a card game.

BEGINNING BASIC
39806A $19.95
Intended for beginners with no computing experience, one should be able to intelligently program in BASIC in a short time.

BEGINNING FORTRAN
46011A $19.95
Starts with simple elementary examples and proceeds to intermediate level programs. Also includes references, tutorials, flow charts, deck set-ups and matrix algebra.

UNDERSTANDING COMPUTERS
39815A $17.95
This book describes how computers work. For people who use small computers, it starts with the most elementary gates and works up to the complete computer. Gives an understanding of languages and how they operate in the computer.

NAILING JELLY TO A TREE
39842A $24.95
This guide to software teaches you about machine language, assembly language programming and BASIC. The emphasis is not on learning to write programs but on learning to use the thousands of available programs that have already been written.

PEANUT BUTTER AND JELLY GUIDE TO COMPUTERS
39813A $14.95
A simple, easy-to-digest source of information on personal computing for the potential buyer who is less than an expert in the field.

INTRODUCTION TO WORD PROCESSING
88076A $17.95
Written for the non-technical reader, this book tells about the concepts common to all word processing systems, then analyses all features in detail.

YOUR FIRST COMPUTER
88045A $12.50
An easy-to-understand beginner's book to small computers. Understanding them, buying them and using them for personal and business applications.

FROM CHIPS TO SYSTEMS: AN INTRODUCTION TO MICROPROCESSORS
88063A $19.95
Explains exactly what a microcomputer system is and how it works. Introduces fundamental concepts and covers all aspects of microprocessors and related components: internal operation, memories, interfacing and system development etc.

COMPUTERS FOR EVERYBODY
39849A $8.95
In this easy-to-understand book it is explained how a computer can be used at home, in the office or at school. Includes a consumer's guide to computer equipment that will help the reader decide what to buy and who to buy it from.

computers hardware & techniques

USING THE 6800 MICROPROCESSOR
21512P $13.25
This will guide the reader through the conception, configuration, writing and running of a variety of programs that demonstrate practical use of a 6800 system.

Z80 MICROCOMPUTER DESIGN PROJECTS
21682P $20.75
This book provides a complete look at the internal architecture of the Z80, the heart of many microcomputers, and even shows how to build a microcomputer, the EX80, using this powerful chip.

MICROPROCESSOR CIRCUITS VOL. 1
21877P $14.75
Presents basic microprocessor concepts in simple language for beginners and teaches you to construct a useful microcontroller system. Offers 30 demo circuits which take you through assembly, operation and programming of a microcontroller.

INTERFACE PROJECTS FOR THE APPLE II
69387P $15.95
A series of interface projects that are easily built and enable the user to realise the computer's potential through project construction. Projects are primarily hardware-orientated, with some software supporting the hardware.

PET INTERFACING
21795P $25.25
Demonstrates how to build numerous interfacing devices for PET hardware. BASIC language programs are used throughout, and the book includes a discussion of the microprocessor's internal architecture and general hardware/software interfacing.

6809 MICROCOMPUTER PROGRAMMING AND INTERFACING, WITH EXPERIMENTS
21798P $21.95
Gives a solid understanding of how to program and interface the high-performance 6809 microprocessor. The author completely explores internal structure, addressing modes, data movement instructions, registers, arithmetic logic and test instructions for the 6809.

Z80 MICROCOMPUTER HANDBOOK
21500P $17.50
This thorough handbook covers hardware, software and microcomputers built around the Z80.

THE S100 AND OTHER MICRO BUSES
21810P $13.25
The key to successful computer expansion is a complete understanding of the bus system, through which the computer communicates with peripherals. This book will give you that understanding.

MICROCOMPUTER DESIGN AND TROUBLESHOOTING
21819P $26.75
Tells you how to design microcomputer systems and make them work without an expensive commercial development system or the need for costly test instrumentation. The author also provides a complete description of two popular microprocessors — the 8085 and the 6502.

DON LANCASTER'S MICRO COOKBOOK, VOLUME 1
21828P $20.75
This 'cookbook' starts with the very fundamentals of microprocessors and microcomputers and takes you through number systems, codes, memory, etc, until you can work intelligently with micros.

DON LANCASTER'S MICRO COOKBOOK, VOLUME 2
21829P $20.75
Carries on where Volume 1 left off.

APPLE INTERFACING
21862P $15.95
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. A better understanding of interactions between hardware and software will enable you to communicate more effectively with your Apple.

MICROPROCESSOR CIRCUITS VOL. 1
21877P $14.75
Presents basic microprocessor concepts in straightforward language for beginners. Teaches you to construct a useful microcontroller system through progressive demonstration circuits.

8080 MICROCOMPUTER EXPERIMENTS
39808A $29.50
This 'hands on' book includes 105 experiments presenting programs and diagrams as required for clarification.

A STEP-BY-STEP INTRODUCTION TO 8080 MICROPROCESSOR SYSTEMS
39804A $16.95
Doesn't require any electronics or computer background. This book describes the 8080 architecture and instruction set through simple examples. Some basic software is introduced.

DIGITAL CIRCUITS WITH MICROPROCESSOR APPLICATIONS
46032A $39.50
An introductory text, this book provides readers with the basic ideas and tools needed to analyse and design digital circuits and computer systems. Discusses microprocessor computer organisation, machine language number systems and gate circuits.

MICROPROCESSOR INTERFACING TECHNIQUES
88029A $24.95
Teaches you how to interconnect a complete microprocessor system and interface it to the usual peripherals. The hardware and software skills needed to effectively interface peripheral devices are covered along with various buss standards and A/D conversion.

PRACTICAL INTRD TO DIGITAL ICS
225B $4.32
Introduction to digital ICs (mainly TTL 7400). Besides simple projects, includes logic test set to identify and test digital ICs. Also includes digital counter-timer.

BEGINNER'S GUIDE TO MICROPROCESSORS & COMPUTING
BP66 $5.92
Introduction to basic theory and concepts of binary arithmetic, microprocessor operation and machine language programming. Only prior knowledge assumed is very basic arithmetic and an understanding of indices.

A MICROPROCESSOR PRIMER
BP72 $5.92
Learning about microprocessors is easy with this book, written in a style that is easy to follow. The shortcomings of this basic machine are discussed and the reader is shown how these are overcome by changes to the instruction set. Relative addressing, index registers follow as logical progressions.

PRACTICAL COMPUTER EXPERIMENTS
BP78 $5.92
How to build typical computer circuits using discrete logic. This book is a useful intro to devices such as adders and storers as well as a general source book of logic circuits.

THE 6809 COMPANION
BP102 $6.56
It is not a beginners introduction to microprocessors in general but a discussion of the features of the 6809 and a reference work for the 6809 programmer in particular.

COMPUTERS & COMPUTING YEARBOOK 1980 $4.95
Includes beginners buying guide, the Apple, Tandy's TRS-80, the Vector MZ, introducing BASIC, S100 VDU, EPROM programmer, microcomputer power supply and lots more.

COMPUTERS & COMPUTING YEARBODK 1982 $4.95
Includes disks, CP/M and your computer, learners microcomputer, programming in CHIP-8, alphasort, fast plotter, PET talk, the System 80 etc.

computing software

CP/M PRIMER
21791P $21.95
A complete one-stop course on CP/M, the very popular operating system for 8080, 8085 and Z80-based microcomputers. Complete terminology, hardware and software concepts, startup of a CP/M system, and a complete list of CP/M-compatible software.

THE CP/M HANDBOOK (WITH MP/M)
88048A $19.95
Contains a step-by-step description of all the CP/M command features. Designed for the beginner, the book progresses to detailed explanations of the file transfer program, the debugging program and CP/M's text editing program.

HOW TO GET STARTED WITH CP/M
39832A $19.95
This practical book eases the reader into the essentials of the system, giving an overview of the operating system, an idea of what it will be like to use and what it can do for the reader.

AUSTRALIAN MICROCOMPUTER HANDBOOK
72505 NOW $15.00
Normally $25.00. A detailed buyer's guide to microcomputer systems and application packages in commercial, industrial, scientific, educational and home/hobby areas.

THE C PROGRAMMING LANGUAGE
10163P $21.95
C is a general purpose 'low-level' programming language. It is not specialised to any particular area of application, but its absence of restrictions make it convenient and effective for many tasks.

THE 68000: PRINCIPLES AND PROGRAMMING
21853P $19.95
An easy-to-read, systematic approach to the 68000 advanced 16-bit microprocessor. The book guides you through the complex architecture, instruction set, pinouts and interfacing techniques. Written for design engineers, programmers and students.

PROGRAMMING IN BASIC FOR PERSONAL COMPUTERS
30739P $14.75
Simple instructions show how to give BASIC commands and statements a wide range of applications, from programming video games to developing business or scientific programs.

PROGRAMMABLE CALCULATORS
46008A $24.95
This book suggests which calculators to buy, their possibilities and limitations, and the how-tos of programming them.

TAKE A CHANCE WITH YOUR CALCULATOR
39807A $14.95
An introduction to modern mathematics, this book deals with programming of programmable calculators and includes probability problems.

AN INTRO TO BASIC PRDGRAMMING TECHNIQUES
BP86 $6.56
Ideal for beginners seeking to understand and program in BASIC. Book includes program library for biorhythms, graphing Y against X, standard deviations, regressions, generating musical note sequences, and a card game.

BASIC FOR EVERYONE
61481P $19.75
349 pages of BASIC information for all purposes.

BEGINNING BASIC
39806A $19.95
Intended for beginners, this book discusses how a programmer and a basic computer interact with the computer, problems likely to be met by the beginner, the need for and uses of documentation etc.

FIFTY BASIC EXERCISES
88056A $17.95
Designed to teach BASIC through actual practice, this book contains graduated exercises in math, business, operations research, games and statistics. The programs were designed to run directly on a TRS-80 and will run with minor or no changes on any system with Microsoft BASIC.

INSIDE BASIC GAMES
88055A $19.95
The medium of games teaches readers how to design error-free, interactive BASIC programs. Rules, algorithms and coding differences for the PET, APPLE II and TRS-80 are also included.

MICRDSOFT BASIC
39823A $19.95
Includes branching and loops, arithmetic in BASIC, strings, editing, arrays and files, the disk and a description of the Radio Shack Level II BASIC.

INTRODUCTION TO FORTH
21842P $14.95
The most complete book available on the MMS FORTH version of FORTH, but also a fundamental approach to programming in all versions of FORTH. Many programming examples are provided, with direct comparisons to the Microsoft Level II BASIC version of these programs.

STARTING FORTH
42922P $23.75
A clear and complete guide to FORTH, this book covers fundamental principles and then a full set of high-level FORTH commands. It concludes with advanced techniques and style.

A FORTRAN PRIMER
80454P $6.95
Assumes no previous knowledge of program writing. It covers the fundamentals of the FORTRAN language, enables extensive program writing and concentrates on programming style.

INTRODUCTION TO STRUCTURED FORTRAN
46007A $19.95
Written for the beginner, the text incorporates the new FORTRAN 77 with a discussion of structural programming. Includes a discussion of time-sharing, pseudo language programming and WATFIV statements.

MICROSOFT FORTRAN
39846A $24.95
An introductory text on FORTRAN in general and Microsoft FORTRAN in particular. The latter is exceptionally well suited for use on microcomputers using CP/M and others of the 8080/8075/Z-80 family.

BEGINNING FORTRAN
46011A $19.95
Introduces readers to FORTRAN. Included are references for further study, brief tutorials on key punching, flow charting, deck set-ups and matrix algebra.

QWIKTRAN
39824A $19.95
Quick FORTRAN for Micros, Minis and Main Frames. Starts with the basic concepts of computing and Qwiktran, a fundamental subset of FORTRAN IV. Lots of examples to increase the reader's proficiency.

THE UCSD PASCAL HANDBOOK
35536P $23.75
Language descriptions organised in a quick and easy reference are given in this book for readers with no prior experience of Pascal programming.

INTRDDUCTIDN TO PASCAL
91522P $19.95
The second edition of this popular book has been updated to conform to the new international standard of Pascal. The contents illustrate the design and construction of Pascal programs, involving a wide range of basic computer algorithms in a practical context.

PASCAL
46028A $19.95
For people with little or no programming experience, this book gives lots of examples that clearly explain proper usage of language features. Discusses top-down programming, debugging, self-documentation etc.

THE PASCAL HANDBOOK
88053A $23.50
This book summarises the entire Pascal vocabulary, including the variations introduced by different commercial versions of Pascal. All in dictionary format.

PASCAL PROGRAMS FOR SCIENTISTS AND ENGINEERS
88058A $23.50
Over 60 of the most frequently used scientific algorithms, along with their program implementation in Pascal, are in this book.

COBOL FDR BEGINNERS
39378P $21.95
It is a solid text for introductory programming courses in Cobol, using a format that is easy to understand, yet comprehensive enough to make supplementary readings unnecessary.

STARSHIP SIMULATIDN
39810A $11.95
This book offers both a specific simulation which can be implemented, modified and played, and a complete look at how to put together a simulation on almost any subject.

BASIC PRDGRAMS FOR SCIENTISTS AND ENGINEERS
88073A $19.95
This book contains scientific and engineering application programs written in BASIC.

COMPUTER GRAPHICS PRIMER
21650P $21.95
Almost every page has a colour drawing, photograph, picture or a schematic to help you learn computer graphics quickly and easily. Programming concepts apply to all microcomputers, and examples are given in BASIC for the Apple II.

INTRODUCTION TO TRS-80 GRAPHICS
39818A $17.95
It begins with the basic concepts of line drawing and leads the reader on to geometric shapes, moving figure animation and other more advanced topics.

CIRCUIT DESIGN PROGRAMS FOR THE TRS—80
21741P $21.75
A number of programs written to aid you in using your TRS-80 and Level II BASIC for the design and analysis of many electronic circuits. The programs analyse information on rms values, periodic waveforms, integrated circuit timers and bipolar transistor circuits.

MOSTLY BASIC: APPLICATIONS FOR YOUR TRS-80 — BOOK 1
21788P $19.25
28 ready-to-use BASIC programs which have been completely tested and debugged. Programs include a telephone dialler, digital stop-watch, spelling test, house buying guide, gas mileage calculator, and others. Complete with explanations of each program, sample runs, and complete program listing.

MOSTLY BASIC: APPLICATIDNS FOR YOUR TRS-80 — BOOK 2
21865P $19.25
32 ready-to-run BASIC programs, including two to test your ability in history and maths, a Dungeon of Danger that's strictly for fun, eleven household programs, seven on money and investment, two to test your ESP level, and more. Complete with explanations, sample run and listing for each program.

INTERMEDIATE PROGRAMMING FOR THE TRS-80 MODEL I
21809P $14.95
Step-by-step instructions for the TRS-80 user who wants to progress from BASIC to machine and assembly language programming with the TRS-80 Model I system. A complete how-to guide with numerous examples.

...and for good measure...

TRS-80 — MORE THAN BASIC
21813P $15.95
Learn to program in Z80 mnemonics by using the book's error-tolerant interactive monitor program. Over 26 commands available, with total documentation that helps you change the commands to meet specific applications.

TRS-80 ASSEMBLY LANGUAGE MADE SIMPLE
21851P $19.25
If you have an understanding of BASIC programming, this book will help you learn to plan, write and hand-assemble your own assembly language programs in memory, using the T-bug and Level II BASIC ROM subroutines.

PROGRAMMING THE TRS-80 POCKET COMPUTER
30531P $13.25
This book explains all aspects of problem-solving in BASIC, and covers cassette machine interfacing and how to make the best use of the system's keyboard and display.

TRS-80 ASSEMBLY LANGUAGE SUBROUTINES
31188P $19.25
A wide spectrum of applications is discussed in this book, which provides easy-to-use routines that can be used as they stand or modified.

32 BASIC PROGRAMS FOR THE TRS-80 COMPUTER
39827A $29.50
Programs for the TRS-80 Level II or Model III BASIC (with 16K or more user memory).

APPLE BASIC
39099P $19.25
This book gives the beginner a thorough introduction to BASIC programming on an Apple computer, and covers all areas of programming, including graphics, games, mathematical programs, and a great deal more.

CIRCUIT DESIGN PROGRAMS FOR THE APPLE II
21863P $23.75
A series of ready-to-run Apple II programs ideal for electronics design engineers and others faced with solving problems related to plotting and verification of experimental data. The programs may be used as subroutines in larger programs, and many can be translated to run on other microcomputer systems.

APPLESOFT LANGUAGE
21811P $13.95
Written for Apple II micros that use the Microsoft language, this introduction covers each aspect of programming in non-technical language, from elementary concepts to advanced techniques.

APPLE MACHINE LANGUAGE
90230P $21.95
This straightforward book teaches machine language programming through BASIC, the transition being made step-by-step. Many sketches of video displays are provided, as well as exercises with answers.

APPLE PASCAL GAMES
88074A $19.95
Explore all the essential elements of UCSD Pascal and learn the important Apple Pascal extensions.

PASCAL PROGRAMMING FOR THE APPLE
95454P $18.95
This book teaches UCSD Pascal on the Apple II. Many examples, programs for financial applications, graphics, file structures and sound reproduction are supplied.

32 BASIC PROGRAMS FOR THE APPLE COMPUTER
38834A $29.50
Full of programs with practical applications, educational uses, games and graphics.

PET/CBM BASIC
61751P $19.25
This book provides a thorough introduction to BASIC programming on a PET computer, explaining programming concepts for graphics, including three-dimensional letters, bar graphs and the use of sound effects in PET programs.

THE PET PERSONAL COMPUTER FOR BEGINNERS
61827P $20.95
This handy guide is written for use with all varieties of PET computer, from the original 2001 to the new 8032 Super PET. It is suited to novices with no practical experience and provides advice and practical examples.

PET BASIC 1
95524P $19.25
For users of the PET computer, this book covers such topics as creative graphics, humour and interesting small programs.

PET GAMES AND RECREATIONS
95529P $18.85
Presenting an interesting mixture of diversions guaranteed to entertain and educate. Ideal for beginners, yet also challenging to computer veterans, the book features progressive levels of difficulty and five different types of games.

32 BASIC PROGRAMS FOR THE PET COMPUTER
39825A $29.50
Each chapter fully documents a different bug-free program. If readers have a good working knowledge of BASIC, they can devise and implement their own program changes.

THE ATARI ASSEMBLER
90236P $19.25
This practical book gives detailed instructions for using the Atari Assembler cartridge for novices with some knowledge of BASIC programming. Fundamental information programming in assembly language is given.

ATARI GAMES AND RECREATIONS
90242P $19.25
Beginners and advanced users can use the preprogrammed games in this book to improve their skill. Charts, flash cards, an error dictionary and graph paper designs are among the features.

EXPLORE COMPUTING WITH THE TRS-80 (AND COMMON SENSE)
96137P $17.95
This introduction to microcomputers and the BASIC language is suitable for novices and users of the TRS-80. Among the topics covered are creating tables, arts and graphics, games and simulation.

32 BASIC GAMES FOR THE EXIDY SORCERER
39835A $29.50
Full of programs with practical applications, educational uses, games and graphics. Each chapter documents a different bug-free program.

THE ART OF PROGRAMMING THE 1K ZX81
BP109 $6.56
This book explains how to use the features of the ZX81 including its random number generator, graphics and timer. PEEK and POKE are explained and you should learn enough to develop programs of your own.

PROGRAMMING THE 6502
88046A $18.95
Principles of assembly language programming for the 6502 microprocessor are taught in this introductory text. Includes a discussion of trade-offs between hardware and software and detailed explanations of the 6502's internal registers and buss operation.

6502 APPLICATIONS BOOK
88015A $17.95
Use this book and a few low-cost components to build a complete home alarm system, an electric piano, a motor speed-regulator, a time-of-day clock, a simulated traffic control system and a Morse code generator, etc.

6502 GAMES
88023A $17.95
You learn how to play ten sophisticated games and also learn assembly language programming. Also learn the techniques of algorithm design and data structures.

8080 MACHINE LANGUAGE PROGRAMMING FOR BEGINNERS
39814A $12.95
The book will take the reader step-by-step through the most common 8080 op codes and it will do so at a level anyone can understand.

PROGRAMMING THE Z80
88047A $19.95
This book will enable every reader to write complete application programs for Z80-based computer systems. Includes exercises to measure progress and comprehension at each level of programming.

PROGRAMMING THE Z8000
88072A $19.95
A complete introduction to programming concepts and techniques for use with the 16-bit, Z8000 microprocessor. Presents detailed descriptions of the architecture and functions of this 'super chip'.

START WITH BASIC ON THE COMMODORE VIC 20
97070P $14.75
Helpful exercises and step-by-step instructions show you how to program in BASIC utilising all the graphic functions on the Vic 20.

computing for business

BASIC FOR ACCOUNTANTS
80098P $9.95
Shows accountancy students and accountants how to use a computer to perform the repetitive tasks associated with record keeping, calculating and report writing. Using the BASIC language attention is concentrated on debtors, inventory and general ledger systems.

COMPUTER BASED BUSINESS SYSTEMS
80192P $10.95
A short introduction to the sorts of systems used by a typical business to handle its typical activities. The book aims at providing a general understanding and therefore avoids technological detail.

THE COMPUTER SOLUTION
80195P $13.50
It should be of interest to business people contemplating, implementing or already using computer data processing or to any non-technical person curious to know why and how computers are used in Australian businesses and organisations.

SMALL BUSINESS COMPUTERS: A GUIDE TO EVALUATION AND SELECTION
81134P $14.95
Ideal for the inexpenenced user, this text emphasises management considerations in determining the feasibility, economics, evaluation, selection, contracts and practicality of installing a computer.

SMALL BUSINESS COMPUTER SYSTEMS
81136P $14.95
This book provides a bridge between the accountant and the DP professional by explaining every step of the trading and reporting process in DP terms. It is especially useful to people engaged in the specification process or in auditing DP accounting systems.

THE VISICALC BOOK — APPLE EDITION
98397P $22.25
If you are using Visicalc on your Apple II and want to learn more about its expanded uses then this book will show you how to build a model, enter your data and solve problems about profit/loss projections, pricing/costing estimates etc.

THE CP/M HANDBOOK (WITH MP/M)
88048A $19.95
Containing a step-by-step description of all the CP/M command features, the book progresses to detailed explanations of the file transfer program, the debugging program and CP/M's text editing program.

YOUR FIRST COMPUTER
88045A $12.50
A beginner's guide to small computers, understanding them, buying them and using them for personal and business applications. Includes peripherals, languages and application packages.

DON'T (OR HOW TO CARE FOR YOUR COMPUTER)
88065A $16.95
A guide to computer and peripheral preservation. Specific advice for the computer, floppy disks, hard disks, the CRT terminal, the printer, tape units, the computer room, software and documentation are included.

INTRODUCTION TO WORD PROCESSING
88076A $17.95
Written for the non-technical reader, this book tells about concepts common to all word processing systems, then analyses all features in detail, from screens to scrolling and formatting.

SMALL COMPUTERS FOR THE SMALL BUSINESSMAN
39831A $24.95
The book tells readers how and where to shop for a computer successfully; what to expect their computer to do for them; how to select software; whether or not to use a consultant; how to introduce the computer to the staff and how much computer is necessary.

INVENTORY MANAGEMENT FOR SMALL COMPUTERS
39848A $24.95
Owners of retail businesses and their employees need this book. The program provides an inventory control system so that you know what stock is on hand, where it is located, what price was paid for it and the selling price.

BASIC FOR BUSINESS FOR THE TRS-80
90352P $22.25
This book covers the application of BASIC language to business uses on the TRS-80 models II and III.

FROM THE COUNTER TO THE BOTTOM LINE
39811A $24.95
A demystifying guide to basic accounting needs and computer use. Includes inventory and purchasing, billing, accounts receivable, accounts payable and general ledger.

amateur radio, DX, communications

INTRODUCTION TO RADIO ASTRONOMY
21246P **$8.75**
It gives background information on the structure of the universe, classification of galaxies and radio-wave propagation. It covers in detail reception of extraterrestrial radio signals and their sources and the types of antennas. It also explains how to construct several practical, low-cost radio telescopes.

TUBE SUBSTITUTION HANDBOOK
21746P **$8.75**
Complete, accurate, up-to-date guide to direct substitutes for receiving and picture tubes. Contains over 6000 receiving tube substitutes, over 4000 monochrome and colour picture tube substitutes, and 600 communications substitutes. Also includes pinouts for quick operational checks.

RF CIRCUIT DESIGN
21868P **$33.95**
A practical approach to the design of RF amplifiers, impedance-matching networks and filters. Uses a minimum of complex maths.

COMPUTERS AND THE RADIO AMATEUR
66306P **$28.00**
For the radio operator who wants to know how computers function and how they can be used with other equipment.

SOLID STATE SHORT WAVE RECEIVERS FOR BEGINNERS
222B **$4.32**
Design and construction of several solid-state shortwave receivers giving high level of performance yet utilising relatively few inexpensive components. See also 226.

HANDBOOK OF RADIO, TV, INDUSTRIAL & TRANSMITTING TUBE & VALVE EQUIVALENTS
BP2 **$2.25**
Equivalents book for amateurs and servicemen. More than 18 000 old and new valves from UK, USA, Europe, Japan et al. CV (military) listings with commercial equivalents included.

RADIO CIRCUITS USING ICS
BP46 **$4.64**
Describes how ICs can be employed in receivers for the reception of either amplitude or frequency modulated signals. Stereo decoder circuits and the devices available at present for quadrophonic circuits are discussed.

LONG DISTANCE TV RECEPTION (TV-DX)
BP52 **$6.56**
Written by UK authority, the book includes many units and devices made by active enthusiasts. A practical and authoritative intro to this unusual aspect of electronics.

RADIO STATIONS GUIDE
BP55 **$5.92**
This is an aid for all those who have a radio receiver. Shows the station site, country, frequency and/or wavelength, as well as Effective Radiation Power of the transmitter and in some cases, the station's call sign as well.

AN INTRODUCTION TO RADIO DXING
3P91 **$6.56**
One section is devoted to amateur band reception and the other section covers broadcast band reception, with advice on suitable equipment and the techniques employed when using that equipment. The construction of a number of useful accessories is described.

AERIAL PROJECTS
BP105 **$6.56**
Practical aerial designs including active, loop and ferrite which are relatively simple and inexpensive to build. The complex theory and mathematics of aerial design have been avoided.

general

AUTOMOTIVE TUNE-UP AND EMISSION CONTROL SERVICE
21712P **$20.75**
Car owners who wish to save money and maintain their cars at peak performance will learn from this book how to adjust, repair and maintain the systems that ensure best operation.

INTRODUCTION TO AUTOMOTIVE SOLID-STATE ELECTRONICS
21825P **$14.95**
For the professional as well as the home mechanic — explains the functions of most on-board automotive black boxes and logic systems, including anti-skid braking, electronic spark control, diagnostic systems and tnp computers.

SECURITY ELECTRONICS
21419P **$11.25**
The principles of operation of the electronic devices used in the various types of security systems are described. Intrusion detection and alarms, object detectors, bugging and debugging devices, computer protection, as well as the planning of systems.

ELECTRONIC SECURITY DEVICES
BP56 **$5.92**
Besides including both simple and more sophisticated burglar alarm circuits using light, infrared and ultra-sonics, this book also gives circuits for gas and smoke detectors, flood alarms, fire alarms, doorphones, baby alarms, etc.

EXPERIMENTS IN ARTIFICIAL INTELLIGENCE FOR SMALL COMPUTERS
21785P **$13.25**
Artificial intelligence is the capability of a device to perform functions normally associated with human intelligence. With this book, a small computer with extended BASIC and some knowledge of BASIC language, you can conduct interesting and exciting experiments in artificial intelligence.

TELEMATIC SOCIETY
02460P **$17.50**
An extensive update of 'The Wired Society', this book demonstrates how developments in telecommunications will affect the way we live.

ELECTRONIC CALCULATOR USERS' HANDBOOK
BP33 **$5.12**
Presents formulae, data, methods of calculation, conversion factors, etc, for use with the simplest or most sophisticated calculators. Includes the way to calculate using only a simple four-function calculator: trigonometric functions; hyperbolic functions; logarithms, square roots and powers.

YOUR ELECTRONIC CALCULATOR AND YOUR MONEY
BP54 **$4.64**
Starts with a basic revision of percentages and decimals, then deals with mortgages, cars, insurance, fuel, shopping, tax etc. There's a section on investment and the last section deals with the calculator in a small business.

ORDER FORM

Send to ETI Book Sales, 4th Floor, 15 Boundary St, Rushcutters Bay NSW 2011.
Allow 4-5 weeks for delivery. Post & Handling $1 per book. Effective until April 30, 1983.

Please supply:

BOOK TITLE	BOOK NO.	QTY	TOTAL PRICE
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....

Post and handling .....

I enclose TOTAL $ _____

Name: .....

Address: .....

..... Postcode .....

Please debit my ☐ Bankcard ☐ American Express Card

Expiry Date .....

Number .....

Signature .....

An EPROM programmer for the MicroBee

This simple, low cost EPROM programmer just plugs into the MicroBee's I/O port and enables you to save programs in any of five different common EPROMs which can then be used in your MicroBee or any other microprocessor-based system. As the MicroBee I/O port is effected with a Z80 PIO chip, this programmer can be used with any other system employing the same I/O.

Tom Moffat
Geoff Nicholls

SICK OF loading tapes? Well here's a way to avoid much of the drudgery, at least for your favourite machine code programs. EPROMs — Eraseable Programmable Read Only Memories — are a storage medium often overlooked by keen computerists intent on blowing big dough on such things as disk drives. Information in EPROMs is the same as in any other read only memory ... it's always there, and instantly available when you switch on the computer.

