AUSTRALIA'S NUMBER ONE ELECTRONICS MAGAZINE

ELECTRONICS AUSTRALIA

JUNE 1984 AUST $2.30 NZ $2.75

Registered by Australia Post
— publication No. NBP0240.

COMPUTERS: What to look for

Cruise control for cars

$599 Yamaha CD player review

VHF AMATEUR TRANSCEIVER

FOR QUALITY, PERFORMANCE & VALUE, AARON MUST BE YOUR FIRST 'SCOPE CHOICE

(and for after sales service too!)

1 BS601 - 20MHz/5mV with Built-in Component Tester

$525 *ex tax $607.60 tax paid*

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

2 BS810 - 100MHz/1mV with 4 Channels and 8 Traces

$2295 *ex tax $2708.10 tax paid*

- 2nS/div max sweep time
- Alternate time base with B ends A mode • Variable trigger hold-off
- Independent position controls
- Signal delay

3 BS625 - 45MHz/1mV with Signal and Timebase Delay

$998 *ex tax $1154.80 tax paid*

- Single sweep • Trigger delay
- 7.7nS risetime • X, Y, Dual, Chop, Add, Subtract etc

4 BS310S - 15MHz/2mV Battery Portable

$745 *ex tax $862.00 tax paid*

- Ideal for field service use
- 2 hour operation from built-in NiCads • Automatic re-charging
- Auto trigger free run • TV sync

5 BS320 - 15MHz/2mV with Digital Storage and DMM

$2295 *ex tax $2708.10 tax paid*

- Built-in 3½ digit multimeter
- Digital storage mode • Trigger delay • X-Y mode component tester • 3 channel operation for 3-phase measurements

6 BS635 - 35MHz/1mV with Alternate and Delayed Timebase

$795 *ex tax $920.00 tax paid*

- 21 range timebase • 100mS-1uS trigger delay • Front panel trace rotate • Multi-mode display

Optional carrying cases available for all 'scopes.

Coline Probes

A comprehensive range of probes and accessories is available. Modular types have pencil slim heads and detachable earth leads. They offer excellent pulse responses and very wide bandwidths. A comprehensive catalogue is available on request.

SP100 - 100MHz Probe

$25 *ex tax $29.00 tax paid*

With x1, ref, x10 positions. 1.5m lead, BNC connector and selection of tips in heavy duty pouch.

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

SOLD & SERVICED IN AUSTRALIA BY

ELMEASCO
Instruments Pty. Ltd.

NEW SOUTH WALES
15 Macdonald Street
MORTLAKE
P.O. Box 30, CONCORD
NSW 2137
Tel: (02) 736 2888
Telex: AA25887

VICTORIA
21-23 Anthony Drive
MT. WAVERLEY
P.O. Box 107, MT. WAVERLEY
VIC 3149
Tel: (03) 233 4044
Telex: AA36206

QUEENSLAND
243 Milton Road
MILTON
P.O. Box 2360, BRISBANE
QLD 4001
Tel: (07) 369 8688
Telex: AA44062

SOUTH AUSTRALIA
99 King William Street
UNLEY
P.O. Box 1240, ADELAIDE
SA 5001
Tel: (08) 271 1839
Telex: AA88160

WESTERN AUSTRALIA
P.O. Box 95, GOSNELLS
WA 6110
Tel: (09) 398 3362

N.S.W. Ames Agency 699 4524 • George Brown 519 5855, (049) 69 6399 • Davred 267 1385 • DGE Systems (049) 69 1625 • Macelec (042) 29 1455 • Radio Despatch 211 0191 • Sheridan Electronics 699 6912 ***N.T.*** Thew & McCann (089) 84 4999 ***A.C.T.*** George Brown (062) 80 4355 ***VIC.*** Browntronics 419 3986 • G.B. Telespares 328 4301 ***QLD.*** Colourview Wholesale 275 3188 • St. Lucia Electronics 52 7466 • Electronic Shop (075) 32 3632 • W.G. Watson (079) 27 1099 • Nortek (077) 79 8600 • ECQ Electronics 376 5677 • Northern Circuits (070) 51 9063 • Fred Hoe & Sons 277 4311 ***S.A.*** Redarc Electronics 278 7488 • Trio Electrix 51 6718 • Protronics 212 3111 ***W.A.*** Atkins Carlyle 321 0101 ***TAS.*** GHE Electronics (002) 34 2233 & (003) 31 6533.

bankcard

AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE

ELECTRONICS AUSTRALIA

Volume 46, No. 6, June 1984

On the cover

Two contributed projects share the limelight this month: a versatile cruise control, and an up-to-the-minute VHF amateur transceiver from Dick Smith Electronics. Construction begins on pages 44 and 58.

Features

Hifi, Video and Reviews

Projects and Circuits

Personal Computers

Columns

Departments

VHF Amateur Transceiver

Are you an amateur wanting to upgrade your two-metre gear? This up-to-the-minute transceiver comes as a kit and is yours for just $199. Construction starts on page 58.

What's coming?

Next month, we intend to publish details of a vintage shortwave receiver featuring 1930s triode valves and plug-in spiderweb coils. Watch for it in our July issue (see also p.147).

DFM Adaptor for Function Generator

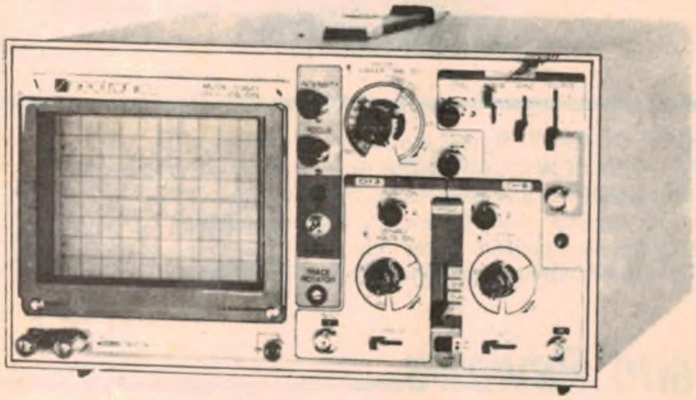
This add-on board let's you use the EA Function Generator (April '82) as a 300kHz DFM. As a bonus, it drastically improves the linearity of the coarse frequency control. (p.68)

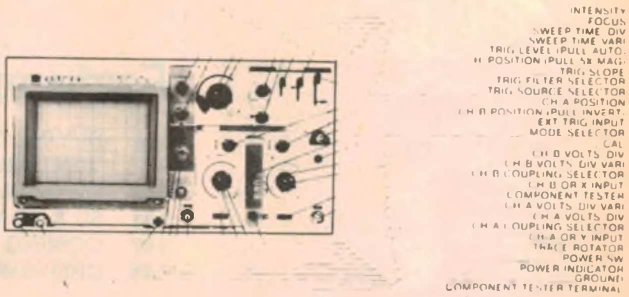
Buying your first computer

Many thousands of people have bought personal computers and many more would if they knew what computers were all about. Our article on page 12 offers some practical advice.

IN STOCK NOW

MORE SCOPE... LESS MONEY.





$465.00 TAX FREE

Price Breakthrough

The Neotronics Model OS620 is a powerful 20MHz dual trace oscilloscope with performance and features normally found on scopes costing $200-$500 more. We sell at lower profit margins and import directly from the manufacturer. You reap the benefit!!

Compare the Features

The Neotronics OS620 is a precision measuring instrument. The tube is 150mm flat screen/internal graticule type with 2kV acceleration potential. The bandwidth is a full 20MHz on both channels. Others offer round faced tubes, plastic graticules, less bandwidth, yet cost more! Intensity modulation is built in. By importing directly we offer you the best value on the Australian market.