It would be fair to say that probably 99% of all EPROMs are programmed once and then forgotten. Manufacturers of computers in small production runs, that is by thousands instead of millions, find it convenient to put their 'firmware' in EPROMs, instead of mask-programmable ROMs. It's cheaper in small quantities, and they can do the programming themselves, instead of having a chip manufacturer make up a special (and expensive) mask.

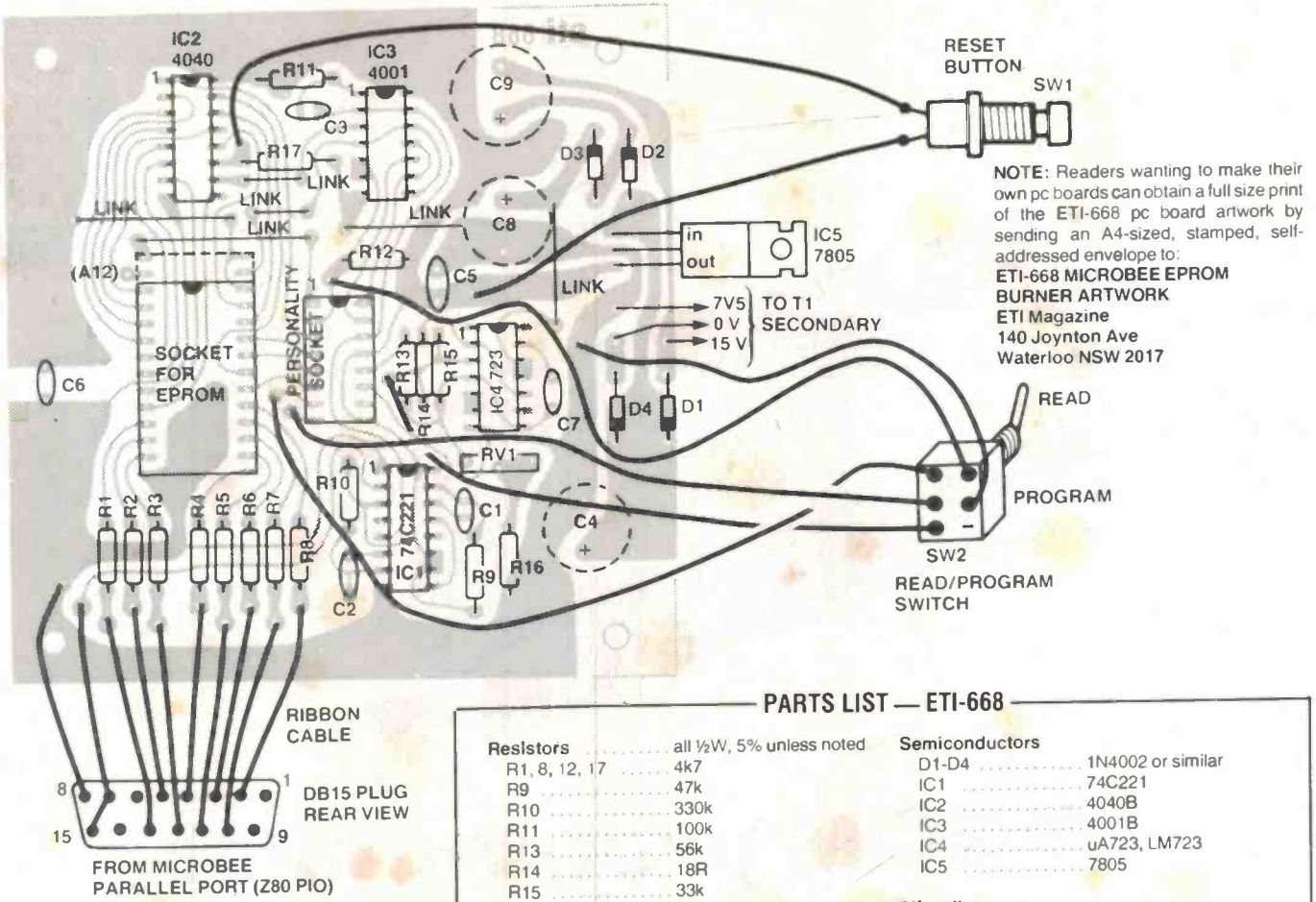
The standard MicroBee has four EPROMs containing its 16K BASIC, and there are two more if the Editor/Assembler is fitted. There's another blank position meant for a future networking EPROM which can be put to use for other purposes with the help of this project.

A version of this programmer has been in use for over two years, connected to a 6800-based computer that I built. Giving credit where credit is due, what was laughed at by some as a 'toy computer' has turned into a highly useful tool, especially since an upgrading in the EPROM department.

It started out with a 1K byte EPROM which was exchanged for a 2K 2716 and then a 4K 2732, a change which required only two jumpers to be moved. The original 1K of machine code now resides in the bottom quarter of the 2732. Within the other three-quarters of the EPROM are a debugging routine, a branch offset calculator, a branch address calculator, a disassembler, hex memory dump to teletype, and teletype printing programs for the Tandy/Sharp pocket computer and the MicroBee. And there's nearly 1K still free!

All this software started off small and just grew until most of it is now interlinked, with some programs accessing subroutines in maybe two or three others.

The point of all this is that there's an empty EPROM slot in the MicroBee that's just *begging* to be filled with a 2532. And Z80 versions of the above mentioned software ▶



could very well fill the EPROM. The same goes for any machine code. (Your favourite game?) It's also claimed that 2716s are pin-compatible with the MicroBee's 6116 RAMs, and if yours is a 16K MicroBee there are eight 6116 slots empty. This hasn't yet been tried and should be approached with caution as it could be disasterous to the 6116 battery backup system.

The hardware

EPROM programmers seem to come in two different types — complicated, and with the arrival of the ETI-668, not so complicated. You could simply go out and buy one, paying hundreds of dollars. Computer-driven home-brew models usually require all 16 address and eight data lines to be brought out, or lots of parallel in/out ports. The MicroBee only has one parallel port. The ETI-668 does the job with one port, an on-board address generator, an on-board programming pulse generator, and a 'trigger pulse'.

The computer first presents a byte of data to the EPROM via the parallel port's eight data lines and then supplies the trigger pulse via the port's handshake lines. The trigger pulse sets off a 50 ms single-shot multivibrator to form the programming pulse, and as the programming pulse finishes it increments the address generator.

The trigger pulse is officially meant to tell a printer to print or a punch to punch, so it applies only to data leaving the computer. But what happens when you want to read material from the EPROM into the computer? If you believed the data books you'd give up at this stage, but now comes the incredible story of *the illegal trigger pulse*.

My 6800 machine uses Motorola's 6821 parallel port chip which can be programmed to provide a trigger pulse via its CB2 handshake line whenever data is sent out. But, wonder of wonders, the pulse occurs even when the port is configured as an input. Data written to it doesn't go anywhere but the act of writing does fire the trigger pulse. So, the trick is to read the port to get a byte from the EPROM, and then write a dummy value back to it to increment the address generator.

Discovering that bit of undocumented information was an unexpected stroke of good luck, but you haven't yet heard the best of it. The MicroBee uses the Z80 PIO chip for its parallel port, a device as different from Motorola's 6821 as night is from day. Would the same trick work again? The gods must have really been smiling.

The PIO data sheet shows that when the chip is configured for output, and with the handshake lines 'ready' and 'strobe' tied together, a half-microsecond positive-going pulse comes from them after an 'OUT' instruction to the port. Once again, outputs only. So what would happen with the port set up as an input? Yep ... one undocumented, illegal trigger pulse! How can this happen to me, I've never even won a miserable 50 cent sweep? Perhaps we should shut up and be thankful to that great chip-designer in the sky.

PARTS LIST — ETI-668

Resistors — all ½W, 5% unless noted
- R1, 8, 12, 17 ..... 4k7
- R9 ..... 47k
- R10 ..... 330k
- R11 ..... 100k
- R13 ..... 56k
- R14 ..... 18R
- R15 ..... 33k
- R16 ..... 15k
- RV1 ..... 4k7 mln. vertical mount trimpot

Capacitors
- C1, C3 ..... 1n greencap
- C2 ..... 100n greencap
- C4 ..... 470u/16 V RB electro.
- C5, 6, 7 ..... 100n ceramic bypass
- C8 ..... 470u/50 V RB electro.
- C9 ..... 470u/25 V RB electro.

Semiconductors
- D1-D4 ..... 1N4002 or similar
- IC1 ..... 74C221
- IC2 ..... 4040B
- IC3 ..... 4001B
- IC4 ..... uA723, LM723
- IC5 7805

Miscellaneous
- SW1 ..... push-to-close single pole pushbutton
- SW2 ..... two-pole, double throw toggle switch
- T1 ..... 2155, 15 V/1 A multi-tapped transformer

ETI-668 pc board; 16-pin DIL socket and set of plugs or DIP headers; 24-pin DIL socket (or a ZIF socket if desired); Jiffy box — 60 x 113 x 196 mm; hookup wire, nuts, bolts, etc.

Options for 2764s — **Delete** 24-pin DIL skt, **add** 28-pin skt; **add** SPDT toggle switch, **add** 4k7 resistor

Price estimate — **$40 — $45**

With that handy trigger pulse available it's now an easy matter to program and read EPROMs with a simple circuit.

Now a few words about the quirks of EPROMs from someone who blew up several during the development of this project.

Each bit in an unprogrammed EPROM is high, so all bytes read 'FF'. During programming each bit required to be low is hit with what amounts to a miniature lightning bolt. If the hit is too long, or too powerful, *Ka-boom* — one blown EPROM.

The supply for properly 'burning' an EPROM comes from a 'high voltage' regulated source, usually 21 or 25 volts. With normal programming, an EPROM draws less than 30 mA from this supply. When something goes wrong, it draws much more, usually resulting in the absolute destruction of the EPROM. With that in mind, the 'programming' supply for this project has a current limit protection of 30 mA designed in.

Many programmer designs let the computer develop the 50 ms programming pulse in software. The ETI-668 does it with a hardware single-shot, nice and foolproof, even if the computer program crashes for some reason. A characteristic of EPROMs often ignored is the specification that the data lines must settle down for at least four microseconds before the programming pulse begins, and another four microseconds must be allowed between the end of the programming pulse and any changes on the address lines. This design provides 50 microsecond delays — much longer than necessary, but easy to see on an oscilloscope when setting up the programmer board.

The barbershop blues

EPROMs are erased by exposure to ultraviolet light. You can go out and buy a special EPROM eraser for many dollars. A UV tube costs about $20. But, if you know a friendly barber your outlay will be nothing more than an occasional haircut. Most barber shops have a device called a 'Servex Ultraviolet Sterilizer' for getting the nasties out of combs and brushes. A half hour in the old Servex will erase an EPROM nicely, and give you and the barber something to talk about besides cricket or football.

Construction

Before we start, a couple of things need to be pointed out. Firstly, for the majority of hobbyist applications the expense of a zero insertion force socket seems unjustified. A better choice would be one of the better quality 'normal' IC sockets, such as the ones with gold-plated pins. I have used one of these in my programmer board and in the spare EPROM position in my MicroBee and both will have EPROMs plugged in and out fairly frequently. (However, the ETI-built version, shown in the photographs, has a ZIF socket soldered in place as we plan to use the programmer rather more frequently than most hobbyists — Ed.)

Secondly, if your MicroBee isn't equipped with a port socket (DB15 female, pc mount style), now's the time to install it. (Editor's note: our MicroBee 64 had the DB15 port socket shown back to front on the pc board silk screened overlay — just check this if you're installing your own socket.)

Assembling the pc board is fairly straightforward. Before commencing assembly, have a good look at the pc board and make sure that no tracks are broken or shorted together. This applies especially if you are making your own pc board. If the visual check is OK, start by soldering the five links in place. These have been included despite the fact that they're often considered 'bad form'. But the few links are preferable to a more expensive double-sided board, just for the sake of a few connections.

Mount all the resistors and capacitors next, with the exception of the three power supply electrolytics, C4, C8 and C9. These can be mounted either on top of the board or, as in the ETI prototype, under the board. The latter course of action enables you to mount the board beneath the front panel of a jiffy box, or other suitable enclosure. If you just intend to have the unit 'hanging around on a shelf or in a drawer', then the electrolytics may be mounted on the top (non-copper) side of the board. For the sake of convenient handling, leave the mounting of the electrolytics till last.

The diodes and ICs can be mounted now. Take care with the orientation of the diodes. ICs 1, 2 and 3 are CMOS types and the usual handling and soldering precautions should be observed. Only handle them between thumb and forefinger, avoid touching the pins, and solder the supply pins first. IC4 is a conventional bipolar IC and no special precautions need be observed. Note that ICs 1 to 4, the personality socket and the EPROM socket are all aligned so that they face the same direction. IC5 is a three-terminal regulator. This mounts with the metal tab facing toward the board. Now you can mount the 16-pin personality socket (an ordinary IC socket) and the 24-pin or 28-pin socket for the EPROM.

Attach suitable lengths of hookup wire to the board and wire up the reset button, SW1, and the read/program switch, SW2. Check it when you've finished. Next strip a short length of ribbon cable so that you have ten wires. Peel back the wires individually at each end, strip and tin the ends, then wire one end to the pc board and the other end to the DB15 plug as shown in the overlay. Carefully check that you have the plug correctly wired.

Now you can mount the electrolytics, C4, C8 and C9. If mounting them on the copper side of the board, leave about 4 mm space between the board and the bottom of the component so that you can reach the leads with the soldering iron.

Wire up a set of personality plugs as shown in the accompanying diagrams. It's a good idea to stick a label to each DIP header before you attach the wires.

Now you can wire up the mains transformer, after which you're ready to check out and set up the programmer.

Check out and set up

For this you'll need a good multimeter. For absolute accuracy in setting up the programming pulse, you'll need access to either an oscilloscope or a counter-timer. Nothing fancy as you're only looking at 50ms +/− a bit pulses. There's a 'fudge' setup method too, where you don't need these instruments.

First off, set the read/program switch to 'read'. Don't put anything in the personality socket or the EPROM socket.

Connect up the mains and switch on. Quickly check the output voltages from the two rectifiers. You should get around 30 V at the cathode of D3 and around 10 V at the cathode of D1 (or D4). If not, switch off and check your transformer wiring and diode orientation. If those voltages check out, measure the output of IC5 (the 7805). It should be 5V, ±0.2 V. Now you can set up the programming voltages.

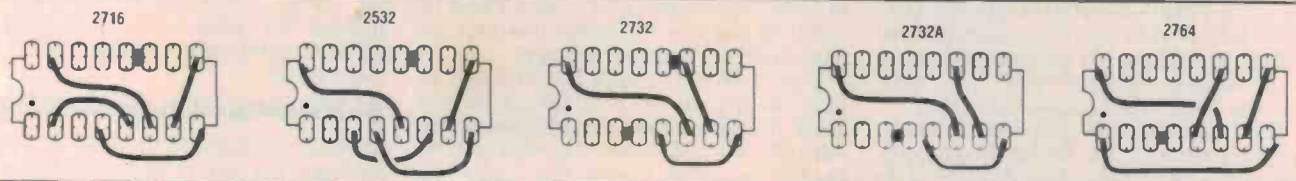
Measure the voltage between pins 7 and 3 (positive lead to 3) of IC4. Vary RV1 so that you get 21.0 V. Then put a 2716 personality plug in the personality socket. Now, again measure the voltage between pins 7 and 3 of IC4. It should now be 25 V, ±0.5 V.

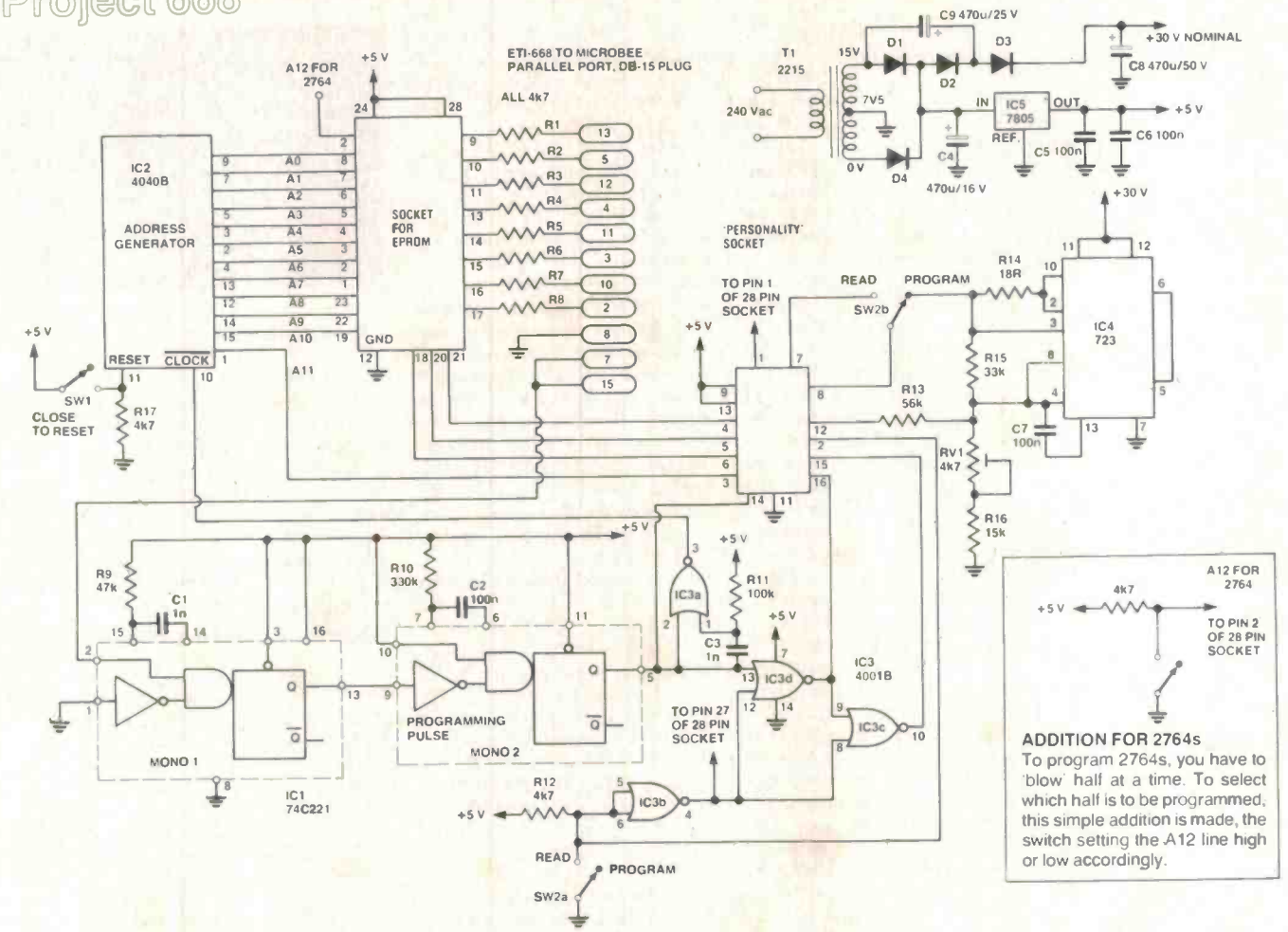
Next thing to do is check the programming pulse width.

There are two ways you can go about this — using the instrumental method or the 'fudge' method.

If you have access to a CRO or counter-timer, plug the programmer into the MicroBee and run the software. Nothing should be plugged into the EPROM or personality sockets. Look at pin 5 of IC5 (it doesn't matter if you're 'programming' or 'reading'). The pulses there should be ▶

'PERSONALITY' PLUGS





ADDITION FOR 2764s

To program 2764s, you have to 'blow' half at a time. To select which half is to be programmed, this simple addition is made, the switch setting the A12 line high or low accordingly.

HOW IT WORKS — ETI-668

This project is designed to be used with one port of a Z80 PIO (Parallel Input/Output chip) as one is used on the MicroBee for the parallel port. Any other microcomputer employing a similar scheme could use this project. This port supplies the data to the EPROM inserted in the programmer board through resistors R1 to R8 which prevent damage in the event of write conflicts. The READY and STROBE lines of the port are tied together to produce a half-microsecond positive-going pulse whenever a read or write operation is performed. This pulse, after a 50 us delay through MONO 1 (from IC1) is used to clock the program pulse generator, which is MONO 2 from IC1. IC1 is a 74C221, a CMOS dual monostable IC. The program pulse should be 45 to 55 milliseconds long and is determined principally by R10 and C2.

The READ/PROGRAM switch, SW2a, is gated with the program pulse to produce the various signals required by different types of UV-erasable EPROMs.

The signals available at the 16-pin 'personality' socket are routed via a programming (or personality) plug to suit the EPROM being programmed. The plug wiring details for five types of common EPROM are shown elsewhere in the article.

IC2, a 4040, generates the address lines for EPROMs up to 4K bytes. It is clocked by the falling edge of the program pulse. To program 8K byte EPROMs an extra switch is required to develop the A12 address line. The switch wiper should be connected to pin 2 of the 28-pin socket and should switch to +5 V or 0 V to select the upper or lower 4K bank, respectively. Closing SW1 effects a RESET of the address generator.

The power supply combines a fullwave rectifier and a voltage tripler to develop the two supplies necessary. Transformer T1 has a 15 V centre-tapped secondary. A fullwave rectifier, consisting of D1, D4 and C4 provides around 10 V for a 7805 three-terminal regulator which derives a +5 V rail for the ICs. A programming voltage of either 21 V or 25 V is required by some EPROMs. A voltage tripler, involving the addition of diodes D2 and D3 and capacitors C8 and C9, develops a nominal 30 V. A 723 precision regulator, IC4, regulates the required programming voltage (Vpp) of either 21 V or 25 V. Output from the 723 is from pin 10, via R14, which limits the short circuit output current to 30 mA. The voltage divider comprising R15, RV1 and R16 establishes an output of 21 V when RV1 is properly set. If pins 11 and 12 of the personality socket are shorted together, R13 is placed across RV1-R16, raising the 723's output to 25 V.

Switch SW2b selects the voltages applied to the Vpp input of the EPROM inserted in the programmer. Note that 2732s and 2732As require 0 V during read while other EPROMs require +5 V.

between 45 and 55 ms wide. If not, change the value of either R10 or C2 to bring the pulse width within these limits. Note that the value of R10 should not be greater than 330k. While you're at it, just check that the pulses on pin 13 of IC1 are around 50 us or so. This pulse width can have considerable latitude as the minimum requires is 4 us.

The fudge method requires a ready-programmed EPROM. Set up the programmer and software to read the EPROM. If the pulse from Mono 2 (IC1) is too long, the first byte will be read correctly, the next byte will read the same as the first byte, the third byte will be read correctly, the fourth byte will read the same as the third ... etc. Change C2 or R10 down by one standard value (i.e: C2 to 82n *or* R10 to 270k) and try again.

If you read the EPROM correctly first go, vary the byte at 0ECF in the control program, reducing it from 10 to 0E, then 0D etc, until the result of a read is the same as if the pulse from Mono 2 were too long (every second byte reads the same as the previous byte). If the pulse from Mono 2 is within limits, you should get a correct read from the EPROM when the byte at 0ECF is between 0D (lower limit) and 12 (upper limit). Increase the value of C2 by one standard value (to 120n) and try again if it's outside these limits.

Software and programming

Although the control program looks long and involved, the actual machine code used by the computer is only 422 bytes long, small

enough to be typed in by hand. Most of the code is involved with the screen display. The EPROM routines themselves are very short.

A feature of the program is its ability to partially program an EPROM, step over existing material and then add new stuff. This avoids lots of unnecessary erasures. It would have been simple to arrange the program so that stepping, programming and verifying happened automatically following a set of predetermined instructions. But, following past experience, it was decided to allow manual operation only ... you specify each action as it happens.

The purpose is to make you think. Are the addresses right? Do I really want to program, or just step? The screen display has been organised to make this quite easy.

When run, the program will show a title and then ask for a 'start address'. You must enter four hexidecimal (hex) digits, including any leading zeroes. You put the MicroBee keyboard into alpha lock for entering hex code. When you've done that, the program then asks for a 'finish address'. You enter more hex digits and the program then asks for a 'command'. You now double-check the addresses to ensure they point to the material you want to work on. If there's a mistake, you hit 'break' and the computer asks you for the addresses again. If all is OK, you now enter your command, using two hands to prevent mistakes. One for the control key, and one for a letter, as follows:

P = program from memory into EPROM
R = read from the EPROM into memory
S = step to a new address
T = test that the EPROM area is erased
V = verify that it all worked.

'PERSONALITY' SOCKET PIN DESIGNATIONS

		prog.	read
1.	Vpp INPUT (2764)	16.	
2.	READ/PROGRAM	15.	
3.	A11	14.	PIN 5 IC1
4.	PIN 21	13.	+5 V
5.	PIN 20	12.	CONNECT TO 11 FOR 25 V
6.	PIN 18	11.	GROUND (0 V)
7.	READ Vpp SELECT	10.	NOT USED
8.	Vpp	9.	+5 V

A white bar now appears on the screen, showing you what you're doing and in what area of memory. The memory locations roll along like a digital speedo in a car. In the event of an error, either from the erasure test or the verify routine, an appropriate message is displayed, telling you your EPROM has just earned a trip to the barber shop!

There are a few other manual operations involved. Before attempting to program an EPROM, make sure the programmer is turned on. If it isn't, you could damage an EPROM if you then attempt to program it. There are two good tricks to ensure you've done the right thing here. Install a 'piggy back' plug on the mains power lead to the programmer. When using the programmer, plug it into the power socket in the wall then plug the MicroBee's plugpack into the piggy back plug. You could also wire a 12 V bezel lamp across the 10 V supply. With the programmer plugged in and turned on, the *first* thing you must do is operate the RESET pushbutton, SW1, to initialise the EPROM address generator, setting the EPROM address to zero. Before issuing a program instruction, the read/program switch, SW2, must be in the WRITE position. You must return SW2 to the READ position after programming.

To ensure you don't make a mess of your EPROM it's best to get a pencil and paper and write down, step by step, exactly what you intend to do. As an exercise, let's say we want to put a program called 'Crash' into our EPROM that lives at the spare location E000. (This and all further addresses will be in hexidecimal notation.) There is already a debugging routine in the EPROM at E000-E0FF. We will assume the rest of the EPROM is empty. Here's how we do it:

We must first assemble the program to run in its eventual destination, but we'll have to physically put it somewhere else so it can be programmed into the EPROM. The MicroBee assembler has an 'offset' feature which allows us to do this.

'Crash' must start at E100, the next byte up from the end of 'Debug'. The normal place to put freshly assembled code is at 0400, so we'll assemble with an offset of 2300. After assembly we find that the last byte of 'Crash' will be at E2FF. Note that, the 'finish address' has to be *one byte more* than the last byte of the program to be entered. Thus, when loading, 'Crash', the finish address is E300.

Turn on your MicroBee and programmer and put SW2 at READ. Then plug the DB15 connector into the MicroBee port. Load the EPROM program and insert the EPROM to be 'burned' into the socket on the ETI-668. Now we go to our pencil and paper:

1) Press SW1 to reset the EPROM address counter. (Is SW2 at READ?)
2) Step E000-E100. (Steps over 'Debug'.)
3) Test E100-E300. (Erased?)
4) Press SW1 again. (RESET address counter.)
5) Step E000-E100.
6) Switch SW2 to PROGRAM.
7) Program 0400-0600. (Have faith, dear fellows ...)
8) Switch SW2 to READ, again.
9) Press SW1 again.
10) Verify E000-E100. (Is 'Debug' still OK?)
11) Verify 0400-0600. (Is 'Crash' OK?)

Did the white bar stop at 0600? Good. Error message? The number on the white bar will say where the error occurred, if you get one, a fact of academic interest really, as there's nothing you can do to fix it, other than erase the EPROM and start again. Perhaps it would be a good idea to have a second, blank, EPROM on hand in case you boo-boo with the first.

What could have gone wrong? Maybe you forgot to reset the EPROM address counter. Maybe you forgot to swith the read/program switch correctly. Maybe it's just not your day for programming EPROMs. In that case relax, and go get a haircut!

Undoubtedly there will be those who want to assemble a program from the beginning of MicroBee memory (i.e: 0000). If you do this, remember that the control program starts at 0E00 and hence only 3½K bytes may reside from 0000 to 0DFF. To avoid this restriction, assemble programs above the control program, i.e: starting at 1000. For example, if you have a 4K program temporarily residing at 1000 to 1FFF, then the steps to transfer it into EPROM are as follows (you must have a 2732 etc in the ETI-668!):

1) Reset the ETI-668 (press SW1), set SW2 to READ
2) Enter start address (= 1000)
3) Enter finish address (= 2000; note, *not* 1FFF)
4) Switch SW2 to PROGRAM
5) Type 'Control P' to program the EPROM

Then go through the verify routine. ▶

SIGNALS/VOLTAGES REQUIRED BY THE FIVE EPROM TYPES

24-pin package pin nos.	read	2716 prog.	read	2732 prog.	read	2532 prog.	read	2732A prog.	2764 read	(28 pin) prog.	28-pin package pin nos.
		⎍		⎍				⎍		⎍	
18	V_{1L}	V_{1H}	V_{1L}	V_{1L}	A_{11}	A_{11}	V_{1L}	V_{1L}	V_{1L}	V_{1L}	20
20	V_{1L}	V_{1H}	V_{1L}	+25 V	V_{1L}	V_{1L}	V_{1L}	+21 V	V_{1L}	V_{1L}	22
21	+5 V	+25 V	A_{11}	A_{11}	+5 V	+25 V	A_{11}	A_{11}	A_{11}	A_{11}	23
									+5 V	+21 V	1
									A_{12}	A_{12}	2
									+5 V	+5 V	28
									V_{1H}	V_{1L}	27

According to the data sheets, no two of the five EPROM types that can be programmed by the ETI-668 may be programmed with the same pin connections. Thus, the 6-pin personality socket is used to customise the programmer for the EPROM in use. The above table shows the signals/voltages required for the five different EPROM types that can be programmed by the ETI-668.

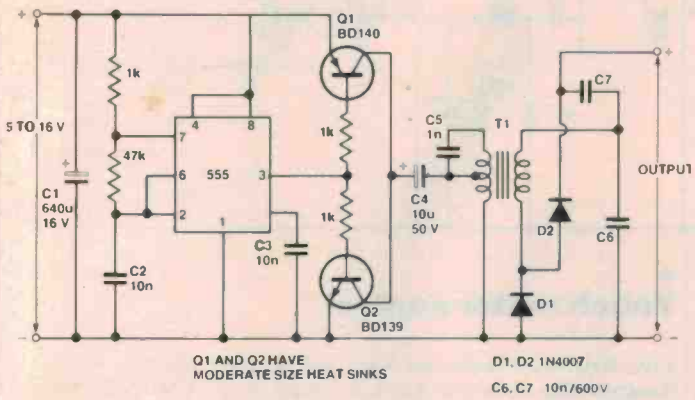
```
ADDR   CODE     LINE   LABEL  MNEM    OPERAND

                00100 ;ETI668 / MICROBEE EPROM PROGRAMMER
                00110 ;       Tom Moffat, 19/12/82
                00120
0400            00130         DEFR    16
0E00            00140         ORG     0E00
                00150
0E00 010004     00160         LD      BC,400  ;CLEAR THE SCREEN
0E03 2100F0     00170 START   LD      HL,0F000
0E06 3620       00180 CLR     LD      (HL),20
0E08 23         00190         INC     HL
0E09 0B         00200         DEC     BC
0E0A 78         00210         LD      A,B
0E0B B1         00220         OR      C
0E0C 20F8       00230         JR      NZ,CLR
                00240
                00250 ;Enter start and finish addresses.
                00260
0E0E 21240F     00270         LD      HL,MSG  ;POINT TO MESSAGES
0E11 01BDF0     00280         LD      BC,0F0BDH
0E14 CD1B0F     00290         CALL    MESS    ;SHOW TITLE
0E17 0115F1     00300         LD      BC,0F115
0E1A CD1B0F     00310         CALL    MESS    ;SHOW START ADDRESS
0E1D CDEE0E     00320         CALL    ADDR
0E20 D5         00330         PUSH    DE
0E21 0195F1     00340         LD      BC,0F195
0E24 CD1B0F     00350         CALL    MESS    ;SHOW FINISH ADDRESS
0E27 CDEE0E     00360         CALL    ADDR
0E2A 0115F2     00370         LD      BC,0F215
0E2D CD1B0F     00380         CALL    MESS    ;SHOW COMMAND
                00390
                00400 ;Enter command, then jump.
                00410
0E30 CD0680     00420 COM     CALL    0806    ;GET KEY
0E33 FE10       00430         CP      10
0E35 2819       00440         JR      Z,PROG
0E37 FE12       00450         CP      12
0E39 2826       00460         JR      Z,READ
0E3B FE13       00470         CP      13
0E3D 2831       00480         JR      Z,STEP
0E3F FE14       00490         CP      14
0E41 283B       00500         JR      Z,TEST
0E43 FE16       00510         CP      16
0E45 2849       00520         JR      Z,VRFY
0E47 FE03       00530         CP      3
0E49 20E5       00540         JR      NZ,COM
0E4B 011F02     00550         LD      BC,21FH
0E4E 18B3       00560         JR      START
                00570
                00580 ;PROGram from memory to EPROM.
                00590
0E50 21000F     00600 PROG    LD      HL,PROGM
0E53 3E0F       00610         LD      A,0FH   ;SET PIO FOR OUTPUT
0E55 CD190F     00620         CALL    INIT+2
0E58 E1         00630         POP     HL
0E59 7E         00640 PROG1   LD      A,(HL)  ;GET BYTE FROM MEMORY
0E5A D300       00650         OUT     (0),A   ;SEND IT TO EPROM
0E5C CDB10E     00660         CALL    SHODL   ;SHOW ADDR THEN DELAY
0E5F 18F8       00670         JR      PROG1
                00680
                00690 ;READ from EPROM to memory.
                00700
0E61 21860F     00710 READ    LD      HL,READM
0E64 CD170F     00720         CALL    INIT
0E67 E1         00730         POP     HL
0E68 DB00       00740 READ1   IN      A,(0)   ;BRING IN A BYTE
0E6A 77         00750         LD      (HL),A  ;STORE IT IN MEMORY
0E6B CDB10E     00760         CALL    SHODL
0E6E 18F8       00770         JR      READ1
                00780
                00790 ;STEP to new address.
                00800
0E70 218C0F     00810 STEP    LD      HL,STEPM
0E73 CD170F     00820         CALL    INIT
0E76 E1         00830         POP     HL
0E77 DB00       00840 STEP1   IN      A,(0)   ;FIRE TRIGGER PULSE ONLY
0E79 CDB10E     00850         CALL    SHODL
0E7C 18F9       00860         JR      STEP1
                00870
                00880 ;TEST for complete EPROM erasure.
                00890
0E7E 21920F     00900 TEST    LD      HL,TESTM
0E81 CD170F     00910         CALL    INIT
0E84 E1         00920         POP     HL
0E85 DB00       00930 TEST1   IN      A,(0)   ;GET BYTE FROM EPROM
0E87 FEFF       00940         CP      0FFH    ;IS IT ERASED?
0E89 2017       00950         JR      NZ,ERROR
0E8B CDB10E     00960         CALL    SHODL
0E8E 18F5       00970         JR      TEST1
                00980
                00990 ;VERIFY memory and EPROM are the same.
                01000
0E90 21980F     01010 VRFY    LD      HL,VRFYM
0E93 CD170F     01020         CALL    INIT
0E96 E1         01030         POP     HL
0E97 DB00       01040 VRFY1   IN      A,(0)   ;GET BYTE FROM EPROM
0E99 4E         01050         LD      C,(HL)  ;GET BYTE FROM MEMORY
0E9A B9         01060         CP      C       ;ARE THEY THE SAME?
0E9B 2005       01070         JR      NZ,ERROR
0E9D CDB10E     01080         CALL    SHODL
0EA0 18F5       01090         JR      VRFY1
                01100
                01110 ;Show an ERROR message.
                01120
0EA2 21730F     01130 ERROR   LD      HL,ERRM
0EA5 0199F2     01140         LD      BC,0F299
0EA8 CD1B0F     01150         CALL    MESS
0EAB 0607       01160         LD      B,7
0EAD CD0C80     01170         CALL    800CH   ;BEEP'
0EB0 76         01180         HALT            ;SWEAR AND HIT RESET.
                01190
                01200 ;Show HL and do time delay.
                01210
0EB1 0124F2     01220 SHODL   LD      BC,0F224;SCREEN LOCATION
0EB4 3EA0       01230         LD      A,0A0
0EB6 02         01240         LD      (BC),A  ;SHOW A WHITE SPACE
0EB7 03         01250         INC     BC
0EB8 23         01260         INC     HL      ;TO MATCH EPROM COUNTER
0EB9 7C         01270         LD      A,H
0EBA CDDB0E     01280         CALL    SHOW    ;SHOW H REG
0EBD 7D         01290         LD      A,L
0EBE CDDB0E     01300         CALL    SHOW    ;SHOW L REG
0EC1 3EA0       01310         LD      A,0A0
0EC3 02         01320         LD      (BC),A  ;SHOW A WHITE SPACE
0EC4 010810     01330         LD      BC,1000 ;55 MS TIME DELAY
0EC7 0B         01340         DEC     BC
0EC8 78         01350         LD      A,B
0EC9 B1         01360         OR      C
0ECA 20FB       01370         JR      NZ,$-3
0ECC E5         01380         PUSH    HL
0ECD ED52       01390         SBC     HL,DE
0ECF E1         01400         POP     HL
0ED0 D8         01410         RET     C       ;FINISHED?
0ED1 011F02     01420         LD      BC,21FH ;FOR PARTIAL SCREEN CLEAR
0ED4 E1         01430         POP     HL      ;CLR RET OFF STACK
0ED5 C3030E     01440         JP      START   ;FINISHED.
                01450
                01460 ;Show "A" register as a hex value.
                01470
0ED8 F5         01480 SHOW    PUSH    AF
0ED9 0F         01490         RRCA
0EDA 0F         01500         RRCA
0EDB 0F         01510         RRCA
0EDC 0F         01520         RRCA
0EDD CDE10E     01530         CALL    $+4
0EE0 F1         01540         POP     AF
0EE1 E60F       01550         AND     0FH
0EE3 C680       01560         ADD     A,80
0EE5 FEBA       01570         CP      0BAH
0EE7 3802       01580         JR      C,$+4
0EE9 C607       01590         ADD     A,7
0EEB 02         01600         LD      (BC),A
0EEC 03         01610         INC     BC
0EED C9         01620         RET
                01630
                01640 ;Enter an address, show it, and put it in DE.
                01650
0EEE CDF20E     01660 ADDR    CALL    $+4
0EF1 53         01670         LD      D,E
0EF2 CD000F     01680         CALL    KEY
0EF5 07         01690         RLCA
0EF6 07         01700         RLCA
0EF7 07         01710         RLCA
0EF8 07         01720         RLCA
0EF9 5F         01730         LD      E,A
0EFA CD000F     01740         CALL    KEY
0EFD B3         01750         OR      E
0EFE 5F         01760         LD      E,A
0EFF C9         01770         RET
                01780
                01790 ;Get a key, convert to HEX, and show it.
                01800
0F00 03         01810 KEY     INC     BC
0F01 CD0680     01820 KEY1    CALL    0806    ;KEY INPUT INTO A
0F04 02         01830         LD      (BC),A
0F05 D630       01840         SUB     30      ;CONV FROM ASCII TO HEX
0F07 38F8       01850         JR      C,KEY1  ;IF LESS THAN ZERO
0F09 FE0A       01860         CP      0AH
0F0B F8         01870         RET     M       ;IF BETWEEN 00-09
0F0C D607       01880         SUB     7
0F0E FE0A       01890         CP      0AH
0F10 38EF       01900         JR      C,KEY1  ;IF LESS THAN 0A
0F12 FE10       01910         CP      10
0F14 30EB       01920         JR      NC,KEY1 ;IF MORE THAN 0F
0F16 C9         01930         RET
                01940
                01950 ;Initialize PIO and/or show a message.
                01960
0F17 3E4F       01970 INIT    LD      A,4FH   ;SET PIO FOR INPUT
0F19 D301       01980         OUT     (1),A
0F1B 7E         01990 MESS    LD      A,(HL)
0F1C 23         02000         INC     HL
0F1D FE24       02010         CP      '$'     ;'$' = MSG TERMINATOR
0F1F C8         02020         RET     Z
0F20 02         02030         LD      (BC),A
0F21 03         02040         INC     BC
0F22 18F7       02050         JR      MESS
                02060
0F24  45 54 49 20 36 36 38 20 2D 20 4D 69              ETI 668 / MICROBEE
0F30  63 72 6F 42 65 65 20 45 70 72 6F 6D 20 50 72 6F  EPROM PROGRAMMER$
0F40  67 72 61 6D 6D 65 72 24 53 74 61 72 74 20 41 64  'Start address? $'
0F50  64 72 65 73 73 3F 20 24 46 69 6E 69 73 68 20 41  'Finish address?$'
0F60  64 64 72 65 73 73 3F 24 43 6F 6D 6D 61 6E 64 3F  'Command? $
0F70  20 20 24 23 25 5C 26 40 20 45 52 52 4F 52 21 24  '#%\&@ ERROR!$'
                02130
                02140 ;Command labels, reverse video.
                02150
0F80 A0D0       02160 PROGM   DEFW    0D0A0   ; P
0F82 D2CF       02170         DEFW    0CFD2   ;RO
0F84 C724       02180         DEFW    24C7    ;G$
0F86 A0D2       02190 READM   DEFW    0D2A0   ; R
0F88 C5C1       02200         DEFW    0C1C5   ;EA
0F8A C424       02210         DEFW    24C4    ;D$
0F8C A0D3       02220 STEPM   DEFW    0D3A0   ; S
0F8E 04C5       02230         DEFW    0C5D4   ;TE
0F90 D024       02240         DEFW    24D0    ;P$
0F92 A0D4       02250 TESTM   DEFW    0D4A0   ; T
0F94 C5D3       02260         DEFW    0D3C5   ;ES
0F96 D424       02270         DEFW    24D4    ;T$
0F98 A0D6       02280 VRFYM   DEFW    0D6A0   ; V
0F9A D2C6       02290         DEFW    0C6D2   ;RF
0F9C D924       02300         DEFW    24D9    ;Y$
                02310
0000            02320         END
00000 Total errors

KEY1    0F01    KEY     0F00    SHOW    0ED8    ERRM    0F73
VRFY1   0E97    VRFYM   0F98    ERROR   0EA2    TEST1   0E85
TESTM   0F92    STEP1   0E77    STEPM   0F8C    READ1   0E68
READM   0F86    SHODL   0EB1    PROG1   0E59    INIT    0F17
PROGM   0F80    VRFY    0E90    TEST    0E7E    STEP    0E70
READ    0E61    PROG    0E50    COM     0E30    ADDR    0EEE
MESS    0F1B    MSG     0F24    CLR     0E06    START   0E03
```

IDEAS FOR EXPERIMENTERS

These pages are intended primarily as a source of ideas. As far as reasonably possible all material has been checked for feasibility, component availability etc, but the circuits have not necessarily been built and tested in our laboratory. Because of the nature of the information in this section we cannot enter into any correspondence about any of the circuits, nor can we produce constructional details.



Cheap high voltage, low current dc-to-dc inverter

Aleç Phillips of Myrtleford Victoria designed this circuit, without a special inverter transformer, when he needed a high dc voltage from a low dc voltage supply. It cost him about $7.

The 555 IC drives Q1 and Q2 alternately, Q1 charging via the transformer and Q2 discharging C4 into the transformer. C5 reduces power consumption and increases the output voltage. The output is fed into a voltage doubler and, with a 15 Vdc supply, the output can exceed 600 V. D1 and D2 must be 1 kV, 1 A diodes.

The transformer is a 12.6-0-12.6 V, 150 mA type. The oscillator drives the centre tap of the primary low voltage winding and the output is from the 240 V end.

Q1 and Q2 must be on a heatsink of moderate size.

If higher output voltages are required, just add more voltage doublers, but obviously it will handle a smaller load on the output. The circuit will operate at input voltages ranging from 5 to 16 volts.

Spotlamp dimmer

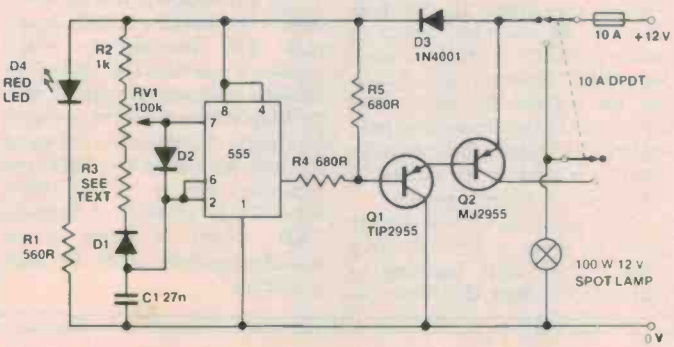
If you're a hunter or a farmer and you've been out walking at night then you'll understand the problem that **Alec Phillips of Myrtleford Victoria** had.

I use a 12 V motorcycle battery and a 100 W spotlamp when I'm out hunting at night but it's often happened that the light starts to fade just when I'm sighting up on the last target. The battery doesn't have enough storage capacity to let me shoot that rabbit or fox, skin them, clean them and find my way home. I didn't want to carry a larger battery so I found the answer with this simple circuit which costs about $12 to set up.

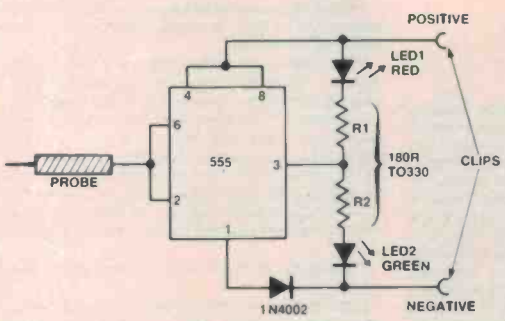
The 555 oscillator has a variable mark/space ratio by means of the 100k linear pot RV1. R4 limits the load on the oscillator and the base current to Q2. D3 is for reverse battery protection of the oscillator. The DPDT switch must be rated at 10A, 12 Vdc.

Q1 and Q2 are mounted and insulated on a 10.2 mm x 7.6 mm (4" x 3") finned black aluminium heatsink which I bolted on to the circuit control box. As Q2 gets hotter than Q1 I found it best to mount Q1 at the top and Q2 at the bottom of the heatsink.

Operation is simple once R3 is chosen to suit your light requirement for walking. When the target is seen, turn the control to full on or switch to direct battery which is brightest, then the lamp may be dimmed again for walking or skinning.



Because the power to the lamp is pulsed at a high frequency the light doesn't flicker and A.H. capacity is conserved.



Positive-negative probe

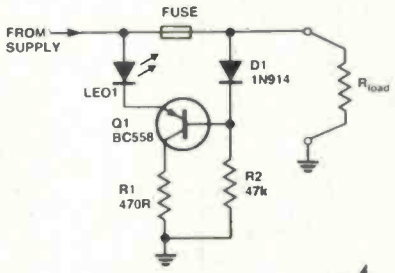
This circuit, which acts as a simple substitute for a voltmeter, was designed by **David Pye of Happy Valley SA**.

I've found in many cases that all I wanted to know was whether the reading was positive or negative. This is particularly useful in car or motorcycle electrical repairs and, as the unit can be made extremely small, it will fit in any tool kit.

It will fit in a small plastic pill container, operate on any voltage between 5 V and 15 V and is quite cheap as it only requires a few components.

When the positive and negative clips are connected to the circuit both LEDs will light. Then when the probe touches a positive point the green LED is extinguished, leaving the red LED on, signifying positive. Touching the probe to a negative point extinguishes the red, leaving the green LED on. The 1N4002 is a protective diode for reverse polarity.

IDEA OF THE MONTH



Idea of the Month

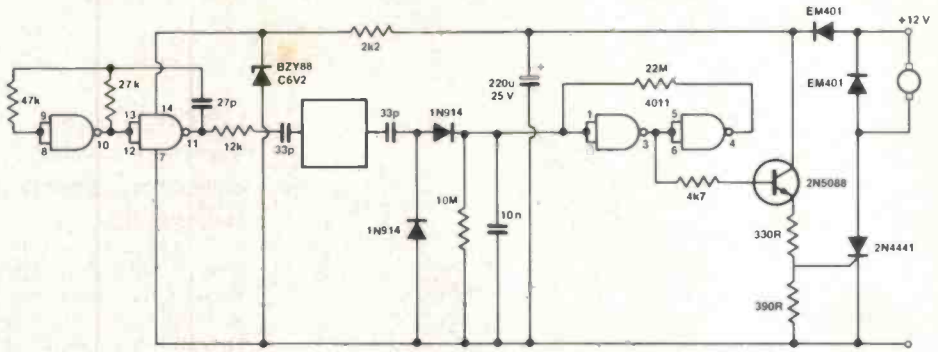
Blown fuse indicator

John Beaver, Concord NSW.

Fuses are probably the handiest tool in electronics in that for an outlay of cents they can save hundreds of dollars worth of equipment. When a fuse blows it is usually obvious as the equipment it supplies stops working, sometimes however this is not always the case. If the fuse supplies, for example, power to brake lights in a vehicle or even long delay timer circuits it may not be noticed for days. This circuit will give immediate indication of a blown fuse whether there is a load on the circuit or not as long as there is power.

On a nominal 12 volt supply there is about a 1.7 volt drop across the LED leaving a potential of about 10.3 V on the emitter of Q1. With the fuse intact there is a potential at the base (via fuse and D1) of about 11 V which holds Q1 off. If, however, the fuse blows, power is removed from the anode of D1 therefore allowing current to flow from the base of Q1 through R2 turning on the LED.

The advantage of this circuit is that in the standby mode it draws only 255 microamps, which makes it particularly useful in battery operated circuits. It may be adapted for different voltages by simply changing the values of R1 and R2 using the following formula: R1 = (Vs-2)*100/2, R2 = (Vs-2)*10000/2. (A flashing LED, which is more of an attention-getter, could be used for LED1.)



Touch motor control

L.W. Brown of Burwood Vic. designed this circuit of a touch switch suitable for operating 12 Vdc motors. He says that an excellent use for it would be to mount the touch switch on a shop window, allowing the movement of a display via a car electric fan motor.

An oscillator drives a touch plate stuck to the inside of a glass window. Anything capacitively grounding the 50 mm diameter touch plate causes the Schmitt trigger to turn on the SCR. The 10n capacitor provides several seconds extra operation once the touch plate has been released. As the SCR will latch on with a dc supply, an unregulated, unfiltered supply should be used. A suitable supply would be the A&R Chargette which is double insulated and very safe.

For intermittent operation no heatsink is required and because of this the entire circuit will be smaller than the touch plate. The small size allows the whole switch to be mounted in a sealed plastic box for protection from environmental humidity. The double insulated power supply could enable the system to operate in hazardous locations.

'IDEA OF THE MONTH' CONTEST

NEW PRIZE! WORTH $90!

COUPON

Cut out and send to: **Scope/ETI 'Idea of the Month' Contest, ETI Magazine, 15 Boundary St, Rushcutters Bay NSW 2011.**

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

* Breach of copyright is now a criminal offence.

Title of idea .....

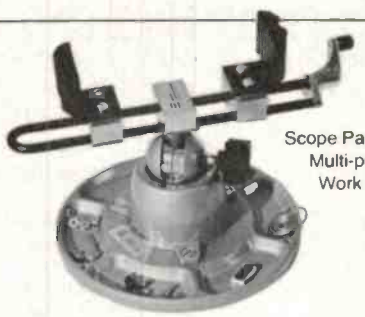
Signature .....

Name .....

Date .....

Address .....

..... Postcode .....



Scope Panavise Multi-purpose Work Centre.

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

RULES

This contest is open to all persons normally resident in Australia with the exception of members of the staff of Scope Laboratories, Murray Publishing, Offset Alpine, Australian Consolidated Press and/or associated companies.

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

The winning entry will be judged by the Editor of ETI, whose decision will be final. No correspondence can be entered into regarding the decision.

Winner will be advised by telegram the same day the result is declared. The name of the winner, together with the winning idea, will be published in the next possible issue of ETI.

Contestants must enter their names and address where indicated on each entry form. Photostats or clearly written copies will be accepted but if sending copies you must cut out and include with each entry the month and page number from the bottom of the page of the contest. In other words you can send in multiple entries but you will need extra copies of the magazine so that you send an original page number with each entry.

This contest is invalid in states where local laws prohibit entries.

Entrants must sign the declaration on the coupon that they have read the above rules and agree to abide by their conditions.

1984 IN 1983

The one-chip microprocessor started it almost 10 years ago. The concept of the low-cost micro has affected the world profoundly since then. It arrived a year early. Now, in 1983 – a year early some might say we have the mechanical equivalent to the microprocessor – the low cost micro-robot.

"Robots" have been around for quite a while now (so were computers before the micro) but they will change in '83. Jaycar Cybernetics Division has secured Australian marketing rights for the Genesis range of robots manufactured by Powertran of the U.K. Powertran's engineering staff have made a prodigious effort to produce robots at a cost which brings them into the R&D scope of CAE's, Universities, commercial organisations and even the dedicated Hobby Robotics individual.

The entire range of Powertran Robotic equipment will be sold and serviced by Jaycar Cybernetics division in Australia. Watch this space next month for further details of this extremely exciting development.

SOMETIMES THINGS AREN'T WHAT THEY SEEM. . . . . .

OK so you have had that high quality cassette deck for some time now. You were thinking of updating to one of those fancy 3-head microprocessor decks but – well they ARE expensive!

Why not give your current deck a new lease on life?

If your deck is more than 3 years old and has had a bit of work its quite possible that the record/replay head is worn. This can lead to poor H.F. performance. Or it may have never been any good in the first place. Or you may want better performance than the head in your car cassette player can give.

Jaycar now stocks replacement very high quality cassette deck heads to suit most machines – especially Japanese. They are made in the U.K. by MONOLITH.

Amazingly most cassette deck heads are standard fittings (EIAJ). So even if you want to just refurbish that cheap player that you use to load programs into your computer Jaycar has the replacement head.

C21RPS18	Mono record/playback	$14.95
B24-02	Stereo record/playback	$17.95
B24-07	Stereo record/playback for use with Dolby	$24.95
C42RPH04	Stereo record/playback glass ferrite faced	$36.50
C21ES18	Mono or stereo erase	$7.95

(All record/playback have mounting hole centres on 17mm pitch and 12.5mm from face of head)

SINCLAIR ZX-81 COMPUTER SOUND GENERATOR

Make amazing sound effects with your Sinclair Computer.

- The ZON X-81 SOUND UNIT is completely self-contained and especially designed for use with the ZX-81. It just plugs in – no dismantling or soldering.
- No power pack, batteries, leads or other extras.
- Manual Volume Control on panel – ample volume from built-in loudspeaker.
- Standard ZX-81 – 16K RAM pack or printer can be plugged into ZON X-81 Sound Unit without affecting normal ZX-81 operation.
- Huge range of possible sounds for games or: Music, Helicopters, Sci-Fi, Space Invaders, Explosions, Gun-Shots, Drums, Planes, Lasers, Organs, Bells, Tunes, Chords etc., or whatever you devise!
- Uses 3-channel sound chip giving programme control of pitch, volume of tones and noise, all with envelope control.
- Easily added to existing games or programmes using a few simple "BASIC" lines.
- FULL instructions with many examples of how to obtain effects and the programmes, supplied.
- Extension card at base of unit allows further use of Sinclair Expansion Card.

$69.50

GREAT ADD-ON

CLEF ELECTRONIC MUSIC

MICROSYNTH

COMPACT MUSIC SYNTHESIZER

Equally suited to home, studio or stage use, the Microsynth has resulted from an extensive re-think of what is required from a synthesiser. Its compact and economic design achieves high performance at low cost out sacrificing versatility or musical stability.

A highly efficient switched routing system for signals and/or control voltages is capable of rapid operation for live work, yet unlike other small synthesisers does not restrict the possibilities for complex sound creation. Despite its small size, the Microsynth can produce startlingly rich sounds owing to the number of waveforms available, together with the sub-octave voices. It is capable of advanced effects such as Ring Modulation as well as rhythmic "staircase" or random patterns.

Operates in two modes depending on the configuration of the second oscillator (VCO2), which can either run at audio frequencies or as a voltage controlled low frequency oscillator (LFO). In audio mode, VCO2 will track VCO1 perfectly over its entire range. A Thumbwheel allows manual control of oscillator pitch or filter cut-off frequency, depth of LFO modulation, etc., and internal power amplification will drive headphones or a monitor loudspeaker.

SPECIFICATIONS (BRIEF)

* Keyboard – 2½ octaves (30 notes) may be stepped through 5 octave range from 16' to 1' using the "Range" switch * VCO1 – 10Hz to 10kHz, triangle output to VCA, ramp and square outputs to VCF * VCO2/LFO – VCO mode 10Hz to 10kHz. LFO mode 0.1Hz to 30Hz. * Sub octaves – 2 divide-by-2 * Noise – white noise source with level control. * Envelope – attack and release times variable 0 to 10 seconds * Retrigger – causes the envelope shaper to retrigger itself with a repeat time equal to the sum of the attack and release times. "Sustain" operates in 3 modes, manual, auto and hold. * VCF – state variable filter with manual control of roll-off frequency. * VCA – controls output volume of synthesiser * Sample and Hold – analogue memory samples instantaneous output voltage from VCO2/LFO each time envelope ends. * Sweep * Thumbwheel – Manual level control * Power amp – output 2 watts into 8 ohms plus headphone socket * Sequencer socket * Size: 19½" x 14" x 5½". Weight: 10lb. Power: 240V AC 5W.

TOP VALUE **$399**

BAND-BOX

LIVE PERFORMANCE – Feed in, store, and play complete Music Pad of around 60–100 Backing Scores up to a total of approximately 3,000 Chord changes, each up to eight Beats in length, on more than 120 different chords.

Program Intros, Chorus Repeats, Codas, Key changes and modulations on single or multi-tune sequences. Use simple Playback procedures for live performance, including optional foot operated controls.

PRACTICE SOLOISTS – Instrumental or Vocal Soloists grow to full four piece BAND performance played in any Key, Tempo, and Rhythm style for demanding practice sessions with unlimited, but controlled, Chorus repeats.

ELECTRO-MUSIC RECORDING/COMPOSITION – Full Chord sequence and Rhythm programmability for three instrumentalists enables creative Composing and Arranging for both Professional and Amateur applications.

SPECIFICATIONS (BRIEF)

* Music simulation capacity – three backing instrumentalists. Over 3,000 programmable stored chord changes. 132 different chords plus additional inversions. * Chord instrumentalist – four note chords, four waveform options, four envelope options sixteen permutations for piano, organ etc, twenty four programmable rhythm patterns. * Bass instrumentalist – four voice /envelope combinations, eight rythmic figures * Drums – twenty four programmable patterns, eight tracks selecting eleven instrument sounds. Sticks, brushes & Latin American, Sequence operation up to 16 bar repetition. * Playback facilites – Keypad selection of score, display of selected score, variable tempo, switched selection of any-key, in-play changes to key, tempo and all instrument voices, rhythmic patterns and levels, bar down beat indicator, all-beat indicator, unlimited chorus repeats, Coda key to cancel repeats, automatic stop, manual instant stop, automatic reset to beginning of selected score, measures/beat selectable to match 4 drumming styles. * Composition facilites * Composition instructions * Pre-recorded scores * Musical compass – Tuning range one semitone, use alternative key for gross pitch change, Bass compass 16 notes, F1 to G2 44Hz to 104Hz, chord instruments 18 notes E3 to A4 165Hz to 440Hz, automatic chord inversion to fit compass * Percussion instruments – Bass drum, low & high tom toms, snare, drum, rim-shot, cymbal, long & short brushes, high bongo, claves, and accent for dynamics. * Operator inetrfaces – numerous * External sockets – numerous * Size: 19" x 11" x 4½" overall. Weight 11lb. Power requirements: 240V 6W.

(MASTER RYTHM KIT EXTRA) **$699**

Both Microsynth and Band-Box are in kit form.

Jaycar NUMBER 1 FOR KITS

125 YORK STREET, SYDNEY 2000
PHONE: 264 6688 TELEX: 72293

"NEVILLES CORNER"
Cnr. CARLINGFORD & PENNANT HILLS ROAD,
CARLINGFORD
PHONE: 872 4422 or 872 4444

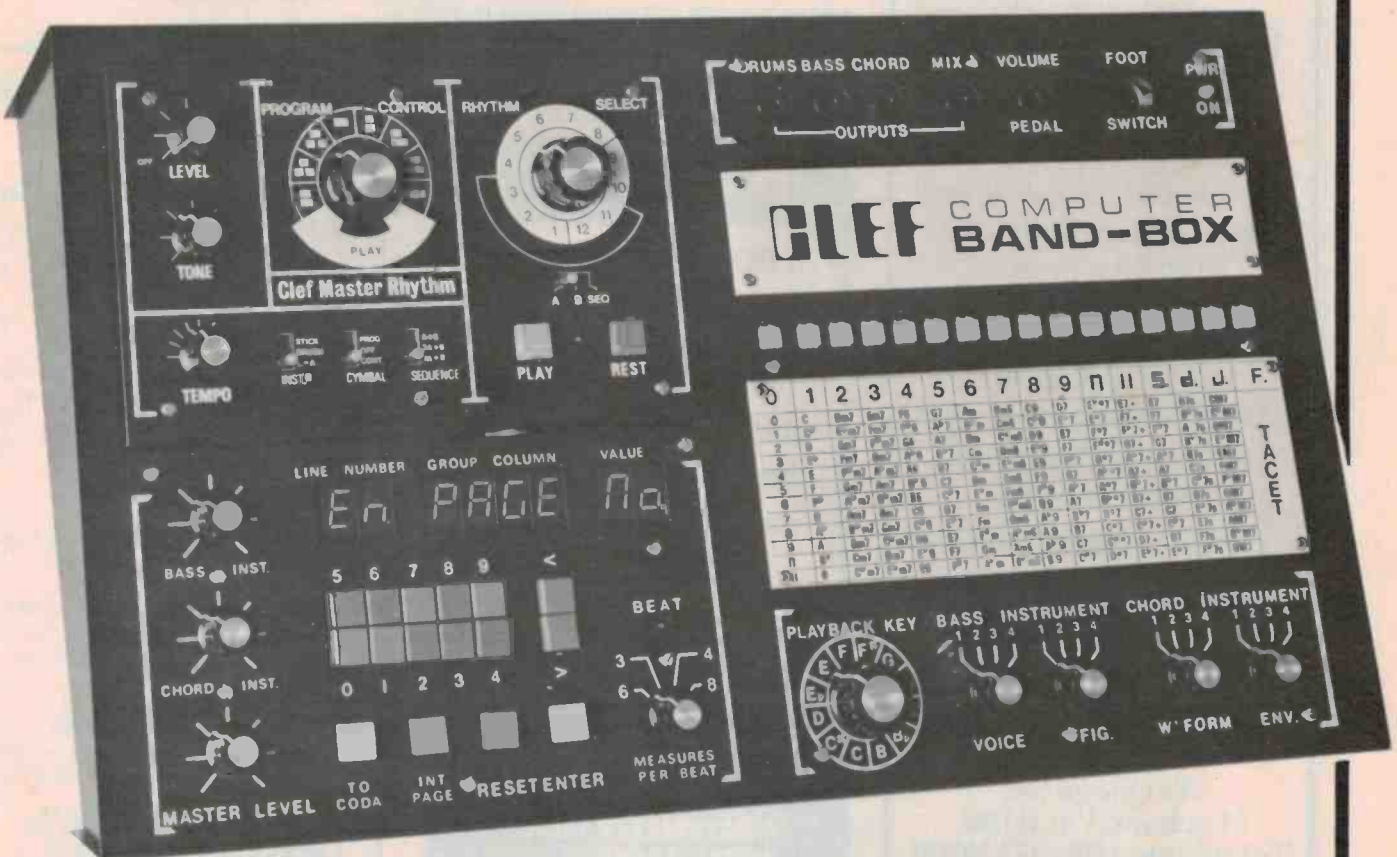
MAIL ORDERS TO: BOX K 39 HAYMARKET, SYDNEY 2000

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 up ($8.00)

NEW SHOP HOURS
Mon – Fri 8.30 to 5.30pm
Sat 8.30 to 12.00pm
Thurs night to 8.30pm

Mail Order By BANKCARD
Via Your Phone

FABULOUS 'CLEF' MICROSYNTH



AT LAST ~ THE BAND BOX

SHOPAROUND

This page is to assist readers in the continual search for components, kits, printed circuit boards and other parts for ETI projects and circuits. If you are looking for a particular item or project and it is not mentioned here, check with our advertisers.

ETI-1511 temperature controller

This simple project uses very few parts, most of which are commonly stocked items. Kits will be available from Rod Irving Electronics. Fish tank heaters, just like the one we used, cost a dozen dollars or so from aquarium suppliers and pet shops. If you're doing it all from scratch, pc boards are available from the suppliers listed on page 64 of the January issue. The CA3059/3089 is distributed by AWA **Microelectronics, Rydalmere NSW.** Stockists we know are: **Rod Irving Electronics** in Melbourne, **Radio Despatch Service** in Sydney and **Tasman Electronics (P.O. Box 110, Preston Vic. 3072).**

Suitable thermistors are widely available. Try **Radio Despatch** and **David Reid** in Sydney, **Magraths** and **Radio Parts** in Melbourne.

ETI-1512 electric fence tester

Kits for this project will be stocked by **Electronic Agencies** in Sydney and **Rod Irving Electronics** in Melbourne. All the parts are generally available from electronic component suppliers. Printed circuit boards and the Scotchcal front panel for this project will be obtainable from the suppliers listed on page 64 of the January issue.

ETI-668 EPROM burner

This project's bound to be popular amongst the thousands of MicroBee owners. Most parts are widely stocked by electronic component suppliers, except perhaps for the 74C221. To date, we have found the following firms stocking this IC: **Altronics** (Perth), **Data Parts** (Shepparton, Vic.), **Ellistronics** (Melb.), **Radio Despatch Service** (Sydney), **Rod Irving Electronics** (Melb.).

Kits should be available from **Altronics** (Perth), **Electronic Agencies** (Sydney), **Jaycar** (Sydney) and **Rod Irving Electronics** (Melb.).

Bucket brigade delay lines

For those readers wishing to experiment with audio delay lines as detailed in Ray Marston's Circuit File this month, we have found sources of bucket brigade delay line chips. **Tandy** stores stock the SAD1024, catalogue number 276-1761, for $19.95.

In Sydney, **Jaycar** stocks the TDA1022 but we couldn't find another single soul with SAD or TDA bucket brigade delay lines in stock.

JAYCAR NUMBER 1 FOR VIDEO

WE HAVE THE BIGGEST RANGE OF VIDEO ACCESSORIES!

Check out our great range of video connector cables! Ideal for video - to - video dubs!

BNC plug - BNC plug 1.5m coax Part No. VC-1 $6.95

BNC plug - PL259 1.5m coax Part No. VC-2 $6.95

PL259 – PL259 1.5m coax Part No. VC-3 $4.95

PL259 - RCA plug (metal) 1.5m of coax Part No. VC-4 $5.95

RCA plug - RCA plug (metal) 1.5 metre coax Part No. VC-5 $4.95

BNC plug - RCA plug (metal) 1.5 metre coax Part No. VC-6 $5.95

Sanyo (6 pin DIN plug) to 2.5 & 3.5 RCA plug Part No. VC-8 $8.95

(all coax 75 ohms)

PLUG ADAPTORS

PA21 PL259 plug to RCA socket $2.95

PA22 PL259 plug to BNC socket $3.95

PA23 BNC plug to RCA socket $3.95

PA24 SO239 socket to BNC plug $3.95

TV ACCESSORIES

FL-1 Coax (75 ohms) fly lead Belling Lee coax plug to B/L coax plug 1.8 metres $2.95

FL-4 As above but 4.5m long $4.95

FL-2 Coax lead 1.8m B/L line plug to B/L socket. $3.45

VIDEO SWITCHING BOX

$49.50

LOW LOSS RF SWITCHING

– Allows inputs for; VCR, Video Disc (etc); Antenna, Cable TV, Video Games and Home Computer.

WOW!!!

MORE VIDEO ACCESSORIES

VP-8 8 pin square video connector line plug $7.95

VS-8 8 pin square video line socket $7.95

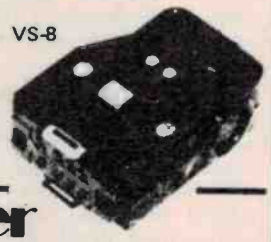
PA-25 5 pin 180 degree dubbing adaptor. Reverse pins for video use $5.95

VC-15 6 pin DIN plug to 6 pin DIN plug 1.5 metres $4.95

VC-17 5 pin DIN plug to 5 pin DIN plug (reverse pins for video) The plugs are moulded in red to indicate that it is a video connector, 1.5m $4.95

VJ.104CY Video camera cable (bulk) 2 x 75 ohm video, 2 x shielded microphone, 6 other carriers. Designed for BETA but perfectly suitable for VHS. Up to 30 metre lengths. $3.95/metre

VS-8



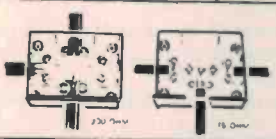
superbright LED

The average 15 cent LED has a light output of 1.8mCd (milli Candelas) at 20mA. Can you imagine a 200mCd LED? (at 20mA)? Well if you can't – buy one and find out. They are ideal for panel illumination or very low current work. (They will still give useful light at 1mA!).

Red with clear lens – 69c each
10 up only
62c each. . . . .

T.V. and F.M. splitters

Model	F Range (MHz)	Impedence (Ohms) IN	Impedence (Ohms) OUT	Output	Band	Splitting loss	Isolation	VSWR
DDF-332 U/V	50-890	300	300	2	VHF	3.5	25	1.5
					UHF	4	20	1.7
DDF-772 U/V	50-890	75	75	2	VHF	3.5	25	1.5
					UHF	4	20	1.7
DDF-774 U/V	50-890	75	75	4	VHF	6.7	30	1.4
					UHV	7.6	22	1.8



75 ohm 2 way $4.95
75 ohm 4 way $6.95
300 ohm 2 way $3.95

Video Enhancer

NOT A KIT – BUILT AND TESTED. . . .

$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 4 VCR's from one VCR input.

NEW EA Wide-band AM Tuner

FANTASTIC VALUE AT ONLY **$249**

Australia is one of the few countries in the world where wideband AM is transmitted. In fact a good quality AM signal can be much better than its FM counterpart!! Anyone who has suffered from FM multi-path distortion will know what we mean. The Playmaster AM tuner is a true broad-bandwidth superhet design. Once again, the Jaycar kit is a high quality approach. The Jaycar kit provides all components to complete the project INCLUDING a completely pre-punched cabinet.

magnificent!

Jaycar NUMBER 1 FOR KITS

125 YORK STREET, SYDNEY 2000
PHONE: 264 6688 TELEX: 72293

"NEVILLES CORNER"
Cnr. CARLINGFORD & PENNANT HILLS ROAD,
CARLINGFORD
PHONE: 872 4422 or 872 4444

MAIL ORDERS TO: 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 ($6.80)
$100 up ($8.00)

NEW SHOP HOURS
Mon – Fri 8.30 to 5.30pm
Sat 8.30 to 12.00pm
Thurs night to 8.30pm

Mail Order By BANKCARD Via Your Phone

Communications test instrument does just about everything

The IFR model FM/AM-500 'Micro-Monitor' is a portable communications test instrument that can perform the wide variety of performance measurements required on communications equipment, whether it be AM, SSB or FM, anywhere between 100 kHz and 1 GHz!

The unit essentially comprises a sensitive multimode receiver and RF signal generator. Also included is an audio signal generator which can be used to modulate the RF signal generator in both AM and FM modes as well as provide an audio signal for testing.

Using this instrument you can perform transmitter tests such as deviation and percentage modulation, transmit frequency and frequency error. You can perform receiver performance tests such as sensitivity (SINAD), bandwidth and squelch threshold and differential.

The RF and AF signal generators are both set with thumbwheel switch controls. The RF signal generator output has a calibrated attenuator, which control dominates the centre of the front panel. Frequency accuracy is quoted as 0.5 ppm but optional 0.2 ppm or 0.05 ppm master oscillators can be incorporated. Frequency can be set in 100 Hz increments. The audio oscillator can generate a fixed 1 kHz tone with the same accuracy as the master oscillator or you can set the frequency between 10 Hz and 9999.9 Hz in 0.1 Hz increments.

RF generator output is from −127 dBm to −20 dBm in 10 dB increments. An 11 dB range continuous vernier is included. AF generator output is variable from 0 to 2.5 V RMS into a 150 ohm load.

The receiver (or receiver/monitor) has a sensitivity of 2 uV from 1 MHz to 1 GHz, quoted (FM, narrow) and you get a selection of six bandwidths: FM wide — 200 kHz, 80 kHz audio bandwidth; FM mid — 200 kHz, 8 kHz audio (as for the rest); FM narrow — 15 kHz; SSB — 6 kHz; AM narrow — 6 kHz; AM normal — 15 kHz.

The demodulated receiver output is available on a front panel socket for further processing or viewing on a CRO. It is possible to use the unit as a spectrum analyser. Output impedance is 600 ohms and levels are: FM — 60 mV RMS, AM — 5 mV RMS. The receiver antenna is protected and will withstand 0.25 W without damage.

The frequency error meter has a quoted accuracy of ± master osc., ±3% of full scale. The scale is marked to give readout direct in kHz in three ranges of ±10 kHz, ±3 kHz and ±1 kHz. A high resolution option is available.

The modulation meter indicates maximum of positive or negative peak modulation (AM and FM) and shows FM deviation in three ranges of 2 kHz, 6 kHz and 20 kHz. Accuracy is given as ±5% of reading, ±3% of full scale. On AM modulation you can read modulation percentage in three ranges: 20%, 60% and 200% full scale.

An optional amplifier is available to boost the RF signal generator output to +10 dBm on FM/CW or +4 dBm on AM, right across the 100 kHz to 1 GHz range. You can also get a microphone, so the unit becomes a complete transceiver!

The Micro-Monitor can be either mains or battery operated and weighs 7.2 kg without the batteries, 2.7 kg extra with the batteries. Battery life is quoted as two hours minimum. The unit can also be operated from a 12 — 14 Vdc external source.

Overall the Micro-Monitor measures 292 mm wide by 124 mm high by 363 mm deep, 457 mm deep with lid and handle.

We had the opportunity to put the IFR Micro-Monitor through its paces in the ETI lab and it proved to be very easy to use, despite its compactness. The controls and input/output sockets are well located. Setting it up to perform a particular measurement is remarkably easy — and what's more, the handbook is very clearly set out.

The Micro-Monitor can be used to test and fault find equipment like AM and FM tuners/receivers, communications receivers, scanners, MF/HF/VHF/UHF transceivers regardless of whether it be marine, land mobile, amateur or whatever. And its portability is a great asset.

A truly remarkable instrument. Such versatility doesn't come cheaply, however, but it's way ahead of the next best thing in terms of both price and versatility.

Enquiries to **Vicom International, 57 City Rd, South Melbourne Vic. 3205. (03) 62-6931.**

Full range of 'UHF-series' coaxial connectors

Over 20 PL259/SO239 UHF-series plugs, sockets and adaptors to suit the widely used RG8, RG58 and RG59 50 and 75 ohm coaxial cables are available from Benelec Pty Ltd.

Standard PL259 plugs to suit RG8, RG58 and RG59 are available, as well as a PL259 that fits the larger diameter coax and takes reducing adaptors for RG58 and RG59 (reducers are available, too).

A standard PL259 with push-on ferrule, rather than the conventional screw-on ferrule, is also stocked along with crimp termination PL259s to suit RG58 and RG59.

Apart from the standard four-point flange mount SO239 socket, Benelec stock a two-point flange type and two no-flange screw-on types. Of the latter, one is front mounting, the other a rear-mount type. In addition, a double female, 50 mm long feedthrough socket is available.

Benelec carry nine different UHF-series adaptors. The range comprises a double female adaptor, a double male type, a female-to-male right angle adaptor, a three-female T-connector, a two-female/single-male connector, a UHF-to-RCA adaptor, a UHF-to-3.5 mm plug adaptor, a UHF female-to-BNC male adaptor and a UHF male-to-BNC female adaptor. A UHF female-to-male lightning/static arrestor completes the range.

Apart from the UHF-series connectors, Benelec stock a range of type-N and BNC connectors and adaptors.

Enquiries should be directed to **Benelec Pty Ltd, P.O. Box 21, Bondi Beach NSW 2026. (02) 665-8211.**

VHF-UHF power and SWR meter

The Maldol HS460 RF power and SWR meter covers the 130 MHz to 500 MHz range and features two-meter indication.

The HS460 supercedes the HS450. Three power measuring ranges are selected by front panel push switches — 5 W, 20 W and 150 W.

The unit is fitted with N-type connectors and is meant for use on 50 ohm systems. Accuracy is quoted as within +/− 10% on both power and SWR functions.

Contact **Imark, 167 Roden St, West Melbourne Vic. 3003. (03)329-5433.**

More HF spectrum for hams!

On 16 December 1982 the 18 and 24 MHz bands, allocated at the 1979 World Administrative Radio Conference, were released for use by Australian amateurs, and more space on the 1.8 MHz, 3.5 MHz and 7 MHz bands was announced by the Minister for Communications, Mr. N.A. Brown MPQC.

From that date, the 18.068-18.168 MHz and 24.890-24.990 MHz bands will be available to Australian amateurs on a secondary basis. Existing fixed and mobile services remain the prime service in these bands until relocated.

The following frequencies should be kept clear within ±4 kHz: 18 075 kHz, then 105, 125, 128, 130, 145, 147 and 160 kHz as well as 24 900 and 24 901.4 kHz.

On the 1.8 MHz MF band, Australian amateurs have the first 25 kHz on a primary service basis now and 1825 to 1875 kHz on a secondary basis. On the 80 metre band, 3794 to 3800 kHz is allocated on a secondary basis (but keep 1 kHz away from 3794 kHz). On 40 metres, 7100 to 7300 kHz (an extra 50 kHz) is allocated on a secondary basis, the primary service being broadcasting.

These new allocations are only available to amateurs holding the 'full' ticket.

Hope is still held by the Wireless Institute of Australia that 50-50.1 MHz operation can be approved (five years too late to be of significant value — Ed.).

Go to Gosford!

Do not pass go, but take $200 with you to the Central Coast Amateur Radio Club Field Day, the largest annual amateur event in Australia, to be held on Sunday, 20th February.

You'll need the $200 to buy up all those goodies on display or to splurge on the 'disposals'.

The 'Gosford Field Day' attracts 600 — 800 attendees every year. What's to amuse them? Well, there's always the all-band open scramble where contestants attempt to contact as many other stations as possible within a short space of time. There are the direction-finding transmitter hunts — foxhunts — plus quiz competitions, etc.

Then there's all the 'eyeballs'. The Field Day is the chance to make face-to-face contact with those voices at the other end or renew old acquaintances.

The commerical displays are popular for ogling the latest equipment, the disposals stall is popular for getting rid of your junk and buying someone else's.

The action starts at 8 am. You can take your own picnic lunch or buy food from the take-away stand at the venue. Talking of venue, it's at the Gosford Showground, Showground Rd, Gosford NSW, on the western side of the railway line. Registration is a few dollars, and this includes free morning and afternoon tea.

Go to Gosford!

Mattel to market 4K home computer and new Intellivision keyboard unit

Mattel Electronics will shortly begin distributing an expandable 4K home computer, dubbed the 'Aquarius', and will replace their Intellivision video game computer keyboard add-on with a lower-priced unit later this year.

The Aquarius keyboard console will retail in the States for less than US$200. It will run a CP/M operating system and 8K Microsoft BASIC in ROM. The 4K RAM is expandable to 52K through the addition of 16K add-on cards.

Video display, either direct to a monitor or via RF output to a TV set, is 24 lines of 40 characters with a resolution of 320 x 192 pixels and it can generate 16 colours.

Mattel will offer Logo in educational software, as well as entertainment (read 'games'), home management and self improvement packages.

Peripherals for the Aquarius will include a 40-column thermal printer, a data recorder and two hand controllers for games.

Following a marked lack of success with their Intellivision video games centre computer keyboard add-on, Mattel are planning to introduce a remake of this unit to retail for US$150 or less. Mattel conceded last year that they had overpriced the Intellivision keyboard unit which was on the market for around US$600.

It seems that Radofin Far East of Hong Kong will be making both the Aquarius keyboard console and the new Intellivision keyboard unit. At present, Radofin are mainly known for their marketing and brand-name manufacturing of Teletext decoders.

New generation miniature ▲ personal computer

Emona Enterprises Pty Ltd has been appointed exclusive distributor for the MPF-II 'Micro-Professor' personal computer, manufactured by Multitech Industrial Corporation.

The MPF-II is not an Apple II copy, although it has most of its features and more, such as 64K RAM, 16K ROM, PAL colour and printer interface incorporated. BASIC commands are available both in standard multikey entry and in single key entry.

With the addition of several optional software cartridges, the MPF-II also operates in Assembly, Pascal and FORTH. The MPF-II, which is compatible to the Apple II BASIC, can also use most of the existing programs for the Apple II.

This home computer can be used for education, home and business management, entertainment and learning programming languages. It can be connected to colour home TV sets and the display can be in either text or low or high resolution graphics.

Options include video display, printer, software cassettes and cartridges, remote control pad, RS232C network interface board, floppy disk drive and Chinese Character Controller.

For further details contact **Emona Enterprises Pty Ltd, CBC Bank Building, 661 George St, Haymarket, Sydney NSW 2000. (02)212-4815.**

S100 colour video board

What seems to be the first locally available S100 colour video board has only recently been released by Queensland-based manufacturer, Technitron, and for the host of features it provides, the makers have dubbed it the 'Provida'.

The board provides a memory-mapped colour video display giving seven colour RGB output and features either an 80 x 24 or a 64 x 16 screen format.

Not only that, but you get 128 programmable characters or 128 x 256 high resolution graphics. The board includes a 2K RAM page buffer, a 2K RAM function block and separate 2K RAM for the 128 programmable characters. The dual character set is generated by an 8K PROM.

The board can generate flashing and inverse characters, half-intensity characters and can do underlining as well as mirror reverse characters.

Technitron claim the board provides jitter-free video and with programmable TV sync it is suitable for use on other video standards (i.e: overseas).

The Provida is constructed on a quality fibreglass through-hole plated board and costs just $220 (plus tax). Further details from **Technitron, 84 Targo St, Bundaberg Qld 4670. (071) 72-5606.**

Test Instrument Showcase

Below are illustrated just some of the extensive range of test and measuring instruments available from Emona Enterprises. All are quality instruments and are priced very reasonably. You are invited to contact us for full details on our range.

TRIGGERING OSCILLOSCOPE GOS-2310
Sensitivity: 5mV to 5V/div
Bandwidth: DC or 2Hz to 10MHz
Sweep Rate: 10ms to 0.1μs/div
Trigger Mode: Auto, Norm, EXT.
C.R.T.: 75 mm

DIGITAL LCR METER LCR-2430
- 5-DIGIT FOR RLC 4-DIGIT FOR D & Q
- Test Range
  R: 1m OHM — 99.999M OHM
  L: 0.2mH — 9999.9H
  C: 0.1pF — 99999UF
  D: 0.0001 — 9.999
  Q: 0.01 — 999.9
- Accuracy:
  ±0.2% (RLC)
  ±0.001 (D)
  ±0.01 (Q)

FREQUENCY COUNTER GFC-8055F
Frequency Range: 1Hz — 550MHz 3 ranges
Sensitivity:
A: 1Hz — 60MHz ≤10mV
60MHz — 100MHz ≤20mV
B: 50MHz — 250MHz ≤30mV
250MHz — 500MHz ≤100mV
500MHz — 550MHz ≤150mV
Display system: 8 digit LED display

GW

UNIVERSAL COUNTER GUC2010
Frequency range: 0 to 100MHz (CHA)
Period range: 5Hz to 25MHz (CHA)
Count capacity: 99999999 (CHA)
Ratio range:
f1: 5Hz to 100MHz (CHA)
f2: 5Hz to 25MHz (HB)
Time Interval Range: 0.1nS to 10S
Sensitivity: ≤35mV

DIGITAL MULTIMETERS (TRUE R.M.S.) GDM8035T
Functions: DCV, ACV, DCA, ACA, OHM
Range:
DCV 200mV, 2/20/200/1200V, 0.1%+1dg
ACV 200mV, 2/20/200/1200V, 0.5% +1dg (TRUE RMS)
DCA 200μA/2/20/200mA/2A 02%+1dg, 20A 0.5%+1dg
ACA 200μA/2/20/200mA/2A/20A 0.5% +1dg (TRUE RMS)
OHM 200ohm/2/20/200K/2M 20Mohm 0.2% +1dg
Display: 3½ digits, 0.5" LED

FUNCTION GENERATOR GFG-8015F
Frequency Range: 0.2Hz to 2MHz
Wave Forms: Sine, triangle, square, pulse and ramp
Output Level: >20V p-p open circuit
>10V p-p into 50 ohm.
v.c.f.; 0 to 10V (1000:1)

FREQUENCY COUNTER GFC8100F
Frequency range: 1Hz — 1GHz 3 ranges
Sensitivity:
A: 10Hz — 60MHz ≤10mV
60MHz — 100MHz ≤20mV
B: 10MHz — 300MHz ≤20mV
300MHz — 600MHz ≤30mV
600MHz — 1GHz ≤50mV
Display system: 8-digit LED display

DIGITAL DISPLAY FUNCTION GENERATOR GFG-8016D
Frequency Range: 0.2Hz to 2MHz
Wave Forms: Sine, triangle, square, pulse and ramp.
Output Level: >20V p-p open circuit
>10V p-p into 50 ohm
V.C.F.: 0 to 10V (1000:1)
Frequency Counter: 6-digit display

GDM-801F
- High Resolution 0.01m ohm
- Four-Terminal Method
- HI-LO Setable With Comparator
- Test Range 20m ohm to 20K ohm 7 Ranges
- Accuracy:
  0.2% + 4 digit
  0.2% + 6 digit (20mΩ range)

PLUS Hand Held, Digital and Analogue Multimeters

The 'Escort' range
The five model range incorporate many advanced design features at low prices.
- Single centre of push to free switch saves time.
- HI-Lo Ohm power
- 10 A DC/AC current capability
- Instant continuity function (Models EDM 301, EDM 302 only)
- Easy to read
- Superior reliability
- Overload protection
- Easy to carry and use.

Illustrated EDM 302
$94 plus S/T

Akigawa L224
SPECIFICATIONS
Measuring Range
ACV: 0 — 10, 50, 250, 1000 (V)
DCV: 0 — 0.25, 2.5, 10, 50, 250, 1000 (V)
DCA: 0 — 50μ, 1m, 25m, 250m (A), 10A at extra jack
ACA: 0 — 1m, 25m, 250m (A), 10A at extra jack
OHM: Rx1, Rx10, Rx100, Rx1K (0.5 — 5M ohms)
dB: −20 — +62 dBm
Load Current: 0 — 75μ, 750μ, 7.5m, 75m (A)
Battery Test: 1.5V (100mA), 9V (10mA)
Temperature Range: +20°C — +200°C
Sensitivity:
ACV: 8,000 ohm/V
DCV: 20,000 ohm/V

$32 + Sales Tax
incl. case

Akigawa L300B

$39
+ Sales Tax
Probe $29
+ Sales Tax

SPECIFICATIONS
Measuring Range
AC Voltage (ACV): 0 — 12, 60, 300, 1200 (V)
DC Voltage (DCV: 0 — 0.3, 3, 12, 60, 300, 1200 (V)
DC Current (DCA): 0 — 60μ, 6m, 120m, 12 (A)
Resistance (OHM): 0 — 4K (R x 1), 40K (R x 10), 400K (R x 100), 4M (R x 1K) (OHM)
Load Current (LI): 0 — 75μ, 750μ, 7.5m 75m (A)
Temperature (TEMP): −20 — +250 degrees C., 0 — 500 degrees
Continuity (CONT): Continuity test by built-in buzzer
Battery Test: BAD/?/GOOD Indication for 1.5V & 9V cells
(BATT TEST) "BAD" range . . . 0 — 60% of rated voltage, "?" range . . . 60 — 73% of rated voltage
"GOOD" range . . . 73 — 107% of rated voltage
Sensitivity
DC Voltage: 20K-ohm/Volt
AC Voltage: 10K-ohm/Volt
Accuracy: ±3% on DC ranges and ±4% on AC ranges of full scale value. ±3% of arc length.
Power Requirements: Two Penlite (AA) Cells
Dimensions & Weight:
160H x 105W x 30D (mm)
6¼"H x 4⅛"W x 1-3/16"D
320 grams
Accessory Included: A pair of banana type test leads
Optional Accessory: Thermometer Probe for temperature measurment (Model PC-250)

Escort Multimeters from $59 + S/T

Analogue Multimeters from $10.50 + S/T

Solderless Breadboards

A comprehensive range of solderless breadboards, breadboard modules, terminal and distribution strips.
Send for an illustrated brochure.

Analogue & Digital Circuit Evaluators

For faster and easier prototyping of all types of electronic circuits.
Each evaluator has 1680 solderless, plug-in tie points, DC power supply with short-circuit protection, sine, square, triangle waveform generator (1 Hz — 100 KHz).

Model AT-101

Model AT-101
Special Features:
Voltage Meter: 30V Full Scale
Current Meter: 100μA full scale
Potentiometer: 1KΩ 1pc,
100KΩ 1pc

Model AT-102
Special Features:
DVM: 3½ digits, 4 ranges, 200mV-200V full scale.
LED display: 8 bits LED display, 2 digits LED display with BCD to 7 segments decoder.

A-TEK

Model AT-102

EMONA ENTERPRISES PTY LTD
CBC Bank Bldg, 661 George St.,
Haymarket, Sydney NSW 2000
Tel: (02) 212 4815, (02) 211 3038

NSW: Radio Despatch Service 211 0191. Emtronics 211 0531. David Reid Electronics 29 6601. Pre Pack Electronics 569 9797. Martin de Launay (Wollongong) 28 6020. (Newcastle) 2 4741. VIC: Radio Parts 329 7888. SA: Int. Communications Systems P/L 47 3688. WA: Hinco Engineering P/L 380 4477. ACT: Electronic Components P/L 80 4654. TAS: D&I Agencies 23 2842.

HP-IL peripherals

Three new HP-IL peripherals, an 80-column impact printer, a video interface and a general-purpose input/output interface, bring added capabilities to Hewlett-Packard Interface Loop (HP-IL) systems.

Not only do they enhance the versatility of HP handheld computers, but they provide a more complete peripheral base for HP-IL instruments and future Hewlett-Packard portable computers.

HP's first full-size impact printer, the HP 82905B, produces dot-mode graphics and retails for $1017 (tax free). It features 80 characters per second bi-directional operation, variable column width, five user-selectable print modes, self-diagnostics and will accept single- or multi-part paper forms.

The HP 82163B video interface, which plugs into a television or monitor, displays any combination of 96 different characters and symbols in a 32-column by 16-line format. It retails for $395.30 (tax free).

The HP 82165A HP-IL/GPIO interface links devices that contain parallel-interface ports with HP-IL systems, permitting communication between the devices and other HP-IL system components. With a recommended retail price of $395.30 (tax free), the GPIO interface is suited for connecting low-cost portable systems to mainframe computers with parallel ports.

More information can be obtained from **Hewlett-Packard, 31-41 Joseph St, Blackburn Vic. 3130. (03)89-6351.**

TRS-80 Model III upgrade

A new series of low-cost hardware/firmware upgrades offers users of the Tandy TRS-80 Model III access to CP/M software, increased RAM, full video processing and 4 MHz clock options.

DeForest Computers of Nunawading have announced a range of upgrades which give this micro all the power of a conventional CP/M computer at a fraction of the cost. There are three stages of upgrade, Compactor I, II and IV priced at $550, $945 and $595 respectively.

The Compactor units, which were developed by Hurricane Laboratories in the US, together increase the onboard RAM of the TRS-80 Model III to 112K and give the facility for full video processing with a 24 x 80 character display.

Both the Compactor I and IV systems add a resident diagnostic/debug monitor, repeating keys, beeper support and auto detect/booting operations for the best of two worlds. Incorporating full support for the TRSDOS system, the Compactor I gives all of the attendent virtues of the original CP/M 2.2 written by Digital Research Corporation. It will also run the new CP/M Version 3.

The Memory Module of the Compactor I plugs into the Z80-A CPU socket of the TRS-80 Model III. Once it has been installed the user can insert either a TRSDOS or CP/M disk and the Compactor I Detect Routine automatically determines which it is, and Boots-up the appropriate operating system.

The Compactor II replaces the CPU in the Model III with a Z80-A CPU. The replacement CPU adds 64K of dynamic RAM which can be totally addressed without recourse to bank switching. The two CPU clock rates of 2 MHz for the standard Model III and the 4 MHz given with Compactor II are software selectable.

The Compactor IV is a full feature video processor and serial interface and is simply installed within the cabinet of the Model III. Compactor IV will allow you to operate under TRSDOS or CP/M on the built-in TRS BASIC ROM. The versatility of the Compactor IV's video processor, which contains RAM, character generator ROM and video signal circuitry is extended even further with a software selectable video switch.

The range of Compactor upgrades are available from **deForest Computers, 26 Station St, Nunawading Vic. 3131. (03)877-6946.**

'Win a Microprofessor' Contest Results

There's no doubt about it, plenty of people want to learn about microprocessing and then apply that knowledge to solving practical problems, according to many of the entries we received for this contest that ran in the September '82 issue.

Some entrants wanted to learn how to use a microprocessor to control hothouse gardens, other wanted to manage home heating/cooling systems using the Microprofessor. Many said they just wanted to learn and that the Microprofessor covered so many facets of microprocessing, not just programming, that it fulfilled their needs nicely.

However, our winner, Lindsay Swadling of Surry Hills NSW, wanted the Microprofessor for a unique application. Here's his entry:

"I would like to win the Microprofessor to try to develop programs to teach my young cousin, Jim, to talk. He is seven years old, with Down's Syndrome, and lives on a property 30 miles from Coonamble. He has no access to speech therapy, which he badly needs.

"A computer is possibly the only 'voice' which has the patience to repeat the same word over and over long enough for him to learn to pronounce it. The speech synthesiser in the Microprofessor would therefore be extremely helpful in teaching him good articulation, and possibly later to write and spell."

Congratulations Lindsay! We'd like to know how it turns out.

Many thanks to all those who entered the contest and to Emona Enterprises for providing a Microprofessor, speech synthesiser and printer for the prize.

Club Call

The **Darwin micro Bee Users Group (DBUG)** can be contacted by writing to DBUG, P.O. Box 3111, Darwin NT 5794 or you can phone Felino Molina (089)82-5613 bh or (089)88-1455 ah.

The **University Computer Club** was established in 1974 on the campus of the University of Western Australia. It is situated on the second floor of the University of WA Guild Building and has its own Alpha 16 microcomputer which has had extensive software developed for it by club members. The club has recently purchased the latest 16-bit computer board using National Semiconductor's 16032 CPU and associated support devices. To find out more about the club phone (09)386-1455.

Emulogic microprocessor development system

Scientific Devices Australia has been appointed sole Australian representative for Emulogic Incorporated and has released their premier product, the ECL-3211 microprocessor development system, in Australia.

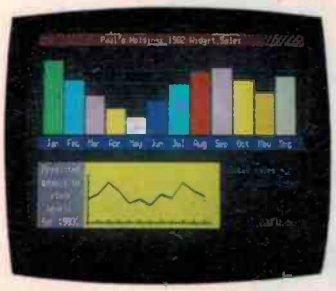
The ECL-3211 features the ability to transparently emulate any chip, any word length and any family at full speed with no reservations as to wait states, shortened stack space or lost interrupt vectors. It will not degrade target performance or require compromise or interpretation of any results obtained during emulation.

The system is based around a DEC PDP II running RTII and RSX-11M operating systems. A VT101 terminal is used so that features such as full screen based editing are provided as standard. Emulogic has added a high speed universal emulator, high speed emulation memory and complete software support from cross-assembler to symbolic debugging.

Further details are available from **Scientific Devices, 21 Jacks Rd, South Oakleigh Vic. 3167. (03)579-3622.**

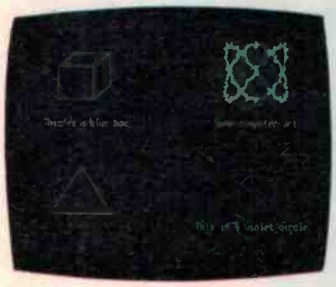
A STAR IS BORN

Business Graphics



Arcade Games

Educational Programmes



MicroBee — Australia's own educational and personal computer!

Designed and manufactured in Australia.

Over 7,000 sold

Over 2,500 in Australian schools.

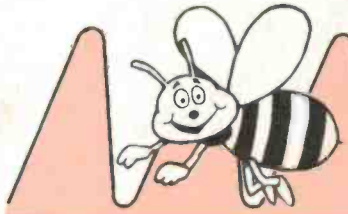
NSW EDUCATION DEPARTMENT APPROVED

MicroBee the fully expandable, cost effective computer you have come to know and love is moving ahead with COLOUR — soon to be announced.

See us at the Australian Personal Computer Show Centrepoint, Sydney, March 1983.

All enquiries to:

Applied Technology
P.O. Box 311, Hornsby, N.S.W. Phone: 487 2711



MICRO WORLD UPDATE

NEW 'PLUS' SERIES WITH EXTRA FEATURES

16K PLUS

The 16K PLUS with features such as built in music generation, 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.

32K PLUS

All of the standard features of the 16K PLUS with twice as much usable RAM. When you add the new Word Bee 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 maybe even the Tasman Turtle and just see what you and your family can now do with your home computer.

64K PLUS

The MicroBee 64K is equipped with 56K of user RAM with Battery backed continuous memory and has built-in 80 x 24 screen format as well as 64 x 16 line. All characters are upper and lower case and powerful graphics are readily available. A value packed exclusive feature of the MicroBee 64K PLUS is that it can double as an ADM3A Terminal operating in serial mode at either 300 or 1200 baud (full or half duplex). You can add a modem and use your MicroBee 64 as your personal information window to the world.

A better Bee for '83

Now with
- **BATTERY BACK-UP**
- **PARALLEL INTERFACE**
- **SELECTED CONTINUOUS MEMORY**

Coming Soon

Colour Bee Conversion
(for any MicroBee)

Bee Modem/Network

More Features . . . More Software . . . More Computer for Your Money!

ROM PACKS

WORDBEE — a full featured Wordprocessor.

Convert your MicroBee into a professional quality wordprocessor. Suitable for any 16K or 32K MicroBee. Enables the user to select either BASIC or WORDBEE/MONITOR as required.

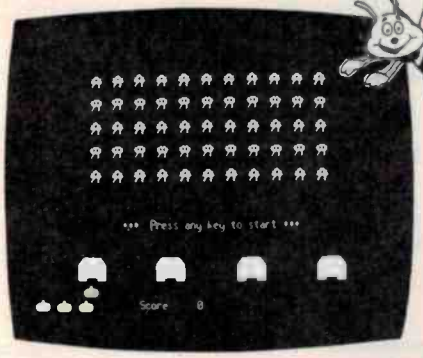
WORDBEE is friendly and easy to use, and has extensive HELP files built into the ROM. It uses the familiar control key and dot commands from WORDSTAR, the on-line help from WORDMASTER and the on-screen formatting from ELECTRIC PENCIL.

EDASM — MicroBee monitor and Z80 Editor Assembler.

This ROM pack converts your MicroBee into a combined BASIC/MACHINE CODE/ASSEMBLY LANGUAGE unit and is ideal for those who need to develop programs in machine code. Built in commands include EXAMINE and MODIFY memory, BLOCK MOVE and FILL memory, EXECUTE a program, READ and WRITE to cassette tape, SEARCH and COMPARE code and RETURN to BASIC.

NETWORK 1

By popular demand we are making this ROM available for networking to other computers over the telephone lines. Contains the software to convert any 16K/32K MicroBee into a 'DUMB TERMINAL'.



ARCADE GAMES

Ideal for parties, these action games make full use of the superb graphics and sound effects of the MicroBee. Your friends and family are set for hours of fun and excitement!

"ROBOT MAN" — A New Release.

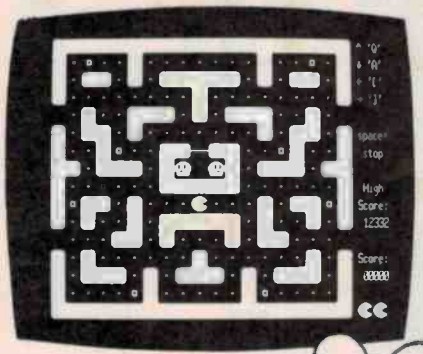
You must move about the maze eating up the power food. Watch out for the Robot Men as they are programmed to destroy you before you complete your mission!

"MICROSPACE INVADERS"

Yes the arcade favourite! This fast-moving version was written especially for the MicroBee by Tim Morris-Yates and has become one of the most popular programs yet released.

"MISSILE WARS"

Equipped with radar and ray cannons your mission is to defend your city against the attacking alien invaders. This game is fast moving and very exciting. The graphics and synchronized sound effects will really involve you in the game.



EDUCATIONAL SOFTWARE

Because the MicroBee is a recommended computer in Australian schools, considerable software is currently being written at all levels. Here are details of just a few.

EDPAK 1

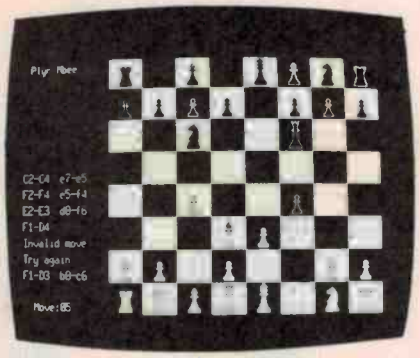
This tape demonstrates the capabilities of the MicroBee in such areas as music, French vocabulary, primary mathematics, geometry, typing drill and infants exercises. All programs are readily modified to suit various teaching applications.

EDPAK 11

Produced by popular demand, EDPAK 11 is a continuation of EDPAK 1. Subjects include drawing, infant maths, spelling drill various maths approaches and general demonstrations.

PILOT

PILOT is a very easy programming language to learn and ideal for preparing CAI (computer-aided-instruction). MicroBee PILOT supports several enhancements including full integer arithmetic.



FAMILY GAMES

"CHESS"

Match your skills against the MicroBee chess master. You can select from 1 to 6 ply and also analyse any position. A built-in 'HELP' feature enables the computer to play YOUR current move.

"CONCENTRATION"

A real family favourite for 1 to 4 players to test your memory skills. If you call one player MERLIN, the computer will play that turn so watch out!

"HOUSE OF FRANKENSTEIN." A New Release

The first adventure game for the MicroBee. Needs a 32K machine and can take weeks to resolve. Has built-in game save facility to re-load the game and resume play from your last session.

"BIORHYTHM/CALENDAR MAKER"

Ideal for parties or carnivals. Requires a serial printer. You can print BIORHYTHMS for anyone — just enter their name and birthday!

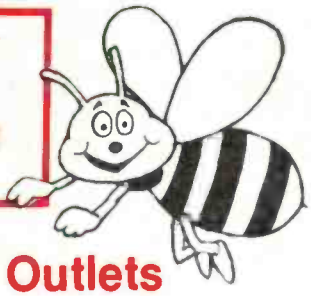
COMPUTER UTILITIES

These programs are included as enhancements of the MicroBee computer itself.

PCG TUTORIAL — ESCKEY — and DISSEM are three of them.

MicroBee

Make a BeeLine for your MicroBee Computer Shop today!



Price List

CODE	DESCRIPTION	PRICE (Inc. S/T) $
HARDWARE:		
110.017	MicroBee 16K PLUS	449.00
110.032	MicroBee 32K PLUS	549.00
110.064	MicroBee 64K PLUS	699.00
110.078	S-100 Desk Top Interface	299.00
110.090	Disk drive with controller & CP/M 2.2	799.00
110.092	Add on Disk drive	659.00
110.116	16K—16K PLUS Conversion	29.95
110.132	16K—32K PLUS Conversion	125.00
110.164	32K—64K PLUS Conversion	175.00
110.025	New MicroBee Moulded Case	25.00
120.580	S-100 Digitalker	155.00
120.274	S-100 Romblaster	165.00
110.210	Parallel Port Inc. DB 15 plug & hood	19.95
250.003	MicroBee Editor/-Assembler ROM	59.50
MONITORS:		
150.020	Kaga Denshi Green Phosphorous 30 cm	299.00
150.025	B & W Monitor (converted T.V.)	149.50
PERIPHERALS:		
110.011	Printer/Cable Interface Kit	49.95
150.030	Audio cassette tape I/O drive	39.50
110.310	C10 Data Cassette Tape	1.10
110.311	C20 Data Cassette Tape	1.20
110.312	C30 Data Cassette Tape	1.30

CODE	DESCRIPTION	PRICE (Inc. S/T) $
PRINTERS:		
150.080	Epsom MX 80 111 F/T	1213.00
150.100	Epsom MX 100 111 F/T	1555.00
SOFTWARE:		
MicroBee CASSETTES		
250.035	Graphic Games	9.95
250.036	Missile Wars	9.95
250.037	PCG Tutorials	9.95
250.020	Space Invaders	14.95
250.021	Concentration	9.95
250.022	Chess	9.95
250.023	Typing / Solitaire	9.95
250.024	Target	9.95
250.025	Lunar Lander/Hurkle	7.95
250.026	Star Shoot/Hangman	7.95
250.027	Biorhythm/Calendar	9.95
250.028	Eliza	9.95
250.029	Kids Game	9.95
250.030	Master Mind/Nim	9.95
250.031	Chase/Wumpus	9.95
250.032	Z Trek	9.95
250.041	"Esc" Key	9.95
250.042	Robot Man	14.95
250.045	House Of Frankenstein	14.95
250.046	Dissem	9.95
SOFTWARE IN ROM:		
250.003	MicroBee Editor/-Assembler	59.50
250.040	MicroBee Word Bee ROMPAK	89.50
250.007	MicroBee 5.1 Basic Upgrade	20.00
250.043	Pascal S +	299.00
250.044	Pilot	P.O.A.
250.047	Network 1	49.50
SOFTWARE DISK SYSTEM:		
	MicroBee CP/M 2.2 MicroBee Disk Basic	200.00

SOFTWARE EDUCATIONAL:

We are continuously developing a wide range of educational software cassettes for use at all levels of education.

250.038 MicroBee PILOT 14.95

250.033 Ed Pack 1 24.95

Includes: Demonstration; Star Constellations; Invasions Package; French Vocabulary; Typing Drill; Triangular; Primary Package; Computer Words; Master Mind; French Phrases.

250.034 Ed Pack 2 24.95

Includes: Demonstration No. 2; Multiplication Test; Star Maths Pack; Halving Numbers; 0 -9 + 1 (Infants); Welcome; Picture Drawing; Music Programs No 1; Subtraction Test; Spelling Drill; 0 - 7 + 3 (Infants); Division Test; Slide The Letter.

WARRANTY

Applied Technology Pty. Limited warrants that the electrical and mechanical parts of its manufactured products are free from defects in design, materials and workmanship for a period of 3 months from the date of delivery to the buyer.

(Freight must be payed both ways by Sender and is not covered by Warranty.)

Outlets

See the exciting new MicroBee 16, 32 and 64 K PLUS Series at your nearest MicroBee Computer Shop.

SYDNEY:
Applied Technology,
1a Pattison Ave. Waitara.
Phone: 487 2711.

Electronic Agencies,
117 York St. Sydney.
Phone: 29 2098.

Specialty Enterprises,
6th Floor,
104 Bathurst St. Sydney.
Phone: 267 7747.

GOSFORD:
Applied Technology,
1 Debenham Rd. West Gosford.
Phone: (043) 24 1022.

CANBERRA:
MicroBee Computer Shop,
Level 1, Cooleman Court,
Weston, ACT.

MELBOURNE:
Computerland Sth. Melbourne,
19 - 37 Albert Road,
(Cnr Kingsway & Albert Rd.),
Melbourne.
Phone: 26 6647.

Specialty Enterprises,
1st Floor,
305 Latrobe Street, Melbourne.
Phone: 67 8811.

BRISBANE:
Specialty Enterprises,
6th Floor, 246 Queen Street, Brisbane.
Phone: 229 2450.

PERTH:
Altronics
105 Stirling St, Perth.
Phone 328 1599

NEW ZEALAND
Checkpoint Computers,
36 Main Road, Tawa,
New Zealand.
Phone: (4) 32 6988.

MicroBee PHONE ORDERS

Save time and order your MicroBee direct on our Beeline number. Just give your Bankcard Number and Name. We will check stocks and get the goods on the way.

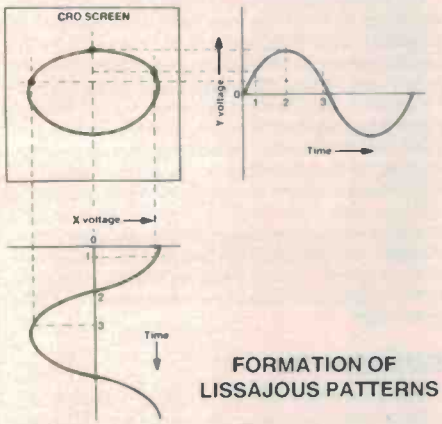
(02) 487 2711

Lissajous pattern generator

Tom Moffat
Fern Tree, Tasmania

Back in the days before frequency counters, electronics enthusiasts thought up some clever ways to measure frequency. One of the classics is 'Lissajous patterns', produced on an oscilloscope. Ever heard of them? I'll bet you can't even pronounce the word. I can't!

The technique works like this: a sinewave of known frequency is applied to the horizontal plates of an oscilloscope (the usual sawtooth timebase being disconnected), perhaps via an amplifier. The unknown frequency (sinewave) is then applied to the vertical deflection plates (perhaps via the Y amplifier). When the two frequencies have a direct integral relationship, a stable pattern will appear on the screen. If both frequencies are the same (i.e: $f_x = f_y$) and the amplitudes are equal, the figure will be a circle. If the amplitudes are different, the figure will be an ellipse.



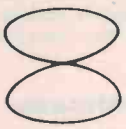
FORMATION OF LISSAJOUS PATTERNS

The two frequency sources must be stable or the pattern will roll around at a rate determined by the varying difference between the two sources.

Determining the ratio of the two frequencies from the pattern is a simple matter. Count the number of maxima on one edge of the pattern in the vertical direction, then the number of maxima on one edge of the pattern in the horizontal direction. The ratio of the two frequencies is then given by:

$$\frac{f_x}{f_y} = \frac{\text{vertical maxima}}{\text{horizontal maxima}}$$

For example, take a 'figure 8' pattern:-



$$\frac{f_x}{f_y} = \frac{2}{1}$$

Thus, f_x is twice f_y.

A commonly used standard frequency is the 50 Hz mains supply. You can calibrate an audio oscillator over a 10:1 range by tuning it for stable patterns and then counting the loops. If you already have an accurate audio oscillator you can determine an unknown frequency by tuning for a circle, the pattern developed when the frequency ratio is 1:1.

Well, where does the MicroBee come into this? This little MicroBee program *demonstrates* Lissajous patterns. You enter the ratios and the computer makes the pretty pictures.

You'll notice that as they get more complicated, they shrink. This is done to prevent the graphics routine from running out of PCG characters and bombing out of the program.

When run, the program asks for 'X-cycles' and then 'Y-cycles'. The screen then blanks and the fun starts. Try 1 for X-cycles and 3 for Y-cycles and you'll see where ABC Television's symbol came from!

```
00100 REM Lissajous Patterns 23/8/82
00110 INPUT "X-Cycles" A1
00120 INPUT "Y-Cycles" B1
00130 C1=186/SQR(A1+B1): D1=142/SQR(A1+B1)
00140 HIRES: P=255: Q=INT(D1+127): SD 4
00150 FOR R=0 TO 360
00160 R1=FLT(R)/57.2
00170 X1=SIN(R1*A1):Y1=COS(R1*B1)
00180 X=INT(X1*C1+255): Y=INT(Y1*D1+127)
00190 PLOT P,Q TO X,Y
00200 P=X:Q=Y
00210 NEXT R
00220 CURS 0: GOTO110
00230 END
```

YES FOLKS!, Tom Moffat now has a *real* printer. No more listings from the teletype machine where you have to work out what some of those schizoid characters really mean. For those who had trouble with his Bee-O-Rhythm program we'll reproduce a 'proper' listing (with improvements, no less) next month.

Letter from Owen Hill, Managing Director, Applied Technology.

**Mr. Roger Harrison,
Editor ETI.**

SUBJECT: MICROBEE REVIEWS ETI December 1982

Dear Roger,

I am writing in response to the product reviews on the MicroBee computer that appeared in the December 1982 issue of ETI. The purpose of this letter is to correct some false impressions the articles may have created. I would very much appreciate your help in answering these criticisms in print in the February issue of ETI.

In general, we welcome any independent product reviews because they give the readers an opportunity to gauge the produce through another source other than paid space advertising. The two articles you published in December, while containing material of interest to all readers, are clearly reviewing MicroBees purchased in *kit* form built by the reviewers themselves and not factory manufactured and tested units. As you may probably realise, the MicroBee was sold in kit form initially, however, all orders since July 1982 have been assembled and tested versions. As there were just over 1000 MicroBees supplied in kit form and almost 6000 fully assembled versions supplied to date, your reviews are not fully relevant for your current readers contemplating the purchase of a MicroBee at this point in time.

Of particular concern to our technical people is the article by Tom Moffat. It appears that Mr. Moffat decided to use a plug pack supplying a lower voltage. Readers should *not* follow Mr. Moffat's example because the battery backup circuit operates by sensing the incoming voltage and changes over when the voltage falls below 10 V. This threshold voltage ensures that the Z80 has sufficient time to reset reliably and switch off the memory enable circuits. The 9.5 V selected by Mr. Moffat hardly provides any 'headroom' and hence the unreliable operation reported is most likely a direct result of this substitution by the kit builder and not the fault of the MicroBee design. Another source of Mr. Moffat's problems could be the use of a backup battery less than the 4.5 V recommended in the Microworld Users Reports and in the later versions of the owner manuals.

Incidentally, despite the reviewer's colourful descriptions, it is not uncommon for the plug pack to run 'warm'. The 12 V/1 A, of course refers to the rating and the reviewer failed to report that the plug pack is manufactured by Arlec and is approved by the Victorian Energy Authority for operation at the stated ratings.

Tests by both Arlec and Applied Technology engineering staff have been carried out to ensure the performance is suited to the MicroBee. I would have thought that a technical reviewer would have at least measured the current drain and supply voltage to see if the plug pack, even if it was 'too hot to touch' was operating within its stated ratings.

As you correctly appended to Mr. Moffat's article, all MicroBees are now supplied in a professionally designed, injection moulded case. For those who purchased MicroBees in the early days the new case is available for $25 complete with all mounting hardware, decals and rubber feet.

Incidentally, those owers of MicroBees with the ▶

MICROBEE COLUMN

Editor/Assembler option who want to clear the memory, or fill it with any known hex byte really do not need to use the program shown on page 97 of the December issue. A suitable command is already built into the EDASM ROMset. The command is:

F 0400 8000 11 ‹CR›

and this will fill memory from 400 to 8000 hex with 11 (or whatever data or addresses are selected).

The criticism relating to delivery delays is understandable. The fact is that the demand for the MicroBee exceeds the supply. While it would be a relatively easy matter to manufacture the MicroBee overseas, it would hardly rate as an Australian computer. The factory facilities at Gosford, NSW are currently being expanded with an additional 8500 sq ft of production area due for completion in January 1983. Production is currently at 1000 units monthly, hardly a small undertaking for any Australian company. Although delivery from the factory involves a delay, dealers have been appointed around the country to carry stocks for customers. Intending buyers of MicroBees are advised to check availability with the dealer closest to them to ascertain what delay, if any, is involved.

Self test facility

All MicroBees fitted with version 5.1 of the Microworld BASIC have a built-in self-test facility. Although this is mainly intended for use at the factory to ensure reliable manufacture of the MicroBee, it may be very useful to owners who would like to test their own MicroBee and ensure it is operating correctly.

To engage the self-test facility hold down the 'S' key and the 'RESET' key simultaneously for about two seconds. Then, while continuing to hold down 'S', release the 'RESET' key and the screen will display:

keyboard #

This is now waiting for the operator to manually test the keyboard. Carefully press each key in turn working from left to right and starting at the back row with 'ESC', '1', '2', '3' and so on. When you have completed the test and pressed the 'SPACE BAR' the test will move on to the other steps.

This stage is automatic, although special shorting plugs are used to test the cassette interface and RS232 port. Without these plugs the test will fail on RS232 and cassette interface but this is no real indication that either is faulty. Other tests performed are checksum tests on the BASIC ROMs and the character generator ROM. All RAM memory is tested using a read and compliment memory test which leaves the contents intact and as such any program in memory is left intact, i.e: the memory testing is non-destructive and the self-test can be applied at any time without damaging a program in memory. Incidentally, all tests other than the keyboard check are fully automatic and recycle automatically. Any intermittent fault will latch the 'X' and indicate a failure so the test is very effective at monitoring the performance of the MicroBee throughout a 24 hour burn-in cycle.

MicroBee in Australian schools

As readers may be aware, the MicroBee was designed specifically for the education market. It has now been selected as an approved computer for schools by the NSW and WA education departments and is currently under close consideration by other authorities as well. MicroBees have been purchased by schools, technical colleges and universities throughout Australia and New Zealand. As this article goes to press there are almost 2500 MicroBees in Australian schools and the vast majority of these have been purchased within the past six months!

MicroBee overseas

Considerable interest has been shown in the MicroBee in many countries outside of Australia. During 1983 the MicroBee is expected to be manufactured under license and distributed in countries such as USA, Canada, Israel, UK, Germany, South Africa, Malaysia, New Zealand and others still being negotiated. An international Microworld Users Group is proposed to promote the efficient generation, collection and distribution of software. Granted we all have a long way to go, but there is a real sporting chance that this little 'Aussie MicroBee' will really find its mark against well established brands worldwide!

Future developments

Considerable development has been carried out on the original MicroBee since it was first introduced.

A world-class colour board has been developed which provides crisp 512 by 256 bit resolution and 16 lines of 64 characters on a modified domestic TV set (with 26 background and 26 foreground colours to boot!). Production prototypes have been demonstrated to education authorities around Australia and New Zealand and it has met with wide acclaim. A public release of the Colour Bee will be at the Australian Personal Computer Show in March.

Low-cost disk drives are now a reality. A much improved disk version of the MicroBee will also be announced at the Australian Computer Show.

Many customers have asked about the Networking ROM for the MicroBee. There are really two situations involved here. For personal use a low cost modem is due for release shortly which will convert any MicroBee into a personal on-line, terminal capable of accessing the proposed Microworld users' network or, for that matter, any other facility such as the various university networks, the Source and the various local bulletin boards now available.

A local networking capability has now been developed by the NSW Education Department which enables MicroBees to be interconnected with other computers, disk drives and printers to produce a very effective computer classroom. The real advantage of the MicroBee has now been discovered in that it is cost-effective and yet versatile enough to meet the most demanding requirements. Many Australian schools have five, ten or more MicroBees in a classroom at this present time. An ambitious project has now been approved to interconnect 50 schools in Sydney's western suburbs on a full network of MicroBees during 1983.

Software developments have not been neglected either. Considerable education software has been developed for the MicroBee over the past year and much more will be released shortly. Pilot has now been released and Pascal and LOGO will be available during 1983 for every MicroBee. We have been very fortunate to engage the services of Dr. Harvey Cohen, who worked on the original LOGO project at MIT with Seymour Papert and is now finalising a very effective version for the MicroBee. The MicroBee running colour and high resolution graphics is an ideal machine for the new approach to educational programs currently represented by LOGO.

On another exciting software front, a complete word processor in ROM has been released. Wordbee is supplied in 8K of ROM and is no toy. It uses almost the same control commands as the popular Wordstar and is very user friendly. With battery backup it is possible for a user to use the word processor to draft letters at home then take the machine back to the office to print them out! With built-in networking he may soon be able to contact the office via a modem using the MicroBee as a terminal and eliminate the trip to the office as well. The Wordbee is similar to most professional word processors and a number of technical colleges are proposing to use MicroBee/Wordbee units as part of a course designed to expose students to the realities of the electronic office of their destined career path.

SUMMARY

Granted we Australians are a race of 'knockers', but given the response to and performance of the MicroBee to date, maybe a few other readers would also like to comment on the December reviews as well. I feel Eric Lindsay and Tom Moffat have done a great job in getting the ball rolling. Have any of the other thousands of users anything else to say?

Kind regards,
Owen Hill
Managing Director,
Applied Technology Pty Ltd.

MINI-MART

Where readers can advertise — For Sale/Wanted/Swap/Join

● We'll publish up to 24 words (maximum) totally free of charge for you, your club or your association. Copy must be with us by the 1st of the month preceding the month of issue. Please — please — print or type adverts clearly, otherwise it may not turn out as you intended! Every effort will be made to publish all adverts received; however, no responsibility for so doing is accepted or implied. Private adverts only will be accepted. We reserve the right to refuse adverts considered unsuitable.

● Conditions: Name and address plus phone number (if required) must be included within the 24 words. Reasonable abbreviations, such as 25 W RMS or 240 Vac, count as one word. Adverts must relate to electronics, audio, communications, computing etc — general adverts cannot be accepted.
Send your advert to:
ETI Mini-Mart,
4th Floor, 15 Boundary St,
Rushcutters Bay NSW 2011.

COMPUTERS

SHARP PC1500 and CE150 printer/cassette interface and 4K RAM, complete, three months old, $500 ono. ZX80 $100 ono. Roger Pirola, 17 Darling St, Glebe NSW 2037. (02)660-8818.

WANTED: 8K ROM for ZX80. Phone Michael (02)477-1021 ah.

FOR SALE: ZX80 1K complete with manual, book of programs, games cassette and power supply, $99. Phone Michael (02)477-1021 ah.

FOR SALE: Apple II computer, with 48K RAM, one disk, Apple graphics tablet, tape recorder and over $1500 worth of programs, $3000. (02)387-2127.

FOR SALE: BBC Model A, 16K RAM. Brand new, still boxed. Complete with 'Welcome' package, 16 programs and user guide. Genuine unwanted gift. Cost $1440, sell $1150. (03)789-3226.

FOR SALE: Radio shack digital computer kit, excellent condition, $20. B. Begg, 18 Sturt Ave, Toorak Gardens SA 5065.

FOR SALE: Sinclair 16K RAM expansion, $80 ono. Phone (02)639-3115 ah.

FOR SALE: Sorcerer dual stringy floppies, new, with word processor linker plus extra software, only $599. Green screen, brand new $169. (02)449-3647.

FOR SALE: Teletype Model KSR-33. Suitable as printer for any microcomputer. Price $130 ono. (03)592-5620 Brighton Vic.

COMMUNICATIONS

WANTED: TV field level meter, 'Leader LFC 944C', David Schell, 38/44 Collins St, Annandale NSW 2038. (02)560-0791.

KRACO AM/SSB CB transceiver. 24 channel, mains or 13.8 Vdc operated, $200 or any reasonable offer. Carl (02)631-0116. Pendle Hill NSW.

FOR SALE: Teletype Model 15 pageprinter, $70. Tape reperforator $70 and tape reader $50 ono. Will separate. (03)793-1672.

AUDIO

PLAYMASTER GRAPHIC ANALYSER with TEAC ME-50 electret microphone, complete, perfect operation and condition. $120. B. Donaldson, 66 Agnes St, Rockhampton Qld 4700. (079)21760.

MISCELLANEOUS

FULL SET of ETI and EA magazines from Jan 1979 to Dec 1982, $250. M. Gardiner, Dorroughby, via Lismore NSW 2480. (066)895-350.

PRINTER CENTRONICS P 1. As new in carton, manual, three rolls paper, $200. R. Wardrop, P.O. Box 595, Lane Cove NSW 2066. (02)57-4648.

WANTED: Instruction manual for Trio 10 MHz oscilloscope CS-1559. Burwood Vic. (03)288-2278.

WANTED: ELECTROLYTIC capacitors, 500u or 1000u, 450 V or higher. Need approx. 72 but any smaller quantity will do. Ray Creeley, 158 South Rd, Penguin Tas. 7316. (004)37-2971.

WANTED: AVAILABILITY of maths tutor programs in BASIC for elementary grades, any help appreciated. R. Pfotenhauer, 21 Hovea St, O'Connor ACT 2601. (062)48-8960.

The military coup

# of Lieutenant Wilson. Aged 20.

When you talk to Geoff Wilson about his 18 months in the Army you can't help but feel he's a young man who's come a long way in a short time.

Already he's graduated from Officer Cadet School, Portsea, with a commission as a Lieutenant. And already he commands an Infantry Platoon of thirty men.

It's a tremendous responsibility. Especially for a 20 year old. But as Geoff says, "You get enormous satisfaction from using what you've learnt in your training to help bring out the best in your team. And in achieving results together."

"Obviously situations which I haven't had experience in crop up all the time. And that's when I have a real responsibility to myself and my men to make decisions based on sound knowledge rather than guesswork. As a result you constantly find yourself learning and mastering new skills. And that's a challenge I always enjoy accepting. You really begin to realise your full potential and believe in your ability."

"I suppose you might say my decision to take on a career as an Army Officer is my personal 'military coup'."

"It's hard to visualise another career as exhilarating, varied and satisfying. Or which provides as many opportunities to be recognised and rewarded for a job well done."

"Think about it carefully. I know I did before joining!"

Armour, Artillery, Engineering, Survey, Signals, Transport, Infantry, Intelligence and Aviation are just some of the fields open for you to enter.

If you're aged between 18½ and 23 on entry (or up to 25 with a degree or diploma), have your HSC or equivalent, and think you have what it takes to pull-off your own military coup, contact your nearest Army Careers Recruiting Centre or fill in the supplied coupon.

There are two courses per year. Applications close mid-March for a July entry and mid-September for a January entry.

For more information post coupon to GPO Box XYZ,
Sydney 212 1011, Newcastle 2 5476, Wollongong 28 6492, Albury 55 2248, Lismore 21 6111, Canberra 82 2333, Melbourne 61 3731, Geelong 21 1588, Bendigo 43 8008, Ballarat 31 1240, Brisbane 226 2626, Townsville 72 4566, Adelaide 212 1455, Perth 325 6222, Hobart 34 7077, Launceston 31 1005.

Name _____

Address _____

_____ Postcode _____ Phone _____

Birthdate _____ Educ. Std. _____

Army Officer. A leading profession.

All enquiries treated in confidence.

OCS2. DPS. 112 ELJ

Authorised by Director-General Recruiting, Department of Defence.

IAGO FOR TWO

Frank Rees, Boort, Vic.

This program is a translation to CHIP 8 of a popular board game program, also known as 'Reversi' or 'Othello', from an original by Milton Collins of South Australia.

Iago is an old game, similar to draughts. You play on a board divided into a grid. Each player has buttons or pieces. The object is, in placing your pieces on the board grid intersections, you bracket one or more of your opponent's pieces between two of your pieces in a straight line running vertically, horizontally or diagonally. Here, the computer not only provides a board and pieces, but also shows your scores and who goes next. This will run on a 'minimum' '660 — B&W, with 1K of memory.

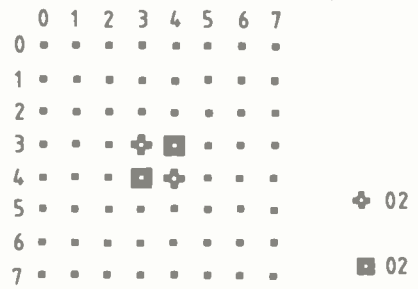
At the start of the game, each player has two pieces placed on the board. Opponent's pieces are shown to the right of the board, scores to the right of them. One of the pieces will be flashing, indicating whose turn it is — the computer randomly chooses which piece will flash at the start of the game.

To enter a move, you have to look where you want to locate your piece. The spots on the board are numbered in rows (X) and columns (Y). Commencing at the top left hand corner is 0,0 (X,Y). The bottom right hand corner is 0,7. You enter the X position first by pressing the appropriate number, then the required Y position. If the move is valid, your piece will appear flashing in the position chosen. Press key F to enter your move or another key, except C, to abort the move and try again. If you wish to concede a move to your opponent, press C. If you make an invalid move, your piece flashes once in the illegal location, you get a beep and have to try again.

Strategy and planning ahead are all-important in this game, but it is possible to come out with equal scores!

When entering your move, the computer will signify each X and Y value has been entered by sounding a beep. The same goes for other keys used, too. If you don't get a beep, just hold your finger on the key until the beep sounds.

This program will *run as is* on machines running CHIP 8 dialects 2 and 3. For those running CHIP 8.D1 and D2 with memory at 0600 to 0800, put a "GOTO" instruction of 1600 at location 0200. For other machines, see 'Dialect Translation' in *Hints for CHIP 8 Programmers*, ETI December '82, page 110.
(NOTE: location 06X0 should read 06B0)




```
0600  1602 1604 2660 2688 6302 6402 26AA C  1
0610  26CC 6508 6A60 4620 1720 6652 3600 1718
0620  26CC 8760 6652 3600 1718 172E 66F6 69FC
0630  276A 4700 1714 8CA0 8DB0 26D4 36DF 1716
0640  26AA 68F6 69FC 276A 4900 1652 27A2 2732
0650  1646 27D2 26AA 6230 6244 4240 17DE 170C
0660  A7EC 6C00 6D00 DCD4 7C04 3C20 1666 6C00
0670  7D04 3D20 1666 6C0C 6D10 A7F0 DCC4 DDD4
0680  A7F4 DCD4 DDC4 00EE A7F0 6C27 6D06 DCD4
0690  A7EC DCD4 6D15 DCD4 A7F4 DCD4 00EE F218
06A0  2702 72FF 3200 169E 00E0 6230 6533 6607
06B0  2638 6240 6533 6614 A7CC F233 A7CD F165
06C0  F029 D565 7504 F129 D565 00E0 6C27 6D08
06D0  4E01 6D15 26F6 DCD4 6600 66A1 16EC 7601
06E0  3610 16DA DCD4 6210 2702 16D6 DCD4 6210
06F0  F218 2702 00EE 3C00 16FE A7F0 00E0 A7F4
```

```
0700  00E0 F215 F007 3000 1704 00EE 6501 7E01
0710  6E52 1610 26F6 DA34 6206 2695 1610 A7FC
0720  1724 A7EC 5F00 DCD4 62F0 DCD4 00EE 66A4
0730  6AA4 6B34 6834 6CA0 6D30 2722 3201 1718
0740  26F6 DA34 162C 6700 6CA0 6D30 2738 420F
0750  1768 2722 4201 1766 271E 62E5 4200 1764
0760  7701 174C 3700 00EE 6700 2772 3908 1746
0770  00EE 7304 4800 1782 3608 00EE 68FC 7904
0780  00EE 5690 00EE 1772 6200 6C84 6D94 65E0
0790  86C0 8652 3600 620F 66D0 6652 3600 620F
07A0  00EE 3E00 17AC 8374 8475 00EE 6375 8474
07B0  00EE 26F6 6CA0 6D30 2788 6204 F21E DCD4
07C0  26F6 DCD4 77FF 3700 1788 00EE 0000 0500
07D0  0000 3E00 17DA 7301 00EE 7401 00EE 6208
07E0  269E 26AA 6210 2702 26AA 17DE 0000 0000
07F0  2070 2000 7070 7000 2070 2000 5000 5000
```

ASTEROID SHOWER

Peter Easdown, Kew, NSW

Here s another program rather like several you see in the parlour video games. You have a ship with a cannon that can be moved left and right across the bottom of the screen. Up to five asteroids come plummetting towards your ship. You score points by hitting them with missiles fired from your cannon and you stay alive by ducking out of their way as they rush past. Eash hit on an asteroid scores you one point. If an asteroid crashed into you, the resultant explosion fills the screen with 'debris', after which your score is displayed and the game ends. Sound effects accompany the scenario. The game will run on a minimum '660' with B&W video and only 1K of RAM.

To manipulate your ship and fire the cannon, use the following keys:

MOVE LEFT	KEY 4
MOVE RIGHT	KEY 6
FIRE	KEY 5

The program is structured with a mainline and three loops.

0600-066C MAINLINE
0676-06A4 FIRING LOOP
06A6-06C4 END LOOP
0714-072E EXPLOSION LOOP

The variables used are as follows:

0,1	ASTEROID 1
2,3	ASTEROID 2
4,5	ASTEROID 3
6,7	ASTEROID 4
8,9	ASTEROID 5
A,B	CANON
C,D	MISSILE
E	SCORE
F	MISCELLANEOUS

Now, go ash them asteroids!

```
0600  6E00 6A10 6002 6238 C40A 740A C60F 7618
0610  632E C10F C30F C50F C70F 6900 A6CE D236
0620  D456 D676 D896 D016 A6C6 6B20 DAB7 266E
0630  EFA1 2676 DAB7 6F04 EFA1 7AFF 6F06 EFA1
0640  7A01 A6CE D236 D456 D676 D896 D016 7102
0650  7304 7502 7703 7903 CFFF FF00 FB18 00FF
0660  00FF 00FF 00FF 00FF 4920 1604 161C 4F01
0670  1714 6F05 00EE 26E8 8CA0 6D20 7DFF A6D4
0680  DCD2 4F01 168E 26F6 4DFF 16A2 167C 7E01
0690  2704 A6D6 DCD8 6F10 FF15 FF07 3F00 169A
```

```
06A0  DCD8 A6D4 16DE 00E0 6C10 6D10 A7FF FE33
06B0  F265 F029 DCD5 7C04 F129 DCD5 7C04 F229
06C0  DCD5 FF0A 16E4 1038 6C38 386C C600 1876
06D0  DFED 6E18 1028 1842 2481 8142 4218 DCD2
06E0  A6C6 00EE 00E0 1600 6F20 FF00 FF18 7FFF
06F0  4F10 00EE 16EA 6F01 FF15 FF07 3F00 16FA
0700  DCD2 1712 6F30 FF00 FF18 7FFF 4F20 00EE
0710  1706 00EE 6200 C12F 7180 F100 F218 C3FF
0720  C4FF A72E D341 7201 3250 1716 16A6 8000
```

• NOTES & ERRATA •

Traditional Space Invaders, Oct. '82, p.95: There is an error in this program at address 06C0. Instead of 4501, this should read 4F01. Thanks to Peter Easdown for the correction.

Black Jack, Nov. '82, p.90: Bill Kreykes suggests the following changes to slow it down and sound evens (i.e: return your bet). Change 0CDE to 1D84, enter 2B42 6F10 FF18 1D04. To allow more time to place your bets, change the data at 079C to 400A or 400B or 400C. You can then use keys 0 to C to place bets and to answer yes.

PATCHES Bill Kreykes, St Albans, Vic.

For this game, you will need your ETI-660 with colour and full memory complement. The program draws 100 'patches' on the screen in a series of columns. Beneath the field of patches is your ship which runs left and right along a coloured line.

The colour of the patches changes constantly at random, except when you fire a missile, at which time the pattern 'freezes' until your missile hits something.

Your ship and colour line change colour every two to four seconds, depending on how much 'fuel' is wasted. You waste fuel if your ship remains stationary, a missile fails to strike a patch when fired, or if you strike a patch with a colour not corresponding to the colour of your ship. The object is to have your missile strike a patch the same colour as your ship. You score points according to the colour of the patch struck. The patch 'explodes' when you score a valid strike. Points are deducted if you hit a patch of a colour different to your ship. That patch then goes red. Patches are worth the following number of points:

BLACK	000
RED	100
BLUE	200
VIOLET	300
GREEN	400
YELLOW	500
PALE BLUE	600
WHITE	700

There are two special patches hidden in the field: one 'bonus' patch and one 'dud' patch, each game. They are worth *10 times* the score of the corresponding colour — added to your score for the bonus patch, deducted for the dud patch! You never know where these special patches are until you hit them! As the colour of these special patches changes constantly, too, the special points added to or deducted from your score can vary between 1000 and 7000.

Your score is displayed in the centre of the screen above the field of patches. You commence with 0000. When you hit a bonus patch, the number of bonus points is displayed at top left. When you hit a dud patch, the points deducted are shown at top right.

Here are the keys for moving and firing:

LEFT	KEY A
RIGHT	KEY D
FIRE	KEY 6

For lefthanders, you can change the data at 068C to 6801 and use Key 1 to fire.

The program as written gives a black background. However, if this is a bit hard on the old eyes (or your TV can't handle it) here are details of how to change the background colour and patch colour selection:

LOCATION	AFFECTS	BLUE	GREEN
0600	background	00FF	0911
0606	bonus points	6004	6002
060C	score	6003	6005
0612	minus points	6001	6000
061A	fuel line	6001	6001
081A	wrong hit	6001	6001
0842 & 0894	bypass black	4002	4002

The program can be lengthened or shortened by increasing or decreasing V8 at 0698.

The game automatically restarts at the end of each game (when you run out of fuel). Sound effects are used throughout.

```
0600  0913 08D2 6100 6004 26AA 6102 6003 26AA
0610  6106 6001 26AA 663F 6900 6001 6203 284E
0620  620F 6007 284E 7202 3217 1624 6C00 6D23
0630  27BC 6D21 27BC 6D1F 27BC 6D1D 27BC 6D1D
0640  27BC 6D1F 27BC 6D21 27BC 6D23 27BC C077
0650  C177 9010 164E ACE8 F155 2840 6C00 6D06
0660  A82E 2878 6C00 6D2E 2878 6001 6100 6200
0670  6300 2728 2732 2746 6700 A91E 6C1C 6D2B
0680  DCD5 A91E 6303 680A E8A1 28C0 6806 E8A1
0690  17F2 680D E8A1 28B6 6880 8875 4F00 2830
06A0  2882 4303 7703 7702 1682 6200 28AE 7201
06B0  3203 16AC 7101 3108 16AA 00EE 7DFD A916
06C0  DBD7 6003 F000 F018 7001 3015 16C4 A922
06D0  DBD8 ACE8 F065 90A0 179E F065 90A0 17B0
06E0  272E 26FE 2732 A92A DBD6 6007 289C 60BB
06F0  ACC0 FA1E F055 A935 DBD8 7901 1826 2752

0700  8410 8384 ACCD F333 F065 8404 1720 2752
0710  8410 8385 3F00 171C 74FF 7364 ACCD F333
0720  ACCB F433 ACCC F365 ACD8 F355 00EE ACD8
0730  F365 6417 6500 4000 176A 3100 1742 7404
0740  1746 F129 274C F229 274C F329 D455 7404
0750  00EE ACD8 F365 4000 1760 710A 70FF 1756
0760  4200 00EE 730A 72FF 1760 2760 6264 8235
0770  ACCD F233 ACCC F365 A930 6415 D453 641B
0780  1746 ACC8 F833 F265 6300 6500 2746 274A
0790  274A 2760 8830 00EE 272E 270E 1732 6400
07A0  2782 60F0 F000 F018 70F8 3020 17A4 16E0

07B0  6431 2782 2798 F400 F418 16E6 27CE 2892
07C0  A934 DCD2 7DFF 3D07 17EC 7C08 00EE 7C03
07D0  6BF6 8EC2 7CFD 6A00 83B0 4300 17E4 73F8
07E0  7A01 17DA 7DFF 83D0 4308 00EE 7A10 73FE
07F0  17E8 F800 F818 A91C DCD3 7DFE DCD3 3F01

0800  17F8 DCD3 4D07 1818 27CE ACC0 FA1E F065
0810  8800 9E80 16EC 2798 7715 6001 289C 6F10
0820  6050 F000 FF18 6D2B A91C DCD3 1698 FFFF
0830  6090 F000 6306 F318 A933 D631 76FF 6720
0840  C007 4000 1840 4005 7002 8E00 6216 6100
0850  28AE 7201 28AE 72FF 7101 3108 1850 4964
0860  1866 36FF 00FE 60FF F015 F007 F000 F018
0870  3000 186A 00E0 1616 DCD2 7C08 3C40 1878
0880  00EE C070 CA37 8A04 ACC0 FA1E F065 40BB
0890  00EE C007 4000 1892 4005 7002 610F 81A2
08A0  6203 85A0 6410 8545 7201 3F00 18A6 ACF8
08B0  F255 08E2 00EE 4C38 00EE DCD5 7C02 18C8
08C0  4C00 00EE DCD5 7CFE F300 F318 DCD5 63EE
08D0  00EE F839 AF96 BFEF F82C 5F62 2FF8 205F
08E0  62D4 F80C BEF8 F8AE EE72 FA07 BFF0 FA07
08F0  5E1E F0FA 1FFE FEFE FE5E F80C 7C00 BDF8

0900  80F4 AF9D 7C00 ED8F 2EF4 ADED 9F5D 63E2
0910  D4E9 61E9 61D4 0000 EE44 2828 1010 1038
0920  7C10 FEEE 4400 0000 4482 0000 0028 1028
0930  0000 F080 6CFE EEAA 00C6 0054 8200
```

SELECT-A-GAME Bill Kreykes, St Albans, Vic.

This program, or better, group of programs, is a continuation from *Wipeout '660 Style* published in ETI, October '82, page 95. Although Wipeout '660 Style will run on its own, when teamed with the listing given here you get a selection of one of three games to play: *Wipeout '660 Style*, *Concentration* and *Block Puzzle*. All three are translations from CHIP 8.D2. All are in colour and you'll need a '660 with colour and full 3K of memory. Colour instructions for each are at the start of each game so you can change colours if they don't suit your taste. Details later. You can also change them to monochrome only if you wish.

Here are the games:

A) WIPEOUT '660 STYLE
As per ETI, October '82, page 95. Enter program as published, but change data at 0600 (2822) to 1B9E.

B) CONCENTRATION
Between two players — A and B. Press a key to reveal the hidden shape. Press another key and match the pairs (eight in all). The computer shows whose turn it is and each player's score. The game automatically re-starts when finished. The winner is the player who attains the highest score over 99.

C) BLOCK PUZZLE
Another version of the program by the same name that appeared on page 92 of the November '82 issue. The computer shows 16 squares in a 4 x 4 array, each numbered 0 to F. The 0 disappears and the computer shuffles the squares about. You have to put them back in order, 1 to F, in the least number of turns. A short beep sounds when the computer has finished shuffling, signifying it's your move. Keys to use are:

UP	KEY 3
DOWN	KEY B
LEFT	KEY A
RIGHT	KEY C

You get a high-pitched beep if you make an invalid move.

The game automatically re-starts after all the numbers are in the correct positions.

Game B cannot be run alone as it uses subroutines from game A. Likewise, game C uses subroutines from game B.

When first run, the screen shows a 'game selector'. Simply press the appropriate key to choose the game you want.

COLOUR OPTIONS

For *Wipeout*, colour options were included in the October '82 article. However, it is now possible to select any background colour by changing data at 0822 (07F7) to that data shown in the Background Colour Chart here. For monochrome, change 0824 (07B8) to 00EE.

Concentration runs from 0860 to 0A56. You can change the background colour by altering data at 0860 (09EB) according to the Background Colour Chart. For monochrome operation, change 086E (4000) to 1876. The 4000 instruction at 086E is used so as to jump the background. The background colour code number is entered as the last digit. This can also be used to jump an unsuitable colour. The colour of the top row of squares is set by the instruction at 0864 (6003). You can display your initials by changing the data at 0A27-0A2E and 0A2F-0A36.

Block Puzzle runs from 0A58 to 0B9C. For monochrome operation, change 0A58 (07B8) to 00FF. Background colour is set at 0A5A. Change 09ED here to whatever you want from the Background Colour Chart. The instructions at 0A64 (4004) and 0A68 (4000) allow you to skip unsuitable colours (which are developed at random at the start of each game by the C007 instruction at 0A62). Change the last digit to that colour's code. The 6005 instruction at 0A82 sets the colour of the score to yellow.

The games selector resides between 0B88 and 0C0C.

BACKGROUND COLOUR CHART

BLUE	00FF
BLACK	09EF
GREEN	09ED
RED	09EB

The program listing has been annotated to give you an idea of its workings. Data not annotated is display data, except for the sector from 09EB to 09F1 which is a machine code subroutine.

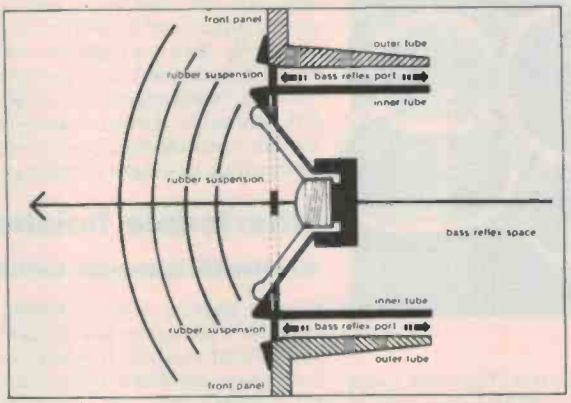
```
0860  09EE call 09EB      08C0  8D00 VD=V0        0920  6063 V0=63
      07B8 call 07B8            2942 do 0942            8095 V0=V0-V9
      6003 V0=03                3600 skf V6=00          3F00 skf VF=00
      6200 V2=00                18D0 go to 08D0         19A2 go to 09A2
      6F04 VF=04                660F V6=0F              2992 do 0992
      27FC do 07FC              8CD0 VC=VD              1864 go to 0864
      7001 V0+01                87A0 V7=VA              F300 pitch =V3
      4000 skf V0#00            18B4 go to 08B4         FD18 tone =VD
      7001 V0+01                6020 V0=20              6304 V3=04
      3218 skf V2=18            F015 time =V0           6420 V4=20
      1868 go to 0868           F007 V0= time           AA2F I=0A2F
      6900 V9=00                3000 skf V0=00          4500 skf V5#00
      6B00 VB=00                18D4 go to 08D4         193E go to 093E
      00E0 erase                97A0 skf V7#VA          6334 V3=34
      29BE do 09BE              18F2 go to 08F2         AA27 I=0A27
      6810 V8=10                2930 do 0930            D348 show 8MI@V3V4
0880  AA37 I=0A37      08E0  7501 V5+01        0940  00EE ret
      F765 V0:V7=MI             6001 V0=01              AA47 I=0A47
      F755 MI V0:V7             8502 V5=V5amdV0         FD1E I=I+VD
      AA3F I=0A3F               2942 do 0942            F065 V0=MI
      C107 V1=RND               8130 V1=V3              8A00 VA=V0
      F11E I=I+V1               8240 V2=V4              AA3F I=0A3F
      F065 V0=MI                8DC0 VD=VC              F01E I=I+V0
      4000 skf V4#00            2942 do 0942            F065 V0=MI
      1886 go to 0886           18AE go to 08AE         40DD skf V0#DD
      70FF V0+FF                6025 V0=25              18B4 go to 08B4
      AA3F I=0A3F               F300 pitch =V3          296C do 096C
      F11E I=I+V1               F018 tone =V0           7301 V3+01
      F055 MI=V0                D345 show 5MI@V3V4      FD29 I=dsp,VD
      AA46 I=0A46               8130 V1=V3              D345 show 5MI@V3V4
      F81E I=I+V8               8240 V2=V4              AA10 I=0A10
      8010 V0=V1                8DC0 VD=VC              FA1E I=I+VA
08A0  F055 MI=V0        0900  2966 do 0966      0960  F065 V0=MI
      78FF V8+FF                AA3F I=0A3F             A9F2 I=09F2
      3800 skf V8=00            FA1E I=I+VA             F01E I=I+V0
      1886 go to 0886           60DD V0=DD              296C do 096C
      29B6 do 09B6              F055 MI=V0              D345 show 5MI@V3V4
      29AC do 09AC              3500 skf V5=00          00EE ret
      C501 V5=RND               29A8 do 09A8            6311 V3=11
      292C do 092C              3501 skf V5=01          6401 V4=01
      6600 V6=00                29B2 do 09B2            600C V0=0C
      6D10 VD=10                7801 V8+01              80D2 V0=V0 and VD
      F00A V0=key               3808 skf V8=08          4004 skf V0#04
      AA17 I=0A17               18B0 go to 08B0         6409 V4=09
      F01E I=I+V0               6063 V0=63              4008 skf V0#08
      F065 V0=MI                80B5 V0=V0-VB           6411 V4=11
      90D0 skf V0#VD            4F00 skf VF#00          400C skf V0#0C
      18B4 go to 08B4           1928 go to 0928         6419 V4=19

0980  6003 V0=03                      09ED call 09ED          8300 V3=V0
      80D2 V0=VD                      00E0 erase              6000 V0=00
      4001 skf V0#01                  6204 V2=04              AA46 I=0A46
      6319 V3=19              0A60    6102 V1=02              F61E I=I+V6
      4002 skf V0#02                  C007 V0=RND             F055 MI=V0
      6321 V3=21                      4004 skf V0#04          AA46 I=0A46
      4003 skf V0#03                  7001 V0+01              FC1E I=I+VC
      6329 V3=29                      4000 skf V0#00          8030 V0=V3
      00EE ret                        1A62 go to 0A62         F055 MI=V0
      63FF V3=FF                      72FC V2+FC              F329 I=dsp,V3
      F315 time =V3                   6F04 VF=04              4300 skf V3#00
      F307 V3= time                   2814 do 0814            1B50 go to 0B50
      F300 pitch =V3                  3106 skf V1=06          D455 show 5MI@V4V5
      F318 tone =V3                   1A62 go to 0A62         D7B5 show 5MI@V7VB
      3310 skf V3=10                  7204 V2+04      0B50    8740 V7=V4
      1996 go to 0996                 3214 skf V2=14          8B50 VB=V5
09A0  00EE ret                        1A60 go to 0A60         8C60 VC=V6
      6380 V3=80                      6210 V2=10              00EE ret
      2994 do 0994                    6F04 VF=04              2B5C do 0B5C
      187A go to 087A         0A80    27FC do 07FC            7901 V9+01
      29AC do 09AC                    6005 V0=05              6E1A VE=1A
      7B01 VB+01                      6F04 VF=04              19B8 go to 09B8
      80B0 V0=VB                      27FC do 07FC            030A
      6E33 VE=33                      6C04 VC=04              0B0C
      19BA go to 09BA                 6D22 VD=22              2040
      29B6 do 09B6                    6E07 VE=07              FE40
      7901 V9+01                      AB64 I=0B64             2070
      6E03 VE=03                      2B8E do 0B8E            5070
      8090 V0=V9                      29BE do 09BE            5050
      6A2A VA=2A                      6712 V7=12              2321
      1726 go to 0726                 6801 V8=01      0B70    A971
      6000 V0=00                      F029 I=dsp, V0          23C0
09C0  6A00 VA=00                      D785 show 5MI@V7V8      41C2
      6801 V8=01                      AA17 I=0A17             40C0
      6E10 VE=10                      FF65 V0:VF=MI           87C1
      6712 V7=12              0AA0    AA46 I=0A46             A381
      A9E4 I=09E4                     FF55 MI=V0:VF           870E
      DEA7 show 7MI@VEVA              6712 V7=12              0808
      F029 I=dsp,V0                   6B01 VB=01              080E
      D785 show 5MI@V7V8              6C00 VC=00              0804
      7E08 VE+08                      6221 V2=21              7E04
      7708 V7+08                      C003 V0=RND             0800
      7001 V0+01                      AB60 I=0B60             6C08 VC=08
      3E30 skf VE=30                  F01E I=I+V0             2B8C do 0B8C
      19C8 go to 09C8                 F065 V0=MI              6E03 VE=03
      7A08 VA+08                      2AF8 do 0AF8            6005 V0=05
      7808 V8+08                      7201 V2+01      0B90    DCD5 show 5MI@VCVD
      3010 skf V0=10                  3220 skf V2=20          7C08 VC+08
09E0  19C4 go to 09C4                 1AAC go to 0AAC         F01E I=I+70
      00EE ret                        6900 V9=00              7EFF VE+FF
      FEFE                            6006 V0=06              3E00 skf VE=00
      FEFE                    0AC0    F000 pitch =V0          1B90 go to 0B90
      FEFE                            6215 V2=15              00EE ret
      FEE9                            F218 tone =V2           6D05 VD=05
      61E9                            F00A V0=key             ABC0 I=0BC0
      61E9                            6140 V1=40              2B88 do 0B88
09F0  61D4                            F100 pitch =V1          6D14 VD=14
      2070                            8860 V8=V6              2B88 do 0B88
      70D8                            2AF8 do 0AF8            6C15 VC=15
      D820                    0AD0    9860 skf V8#V6          6D23 VD=23
      D8D8                            1AEE go to 0AEE         2B8C do 0B8C
      F850                            2B58 do 0B58            F00A V0=key
      F8D8                            6201 V2=01      0BB0    400B skf V0#0B
      F8A8                            AA46 I=0A46             1860 go to 0860
      88A8                            F21E I=I+V2             400C skf V0#0C
      F888                            F065 V0=MI              1A58 go to 0A58
      D888                            8100 V1=V0              300A skf V0=0A
      F8A8                            AA17 I=0A17             1BAE go to 0BAE
      F8A8                            F21E I=I+V2             2822 do 0822
      F888                            F065 V0=MI              1602 go to 0602
      5020                            9010 skf V0#V1          EE88
      5088                            1AEC go to 0AEC         EC28
0A10  1703                            1AC6 go to 0AC6         EE8E
      070C                            7201 V2+01              888C
      1014                            3210 skf V2=10          88EE
      1900                    0AF0    1AD8 go to 0AD8         EE84
      0102                            6360 V3=60              8484
      0304                            2994 do 0994            E41E
      0506                            1A5C go to 0A5C 0ED0    1016
      0708                            8470 V4=V7              121E
      090A                            85B0 V5=VB              E8AD
      0B0C                            86C0 V6=VC              EAA8
      0D0E                            300B skf V0=0B          A8B8
      0FF8                            1B0A go to 0B0A         A3B0
      4444                            4501 skf V5#01          A3B8
      7878                            1B0A go to 0B0A         AA00
      4444                            75F8 V5+F8              AA00
      F870                            76FC V6+FC              1C80
0A30  8888                            3003 skf V0=03          1C80
      88F8                            1B16 go to 0B16         1C00
      8888                            4519 skf V5#19          E0A0
      8802                    0B10    1B16 go to 0B16         E0A0
      0202                            7508 V5+08              A0F9
      0202                            7604 V6+04              A9D9
      0202                            300C skf V0=0C  0BF0    A9F9
      0200                            1B22 go to 0B22         F0B3
      0000                            4412 skf V4#12          FCB3
      0000                            1B22 go to 0B22         F03C
      0000                            74F8 V4+F8              941C
      0000                            76FF V6+FF              943C
      0000                            300A skf V0=0A          9580
      0000                            1B2E go to 0B2E         9580
      0000                            442A skf V4#2A          9538
      0000                            1B2E go to 0B2E         2130
0A50  0000                            7408 V4+08              2120
      0000                            7601 V6+01              0EC8
      0000                            AA46 I=0A46             08C8
      0000                    0B30    F61E I=I+V6     0C0A    0E00
      07B8 call 07B8                  F065 V0=MI              ********** ●
```

The Vikings are coming

Jamo loudspeakers are designed and manufactured in Denmark and have been in production for twelve years. And now Australia is getting a chance to hear them.

Scan Audio, a new name to the Australian scene, has recently been set up by Michael Henriksen who used to work for the distributors of Jamo loudspeakers in Denmark. Scan Audio will be importing three of the Jamo ranges of loudspeakers, the Professional, Power and Popular ranges, plus accessories such as pedestals.



Four models in the Professional range and three models in the Power range are designed around the CBR (Centre Bass Reflex) system, Jamo's patented bass reproduction system. On the reverse of the front panel of the loudspeaker, an outer bass-reflex tube has been cast, enclosing an inner bass-reflex tube which is mounted on the bass loudspeaker itself. The space between these two tubes forms a circular bass-reflex port providing symmetrical loading of the bass diaphragm and lowering distortion, claim the Jamo manufacturers.

The bass speaker, together with the inner bass-reflex tube, is suspended in the middle of the circular bass reflex port by means of four vibration absorbing rubber blocks. It is claimed that this technique prevents uncontrolled vibration of the front panel and resulting coloration of the sound field.

On all models of the Professional range, the area of the front panel around the treble and mid-range units is faced with neoprene rubber to avoid edge reflections.

The top model in the Professional range, the CBR-1703, is a four-way system and has a rated power of 170 watts RMS and is priced at $1528 per pair (including pedestal).

For more information about Jamo loudspeakers contact **Scan Audio, P.O. Box 741, Dandenong Vic. 3175. (03)793-5670.**

Sansui compu-receivers

Sansui claim that their two new compu-receivers, models Z-9000 and Z-7000, are the easiest to use receivers they have ever offered.

Both receivers have multi-programmable timers that are capable of turning the receiver (and two connected units) on and off at any preset times. The Sansui Super Feedforward System is incorporated into the dc power amplifiers of the receivers which, it is claimed, significantly reduces every known type of distortion.

The FM tuner sections of the receivers incorporate quartz-PLL frequency synthesisers and provide presets for eight FM and eight AM stations, with a preset scan facility.

The Z-9000 features a seven-band graphic equaliser and the level of each frequency range may be boosted or cut by up to 10 dB. The Z-9000 also has a built in reverberation amp.

For more information on these products contact **Vanfi (Aust) Pty Ltd, 297 City Rd, Sth Melbourne Vic. 3205. (03)690-6200.**

Acoustat electrostatic loudspeakers

Acoustat Corporation of Florida USA claim that all their loudspeakers utilise full-range-element electrostatic panels to reproduce all the frequencies in the audible spectrum.

And this is achieved without splitting the frequency spectrum with separate woofer, mid-range and tweeter drivers and without crossovers and phase distortion.

The Model Two has a frequency response of 35 Hz to 20 kHz with a sound pressure level of 105 dB at 5 m in a 4 m x 6 m room. The Model Three has a sound pressure level of 110 dB at 6 m in a 4.5 m x 7 m room. The frequency response of the Model Four is 28 Hz to 20 kHz with a sound pressure level of 115 dB at 7 m in a 5 m x 8 m room.

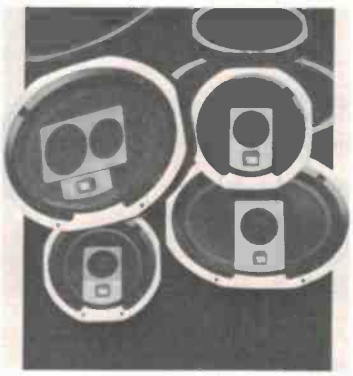
At the top of the range are the Model Six and Model Eight which double the radiating area of the Three and Four without an increase in panel width. In the Six and Eight the additional panels are stacked above rather than next to the original three or four panels, adding three 3 dB of conversion efficiency and about a third-octave of low-frequency range. Acoustat claim that the large radiating area is the reason for the better acoustic impedance match to air, particularly in the difficult low-frequency range. The Model Eight has a frequency response of 24 Hz to 20 kHz with a sound pressure level of 125 dB at 8 m in a 6 m x 9 m room.

And that's not all; there's also the Acoustat Trans-Nova Twin-200 power amplifier which has a power output of 200 W per channel into eight ohms, both channels driven, from 20 Hz to 20 kHz, at no more than 0.09% THD.

If you want to find out more about the Acoustat range of products contact **Allen Wright Electronics at 13 Wentworth Ave, Surrey Hills NSW 2010. (02)264-8084.**

JBL automotive loudspeakers

JBL have introduced a range of automotive loudspeakers which, they say, are built to the same criteria as professional systems.



Designed to fit standard rear-deck mounting holes, the T540 and T545 each have a 152 mm x 229 mm woofer and a 64 mm dynamic tweeter, giving a frequency range of 40 Hz to 18 kHz. They have a flat-wire voice coil, 38 mm in diameter which is claimed to increase both efficiency and power handling. The three-way design has a power capacity of 100 W and both can be biamplified for further improvements.

The T420 is suitable for either door or rear deck mounting and has been designed so that it will fit in the standard 133 mm cut-outs. The tweeter is angled 15° relative to the woofer, the frequency range is 70 Hz to 18 kHz and the power capacity is 75 W.

JBL has designed the T205 speakers for smaller cars with limited space for speakers. This 114 mm model will fit into shallow doors and other tight spaces. It has a frequency range of 90 Hz to 18 kHz with a 60 W power capacity.

Harman Australian Pty Ltd stock JBL speakers and can be contacted at **Unit A2, 6-8 Byfield St, Nth Ryde NSW 2113. (02) 887-3233.**

Arista Electronics has PA amplifiers

Arista Electronics has a range of PA amplifiers. The Japanese suppliers have changed the model numbers, so to avoid confusion use the Arista equivalent numbers.

Top of the range is the Model J-8 (Arista PS104L) priced at $245.50. This has an ac and dc power supply and a power rating of 100 W. Two microphones can be used with individual volume controls, input impedance is 200-50k adaptable. It has a chime and fog-horn switch, siren and siren lock switch, an output impedance selector of 4, 8 and 16 ohm switchable and an output line voltage of 25, 70 or 100 V.

Model J2 (Arista PS103L) has an ac/dc power supply. J3 (Arista PS101M) and J4 (Arista PS102M) are priced at $179.99 and $149.99 respectively and are both for marine use.

Wharfedale finished

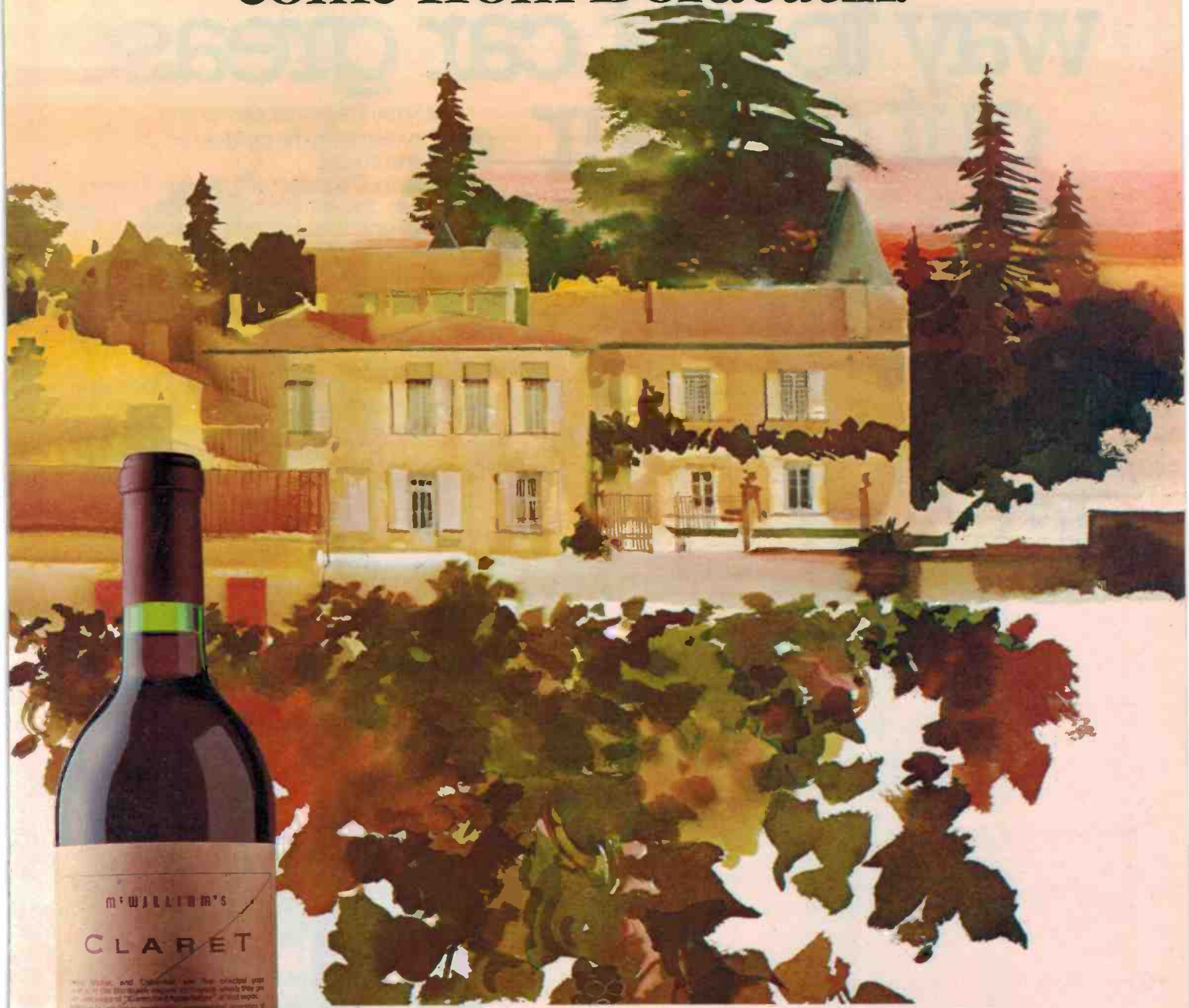
Wharfedale is another casualty of the slump in hi-fi.

Despite putting a lot of money into R&D using the latest lasar vibrational analysis techniques, Rank have decided to close down the factory after two years of losses.

Wharfedale started up in 1932 and became an extremely innovative and successful UK business but now it has gone the way of many of the other hi-fi manufacturing businesses in England.

This seems to have happened because of the failure of the more recent designs to capture the favour of the fickle hi-fi press. Wharfedale did not even have a prospect of an acquisition by a Japanese manufacturer, so where do you go from there.

Not all great Clarets come from Bordeaux.



Claret is the name which the English gave to the elegant, delicate reds of Bordeaux. These clarets were the product of the sun, the earth, Merlot, Cabernet Sauvignon and Malbec grape varieties and French wine making skill.

We took the same sun, earth and grapes, plus Australian wine making skill and produced an indescribably delicate and complex Claret which we think is just as worthy of the name.

Indeed the only real difference between McWilliam's Claret and a comparable French Bordeaux is the price. Vive la différence. **McWILLIAM'S**

AB 1984/82, MC 1206

The slickest way to get car grease out of your hair.

Getting rid of grease from your car engine used to be a headache. Then Kitten came along and invented two magic products that do the whole job quickly and thoroughly.

Simply ask for Degreezo or Jet Spray Degreaser from The Kitten System.

Jet Spray Degreaser eats oil and grease, swallowing the build-up on the engine and chassis.

Jet Spray Degreaser will not harm paint, metal or lacquer. Just spray on, let it work for five to ten minutes, and then hose off. The job's finished.

If you prefer a paint-on application to an aerosol, try Degreezo in the economical 750ml pack.

Paint it on engines, extra dirty motor parts or your oil-stained driveway and stand back to watch Degreezo lift out the muck.

Degreezo's specially developed formula dissolves oil and grease, so all you have to do is hose it off, leaving your parts as bright as the day you bought them.

So, to get car grease out of your hair permanently, ask for either Jet Spray Degreaser or Degreezo from The Kitten System.

KIW 3113

THE KITTEN SYSTEM.

THE CREAM OF CAR CARE.

Best bass yet from a kit!

As featured in Electronics Australia Projects June and July 1981.

Now Peerless introduces another major advance to kit-set loudspeaker technology. A bass speaker with a rigid polypropylene cone that clearly outperforms traditional paper composite cone speakers to provide: • Cleaner, tighter bass sound reproduction • Low colouration and distortion • High efficiency, suiting 25W to 100W amplifiers • Consistent rigid panel, low mass speaker cones.

Other outstanding features of Danish-built Peerless speaker kit-sets are: • Sealed back mid-range with excellent linearity and low distortion • Latest Peerless 1" soft-dome tweeter • State-of-the-art crossover networks • Exceptionally flat response extending to 25,000 Hz.

Choose from these EA/Peerless speaker projects:
- PAS 100 12" 3-way 100W (100L)
- PAS 60 10" 3-way 90W (60L)
- PAS 25 8¼" 2-way 60W (25L)

includes drivers, crossover, wiring and instructions.

Peerless

Sole Australian Importer, G.R.D. GROUP PTY. LTD.
698 Burke Road, Camberwell, Vic. 3124. Trade enquiries welcome.

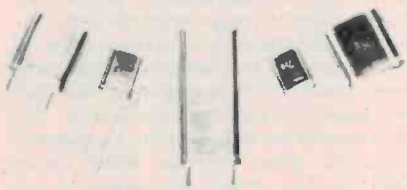
CONCORD/6480

N.S.W.		VIC.		S.A.		W.A.	
Bondi Junction		**Ballarat**		**Adelaide**		**Nedlands**	
Danish Hi-Fi Aust. Pty. Ltd.	Ph: (02) 387 5878	Turner Audio	Ph: (053) 32 2042	Hi-Fi Acoustic	Ph: (08) 223 6774	Danish Hi-Fi Aust. Pty. Ltd.	Ph: (09) 386 8564
Concord		**Camberwell**		**Adelaide**		**QLD.**	
Electronic Agencies	Ph: (02) 745 3077	Danish Hi-Fi (Aust) Pty. Ltd.	Ph: (03) 82 7348	Danish Hi-Fi Aust. Pty. Ltd.	Ph: (08) 51 2124	**Brisbane**	
Crows Nest		**Cheltenham**		**Goodwood**		Brisbane Agencies	
Deeva Hi-Fi	Ph: (02) 439 3999	Beland Electronics	Ph: (03) 550 2279	The Acoustic Foundry	Ph: (08) 271 0276	Audio Centre	Ph: (07) 221 9944
Dee Why		**Geelong**		**Hawthorn**		**Barunda**	
David Ryall Electronics	Ph: (02) 982 7500	Steve Bennett Audio	Ph: (052) 21 6011	Sound Craftsmen	Ph: (08) 272 0341	G. Mills Stereo	Ph: (07) 391 5606
Sydney		**Hawthorn**		**St. Peters**		**Redcliff**	
Electronic Agencies	Ph: (02) 29 2098	Tivoli Hi-Fi	Ph: (03) 818 8637	Miltronix	Ph: (08) 42 3781	Hi-Fi Sales	Ph: (07) 284 2495
Wagga Wagga		**Warrnambool**					
Car Radio & Hi-Fi Centre	Ph: (069) 21 4618	Bruce Henderson Audio World	Ph: (055) 62 5147				

Bright Star Crystals Pty Ltd

PO Box 42, Springvale.
Ph (03) 546-5076 Telex AA36004

36 years in the business



AND STILL ON TOP

Manufacturers of
PIEZO ELECTRIC CRYSTALS
Contractors to Federal and State Government Departments.
REPRESENTATIVES:
NSW: Master Communications, 27 Woodville Rd., Granville N.S.W. (02) 682 5044.
SA: R.W. Electronics, 51 Woodville Ave., Riddleton S.A. (08) 464 571.
QLD: Fred Hoe & Sons P/L, 246 Evans Rd., Salisbury North, Brisbane. (07) 277 4311.
WA: Westest Electronics, 71 Jean St., Hamilton Hill 6161 (Mail Only) (09) 337 6393.
TAS: Dilmond Industries, PO Box 219, Bellerive, Hobart. (002) 47 9077.

CRYSTAL UNITS

- Decade Counting Units to 1 Hz.
- Wide Band Amplifier for your counter, 1MV sensitivity, band width 1-250 MHz.

Send SAE for new catalogue or quote for your requirements.

Sony CDP-101 compact disc player

Louis Challis

Louis is completely entranced with the compact disc player. Its performance far exceeds that of conventional systems. Regardless of dust, static or dirty fingers on these digital discs, there's a total absence of surface noise.

I WAS SURPRISED to find an unusual piece of high fidelity equipment waiting for me in my office when I returned from a trip to Brisbane. Lo and behold, the Editor had received one of only two new Sony Compact Disc players in the country and instead of playing with it, 'Himself' had decided to be magnanimous and let me play with it first. But I soon discovered that he didn't really want me to play with it. What he wanted me to do was to evaluate its technical performance in a similar way to our evaluations with conventional equipment.

Newspapers, journals, television programmes and technical press have been extolling the virtues of the Compact Disc digital audio system and raving about its potential in the market for well over a year now.

The system is basically a technical offshoot from the video discs developed and marketed by Magnavox in the USA some five years ago and redeveloped by Philips of Eindhoven in conjunction with Sony of Japan.

The Philips system is quite revolutionary, but not a surprise, based on our knowledge of the work they have done between 1970 and 1980. During those critical ten years Philips developed the VLP, the Video Long Playing disc, and made a wise decision in the interest of international standardisation. This was to work with Sony in a joint research program as they realised that only with the assistance and full support of the Japanese would they have any chance of repeating what they had already done with the 'compact cassette'. We are all aware of the failure of the Elcassettes and various other systems which have suffered the fate of oblivion, primarily as a result of a lack of standardisation and consequent market-place rejection.

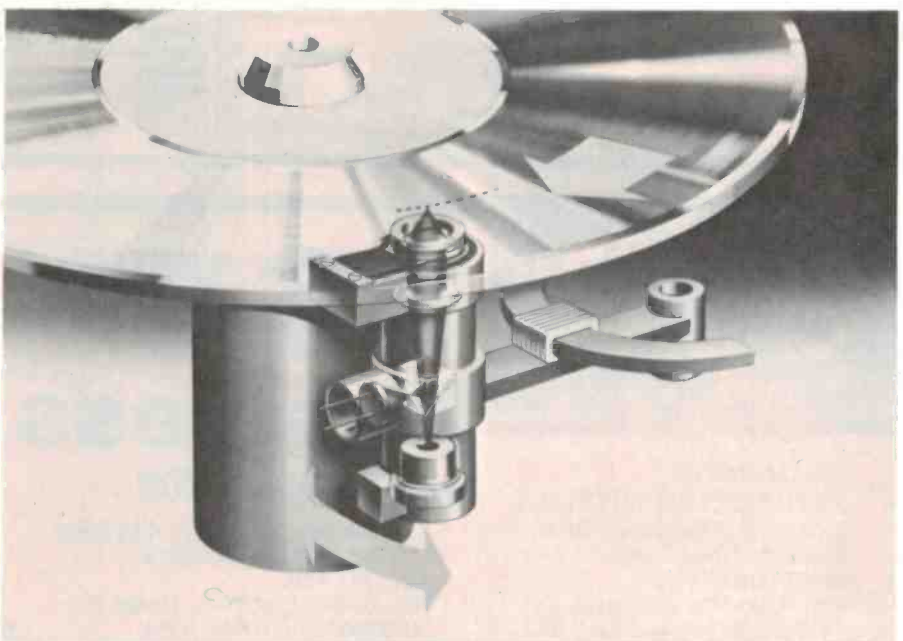
It is clear to me, as it will soon be to you, that the Compact Disc will undoubtedly replace the conventional analogue microgroove disc with its stylus, cartridge and pivoted or parallel tracking tone arm system in much the same way as the ubiquitous slide rule has been replaced by digital calculators. The replacement of the microgroove record by the compact disc will however, be much slower than was the demise of the slide rule, and I expect the two systems to live harmoniously together for many years (if only because both will be produced by the same people).

SONY CDP-101 COMPACT DISC PLAYER

Dimensions:	*355 mm wide x 100 mm high x 330 mm deep*
Weight:	*7.3 kg*
Manufactured:	*In Japan by hi-fi audio division of Sony Corporation*

So what's it all about?

The Compact Disc system replaces the stylus, cartridge and indented spiral track with a laser light emitter, a photo-diode optical detector and a specially formulated disc containing the program material. This laser disc incorporates the digital signals, which constitute the software or program material, in millions of minute indentations within the active surface of a metalised substrate. This metal layer is covered by clear plastic which has been designed to pro-



Light reading. Laser light is focussed into the disc's bright, reflective surface where it reads the microscopic pits as either a high reflected light level or a very low level since light is scattered in the pits. These signals are converted into electronic digits by the illustrated photodiode. Note the tracking arm, which moves from the inside to the outside with a progressive speed change from 500 to 200 revolutions/minute.

tect the substrate from physical abuse and is simultaneously claimed to be immune to dirt, dust, finger marks and the problems faced by conventional microgroove discs. The data capabilities of the disc are quite outstanding and we have calculated that the typical disc will contain up to 200 megabytes of information. For those of you who are unfamiliar with other data storage systems, this is quite fantastic and greatly exceeds the capacity of a 200 mm diameter floppy disk or a Winchester disk drive of the type currently used in the majority of small computers.

It is this tremendous digital information capacity of the compact disc which makes the whole concept viable and provides the dramatic improvements in dynamic range, information content and playing time which are the main features of this new system.

Features

The Sony CDP-101 disc player features a shiny black molded escutcheon with the left hand side devoted to the disc loading system while the right hand side has the digital display panel and associated touch switch controls.

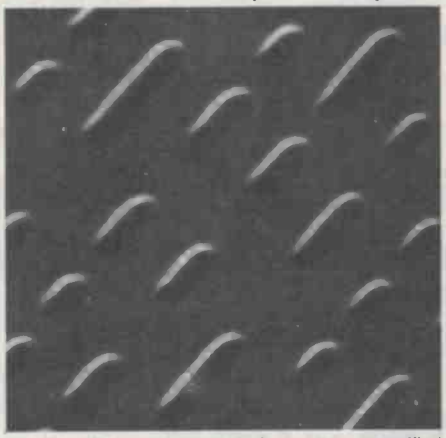
At the extreme left hand end is a push-button power switch and below it is a time on/off selector. At the bottom left hand corner is a standard tip, ring and sleeve headphone socket with its own miniature volume control so that you can listen to the discs without recourse to a separate power amplifier.

To the right of these controls is the compact disc loading tray. You touch a small switch to open the tray, which whirs as it slowly slides out and whirs as it shuts after you touch the switch to close it again. When the disc 'receptor tray' comes out all you have to do is to gently place the disc in the bottomless tray and then return it to its playing position. The internal mechanical system loads the disc onto its precision spindle and then all you do is select the operational function that you then require.

The display panel to the right then lights a red LED to indicate that the disc is correctly set and it also indicates the track number that has been selected. The 'time display' shows the elapsed time of that particular track or alternatively the time left to the end of the disc, as selected. This is a new and exciting facility which has only previously been offered on professional tape recorders and it revolutionises the information and scope of control available to the user.

At the upper right of the display panel is an optical sensor for the remote control unit and next to it is a little green LED to indicate that it has responded to or received a signal.

Immediately below the display panel are six pushbutton controls that allow one to reset the special controls. On the left is a full reset button and the next three to the right provide a complex repeat function sequence. The first of these buttons provides a repeat of the track just played, the second provides a replay of all tracks and the third labelled 'A-B' allows you to select the start point and finish point anywhere during the programme to cycle over and over again. This sequence may be as short as a second or as long as the whole disc. This 'A-B' repeat function facilitated some of the test results which were used to compare the compact digital disc performance with conventional high quality microgroove recordings.

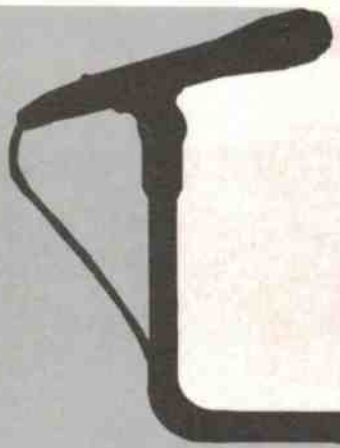


It's the pits! Compact disc pit structure, magnified 12 500 times. The pits are about 0.5 um wide and from 0.833 um to 3.56 um long. Tracks are 1.6 um apart.

The next button, labelled 'clear', provides a reset for the A-B function. One other button at the extreme right hand end of the facia is labelled 'time' and converts the normal elapsed minute and second time display to one in which the remaining time till the end of the disc is displayed. This is both unusual and ingenious and is a biproduct of the microprocessor technology which makes it all possible. This feature tells you exactly how long you have left on the disc so that you can time your meal, your departure and most particularly your entertainment accordingly.

The main function controls are located in the bottom right quadrant and, not surprisingly, these are different to the conventional cassette or tape recorder controls On the left hand side of this section is a play button and a smaller pause button. Each of these incorporates a LED so that the activation of the function is clearly indicated.

To the right of these controls are three controls for forward activation and three for reverse. The two largest controls are for forward and reverse, automatically stopping at the beginning of a programme section. The other controls provide three times and ten times normal cueing speeds which is something that you cannot do with a conventional cassette player or record player. These controls are unquestionably a delight to use and provide a flexibility which you miss once you go back to using a conventional compact cassette recorder. ▶



NEED MICROPHONES? WE HAVE THE FOLLOWING IN STOCK.

(Also available, a full range of Audio Technica.)

DYNAMIC MICROPHONES

AKG
D 310
D 320
D 330
D 12E

BEYER
N 88
M 500 RIBBON

SENNHEISER
MD 416
MD 421
MD 441

ELECTROVOICE
PL80 RE20
PL88 OMNI
RE16 RE50

REPLACEMENT GRILLS TO SUIT
SM 58 ..... $25.00
MIC CLIPS SHURE TYPE ..... $4.00 ea
MIC CLIPS BUTTERFLY TYPE ..... $6.00 ea
BOOM STANDS $65.00
STRAIGHT STAND $45.00
ROUND BASE STAND $60.00
BANQUET STAND $42.00
BOOMS $29.00

SHURE
SM 57
SM 58
SM 77
SM 78
SM 10 Head-Set Mic
SM 11A Lavalier Mic
565 SD
545 SD

CONDENSER MICROPHONES

AKG
C 451 Pre Amp CK 5
CK 1 Capsules CK 8
CK 2 20 Db Pad

SENNHEISER
ME 80 Shot-gun Capsule
ME 88 Shot-gun Capsule
ME 40 Cardoid Capsule
ME 20 Omni Capsule
K 3U Pre Amp
MKH 816 (P 48 UB)

SHURE
SM 81
SM 85

PZM
30 GP
6 7P

SWITCHCRAFT CONNECTORS
FEMALE LINE ..... $5.00 ea
MALE LINE ..... $4.50 ea
CHASSIS FEMALE $5.00
CHASSIS MALE $4.50
BELDEN MIC CABLE (8412) ..... $2.85 per m

DI BOXES
LINE LEVEL SPLIT BOXES
LIGHT SPLIT BOXES
MULTICORE CABLE
MIKE STAND ADAPTORS

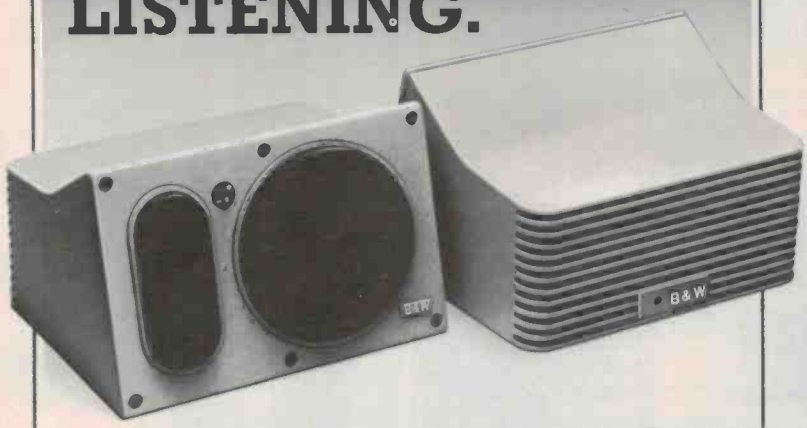
THIS IS ONLY PART OF THE LARGE RANGE OF MICROPHONES AND ACCESSORIES WE HAVE AVAILABLE. FOR FURTHER DETAILS SEND S.A.E. TO:

SOUND ON STAGE

405 KENT ST., SYDNEY NSW 2000.

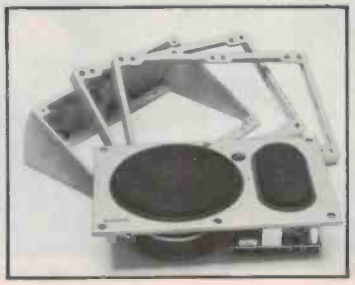
Phone 29 4558 29 7426

LM 1.FIRST CLASS LISTENING.



A MICRO REVOLUTION IN SOUND REPRODUCTION.

For the first time Micro Size means great sound at home, in your car, yacht or caravan. B&W, who created the loudspeakers used by all the world's major recording companies, now miniaturise their professional monitor.



Advd Saronno Italy

B&W Loudspeakers

For further information contact
Convoy Sydney,
400 Botany Rd., Alexandria 2015.
Telephone (02) 698 7300

SYSTEMDEK II

an enviable standard for its price, representing fine engineering & acoustic value for money.

$399

Incorporating many of the design and performance features of our most advanced unit, the Systemdek III, this completely new concept in a budget turntable provides the opportunity for audiophiles to experience the immense benefits that an advanced signal source is able to achieve.

An improved suspension system isolates the specially designed glass platter from the base and its surroundings to provide a level of performance unheard of in this price bracket. And compared with its competitors, the Systemdek II offers a two speed option, simpler alignment procedures, levelling feet and easier arm fitting.

If you are serious about your hi-fi and interested in 'acoustic value for money', then the Systemdek II is worthy of your attention.

See your Systemdek dealer today and discover the true meaning of value for money . . . Systemdek II.

Arm & cartridge not included
Record clamp optional extra

For further information contact
Convoy Sydney, 400 Botany Rd., Alexandria 2015. Telephone (02) 698 7300

On the rear of the unit is an 'auto-pause' switch which makes the unit pause at the end of each track necessitating a restart function to play the next number. This would not be used very often, but could prove to be of some special use, particularly for disc jockeys at radio stations. The next control on the rear is labelled 'anti-shock' which would be used in locations where the level of structural vibration is high and mistracking or malfunction might otherwise occur. We did not evaluate this function but when we get the unit back again we intend to subject it to various spectral vibration levels on our shaker table to determine how efficient it really is. The third switch on the rear of the unit is labelled 'beep'. When this particular switch is used the remote control will emit a little 'beep' each time a function is executed.

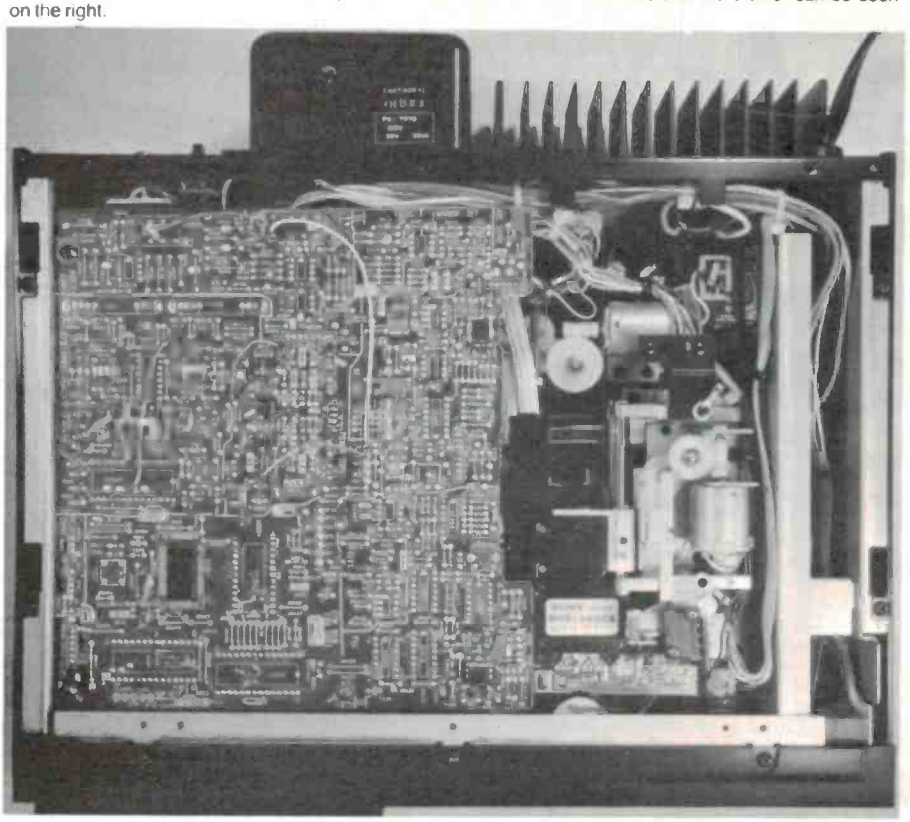
The rear of the unit features a large heatsink for the servoamplifier and an external mains transformer which has obviously been positioned there to either minimise magnetic flux leakage or because of the lack of space in a jam packed unit.

Software. A selection of the software supplied with the review equipment. Some 300 titles will become available this year.

Inside the CDP-101

The inside of the unit is filled with printed circuits, miniature servo drive motors and large scale integrated circuitry which is constructed to standards applicable to the best communication circuitry. The disc drive mechanism is supported by an intricate die casting which features two perpendicular sets of parallel slides to facilitate a primary translation motion of only 33 mm which is the width of the digital tracks, as well as a secondary longitudinal motion which the tracking mechanism has to provide to cover the disc surface. The circuitry is designed with a series of stacked arrays of pc boards located below and to the side of the drive mechanism which is on one side of the unit. It would be interesting to compare this Sony unit with the Philips unit which we feel sure will be a 'little bit different' in the physical details and possibly in a number of other respects.

Construction. Inside the CDP-101 player. The drive mechanism for the disc and the drawer can be seen on the right.



Testing difficulties

It wasn't possible for us to test the unit as we would have liked to. And, no doubt, you would have liked us to test it in the manner you have come to expect. The device can be considered as being a 'black box' which means that in order to evaluate it one needs very special facilities. Neither Sony nor Philips have yet provided or released such facilities, even to their own people in Australia, although we feel sure they have them in both Japan and Holland. In the absence of such special software we have utilised our existing facilities and have innovated to make up for the deficiency.

The obvious parameters that we would normally evaluate are:

- The dynamic range in terms of either unweighted or A-weighted performance.
- The frequency response generally in terms of +0 to −3 dB points.
- The distortion generated by the unit is of particular importance and requires special software, together with our existing distortion measurement facilities, for proper evaluation.
- The speed stability and the wow and flutter characteristics of the unit are particularly important and also require special software.
- The channel separation and phase linearity of the unit should normally be evaluated to confirm the overall performance.

Considering the lack of software we have made reasonable strides in evaluating the characteristics of this unit. For a start, we have confirmed that the dynamic range of the software provided by the manufacturer exceeds 80 dB. We have good reason to believe that a realistic figure of 86 dB would be appropriate for programmes provided using the full dynamic range of the system. We were able to confirm that the frequency response of the system, compared with a similar content recorded on conventional half-speed mastered records which is ±2 dB from 20 Hz to 16 kHz, is at least as good and possibly extends to 20 kHz.

We were unable to evaluate distortion by normal methods. A comparison was made between single transients taken off a half-speed mastered Sony CBS analogue record (Hiroko Nakamura playing Grieg's 'Piano Concerto' in A Minor) and the Sony CBS CD disc number 38DC14 playing the same piece of music from the same digital master recording. It clearly showed that the distortion levels on the digital disc were at least one order of magnitude lower than those found on the conventional analogue recording.

The speed stability of the system was even more difficult to assess than the distortion characteristics. All we were able to ascertain was that the digital disc is significantly lower in terms of audible wow and flutter than the conventional recording played on a transcription turntable.

Subjectively

The subjective assessment of the unit was limited to the five compact discs provided by Sony. These included two sampler 'pot-pourri' discs, Simon and Garfunkel's 'Bridge Over Troubled Waters', Grieg's 'Piano Concerto' played by the Hiroko Nakamura and one jazz record by a group which I had not previously heard. Surprisingly the 'Bridge Over Troubled Waters' record and the half speed-mastered digitally recorded Sony CBS pressing of the 'Greig Piano Concerto' 28AC703, which is a 45 rpm digitally mastered recording, are in my collection. They are, and hopefully will continue to be, two of the better records which I own and I have used them for reviewing record playing equipment in the last few years. More significantly, they provided me with the opportunity to undertake a direct assessment of the relative dynamic range, signal-to-noise characteristics, wow and flutter, distortion and over-all quality of the two media.

It soon became clear that just as the 'Bridge Over Troubled Waters' recording was surpassed by the technology of a digitally recorded half-speed mastered microgroove record, so too was the digital compact disc at least the same order of magnitude better than the half-speed mastered microgroove record. In more objective terms 'Bridge Over Troubled Waters', even when new, only had a dynamic range of less than 60 dB A scale. The half-speed mastered 'Grieg Concerto' record has a dynamic range approaching 68 dB A scale, while the digital disc has a dynamic range of better than 86 dB.

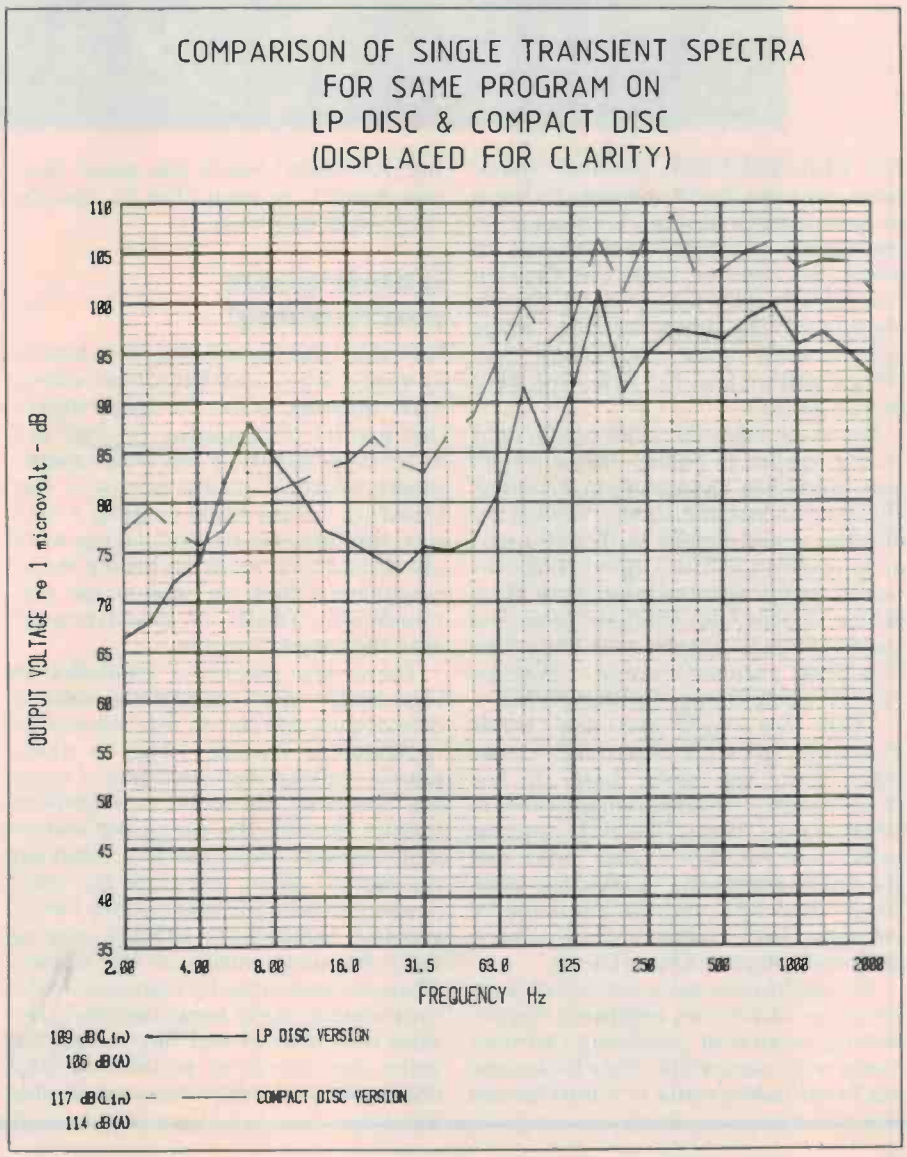
If this were all that the digital disc offered by way of improvement, then one would be hard pressed to justify the new medium. But this is far from being true, for the most impressive feature of the digital disc is the *total absence* of surface noise which is a continual and everpresent problem with the normal microgroove record. Irrespective of the use of surface sprays, careful cleaning, anti-static compounds and brushes, dust proof rooms or whatever else you may choose to use, you will have the same problems that I and every one else has in avoiding dust, dirt and regrettable damage to your precious records.

The fact that dirty fingers and these other irritating problems just do not affect the performance of the compact disc will endear the system to a new generation of audiophiles.

I took Sony and Philips at their word and placed dirt, dust and debris on the active surface of one of the discs to determine whether the manufacturer's claims of immunity to signal drop out, with a dirty disc, would be supported in practice. With some relief I found that barring the situation of total obscuration of the disc surface, which is easy to do deliberately, but hard to do inadvertently, those claims were fully substantiated.

I was completely entranced by the new compact disc and I believe you will be too. The approximate recommended retail price is $800 to $1000 per unit (depending on import duty) and the disc price is around $18. I can see queues forming outside the shops to buy both the players and the discs when they finally arrive about April. Obviously there may not be as many people around with that sort of money as the marketing people might like, but this situation will hopefully be short lived so that all of us can enjoy the refinements and pleasures that this new medium can provide.

In case you hadn't guessed I am going to place my order as soon as I finish this review!



AS ELECTRONICS pervades music more and more, it will undoubtedly begin to have a great deal more influence on the names of bands. Readers will no doubt be familiar with the German band Kraftwerk whose music is entirely electronic. The lyrics of their songs reflect solid state technology, too. (When will we hear "16 bytes and what do you get ...").

Let us speculate for a moment on what would happen to bands' names should they decide to change them to reflect this ever-increasing trend. Perhaps the Hitmen would change to 'The Bitmen', or Love Mum & The Urgent Ring-Mes would change their name to 'Love Mum & The Modem Auto-Diallers'! Instead of the Sex Pistols maybe we'd have 'The One-Shot Multivibrators'. Perhaps AC/DC would change to 'PNP/NPN'!

Then, too, we'll see new bands emerging, all with 'electronic' names right from the down beat. A few imaginative (?) examples might serve to illustrate my theme: like 'R1D1 and the solid state astables', 'Laser Luke and the angry angstroms' (a ferocious punk band), 'Red LED and the brothel boys' (straight from Sydney's Darlinghurst and the flesh pots of King Cross).

We might even get a few out-of-work analogue electronics engineers (digital having taken over completely) forming bands with names like 'Moto Roller and his Texas Instruments' or 'Cath Ode and her Rectifiers' (we're not sexist here, you know!), or even 'Tip 31 and the three-oh double fives'.

Watch where you're going!

Now that 'hip stereo', otherwise known as 'stereo to go', is all but all-pervading, we're starting to see the tragic effects this marvel of modern technology can have on our society. A recent newspaper report told of a young man who was killed by a train while crossing a railway line because he was paying more attention to the music on his hip stereo headphones than he was to his surroundings. "Death by misadventure" read the coroner's report.

There are plenty of examples of less tragic, but nonetheless socially deleterious, effects of hip stereos on individuals. Parents write to newspapers wailing that teenagers of today are becoming antisocial (... a familiar theme) through the use of hip stereos and wearing headphones to "... shut out the world". Then there are the train passengers who while away long boring journeys through the suburbs playing their favourite music on hip stereos. Many become so totally engrossed in the microcosmic world so created that they miss their station and have to pay an extra fare to return to their rightful destination, arriving home considerably later than usual to the righteous indignation of their familys, too sheepish to give a coherent explanation of where they've been and what they've been doing.

But, I warn you — things are going to get worse! Now they've introduced the dreaded wristwatch TV. Well, the screen (LCD — of course) is strapped to your wrist and the receiver is carried in a pocket on your hip — a la hip stereo. Headphones (a la hip stereo!) convey the sound to your aural consciousness.

Heaven knows how the makers expect you to watch the ball in a World Series Cricket match on a 30 mm screen. People are obviously going to be walking around, totally mesmerised by the wristwatch screen, not looking where they're going. Pedestrian deaths will rocket! Apart from that, thousands of wrist TV equipped commuters will be missing their stops, stumbling up/down railway station stairs, walking into electric light poles, parked cars, buildings and other people. Teenagers (unable to afford a wristwatch TV) will be writing into the newspapers wailing that today's parents have become antisocial through watching their wrist TVs almost every waking hour!

However, some good might come of it. The wristwatch TV may well catch on so thoroughly with the adult world that talk-back radio will *die*.

Power you can taste.

Sony's new TA-AX5 amplifier with memory is a high fidelity feast.

Its multiple memory lets you create your own acoustic "flavours." Bass and treble tone settings, turnover frequencies, high and low filter are all programmable.

At a touch you can instantly recall the recipe for bittersweet country, hot 'n' spicy rock, or a well-seasoned Stravinsky. And electronic displays graphically show you everything the amp is cooking up.

Sony's Audio Signal Processor means that every function is touch controlled. This knifes through the usual maze of audio circuitry for a streamlined design of the future. Pure and simple, it sounds delicious.

TA-AX5

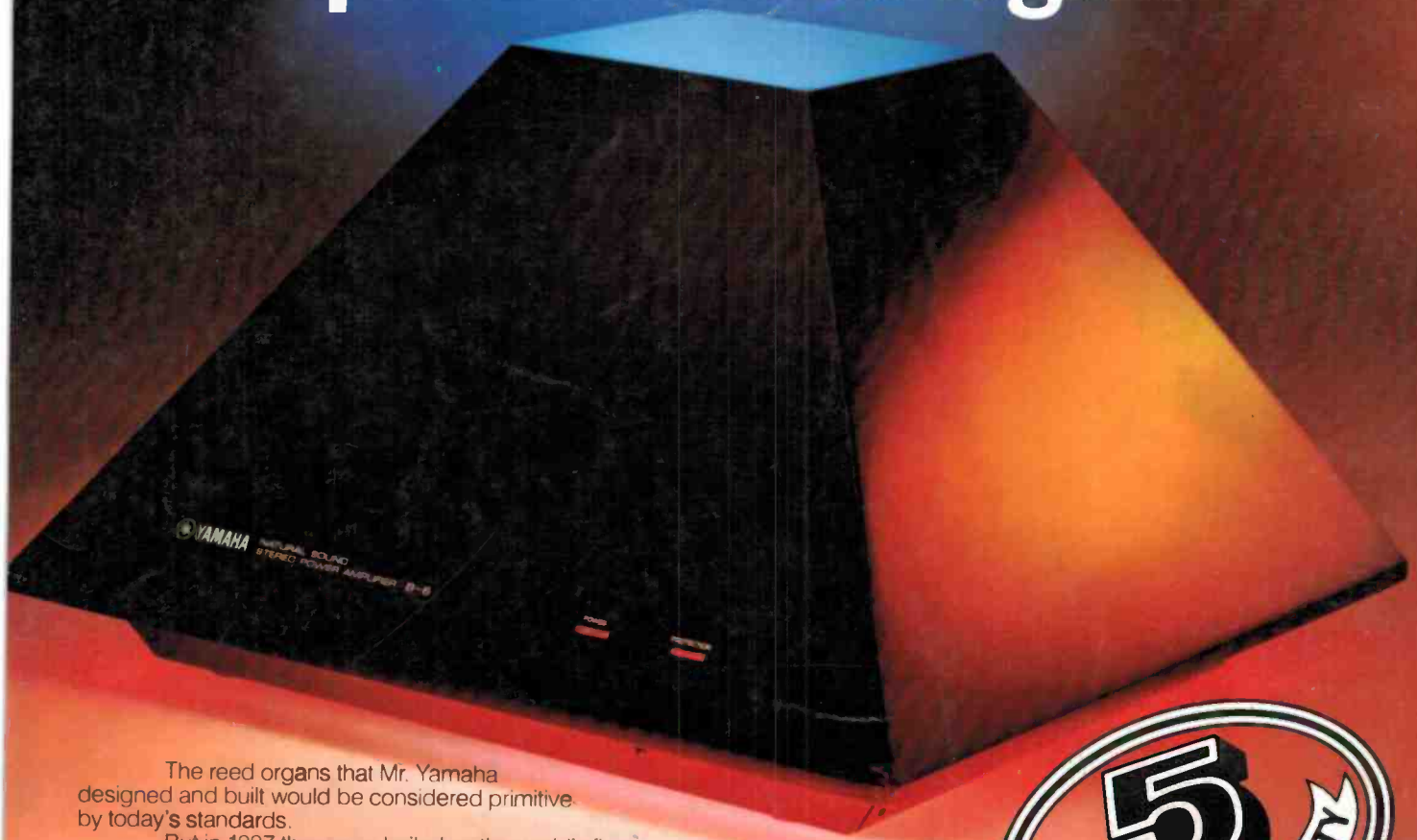
ST-JX4

The ideal companion for this tasty new amplifier is Sony's ST-JX4 synthesizer tuner. Why not make a reservation for two?

SONY®
THE ONE AND ONLY

SON 0118

This remarkable amplifier was developed over 95 years from a primitive reed organ.



The reed organs that Mr. Yamaha designed and built would be considered primitive by today's standards.

But in 1887 they were hailed as the world's finest.

Since then, Yamaha has become the world's largest maker of high quality musical instruments; from flutes to flügal horns, from clarinets to concert grands.

But our audio equipment is perhaps our proudest achievement.

The pyramid-shaped B-6 amplifier illustrated above for instance, is just as much 'state-of-the-art' now as Mr. Yamaha's reed organs were 95 years ago. And though technology has changed, the Yamaha principle hasn't.

All of our audio equipment, just like our fine musical instruments, is designed, crafted and ruthlessly tested by musicians. Just like our reed organs almost a century ago.

Indeed, the trained ear rather than a computer will always be the final arbiter of perfection.

And naturally the perfection that our musicians require and that our heritage demands, cannot be achieved by cutting corners or trimming costs.

Which may explain Yamaha's premium pricing and the full five year warranty we give all our audio equipment.

Simply, Yamaha precision audio equipment will reward those whose passion for perfection matches their means with a lifetime of the finest, most natural sound reproduction.

5 FIVE YEAR WARRANTY

Please send me the latest Yamaha Hi-Fi Catalogue

Name _____

Address _____

_____

Send to: Yamaha Hi-Fi Catalogue,
Rose Music Pty. Ltd., 17-33 Market Street,
South Melbourne Vic. 3205

YAMAHA Music Land

MCR/RM3863E