$536.80 INC. TAX

Built-in component tester

The component tester allows you to make full use of the OS620. With no additional test gear, you can check resistors, capacitors and zener diodes as well as trouble shoot solid state circuits. Testing signals are available via the COMP. TEST terminals.

Probes included in price.

Probes included

Most users will need a set of probes. These are sold as very expensive 'extras' with some other brands – often costing over $60.00 a pair (we think this is a bit like selling a car and then saying it's extra for the tyres!). The Neotronics OS620 comes complete with a pair of high quality probes.

Check these specs

- Vertical sensitivity: 5 mV/div to 10 V/div. 11 ranges
- Operating modes: ch-A, ch-B, dual, add, invert ch-B.
- Rise time: 17nsec
- Time base speed: 0.5µsec to 0.5s/div. 19 Ranges (plus 5X mag.)
- Trigger source: Int, ch-A, ch-B, line, ext and auto.
- Trigger coupling: AC, HF reject, TV line and TV frame.
- X-Y operation: Ch-A becomes Y axis, Ch-B becomes X axis.
- Trace rotation on front panel.

neotronics

FOR HIGH TECHNOLOGY ELECTRONICS

314 Lower Plateau Road, Avalon NSW
2107 Australia PO Box 289, Newport
NSW 2106. Phone: (02) 918 8220.
Telex: AA 70842

DELIVERED ANYWHERE IN AUSTRALIA FOR $7.50

BUY DIRECT AND SAVE

Prices correct and goods expected in stock at time of going to press

Phone on the Hotline

(02) 918 8220

Avoid disappointment. Order your OS620 by Bankcard or MasterCard on the phone. Just call up, reverse the charges and we'll take your order. Shipping is only $7.50 anywhere in Australia – including packing and insurance.

Full 12 month warranty. Your OS620 is fully guaranteed for a full year.

ELECTRONICS
AUSTRALIA

EDITOR
Leo Simpson
B. Bus. (NSWIT)

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

EDITORIAL CONSULTANT
Neville Williams
F.I.R.E.E. (Aust.) (VK2XV)

TECHNICAL STAFF
John Clarke, B. E. (Elect. NSWIT)
Colin Dawson
Robert Flynn

ART DIRECTOR
Merton Jones

PRODUCTION
Danny Hooper

SECRETARIAL
Christine Cleary

ADVERTISING MANAGER
Selwyn Sayers

CIRCULATION MANAGER
Alan Parker

Editorial and Advertising Office
57 Regent St, Chippendale 2008.
Phone (02) 699 3622 Telex 25027.
Postal Address: PO Box 163, Chippendale, 2008.
Advertising Sales Manager: Sel Sayers.
Melbourne — 392 Little Collins St, Melbourne 3000. Phone (03) 602 3033.
Representative: Matt Kennedy
Adelaide — Charles F. Brown & Associates Ltd, 178 Fullarton Rd, Dulwich 5065
Representative: Sandy Shaw (08) 332 7711.
Perth — 454 Murray Street, Perth 6000.
Representative: Ashley Croft (09) 321 8217.

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

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

Registered by Australia Post — publication No. NBP0240.
ISSN 0313-0150
*Recommended and maximum price only.

Editorial Viewpoint

Anyone for a three-year battery?

Few people would decry the increasing evidence of electronics in today's cars. As time goes on we are sure to see the process accelerated as the auto makers try to meet the requirements for more reliability, more economy and power and less pollution.

Already, features such as alternators, hybrid voltage regulators and breakerless ignition systems have proved their worth. They are reliable (on most cars anyway), seldom require adjustment and work better than the old systems they replace.

In the future we shall see more cars with computers for engine management and diagnostics. Electronic fuel injection will become commonplace. And luckily, in view of the shortage of competent technicians to service this equipment, the new technology is very reliable.

Does this mean that car electrical systems are super-reliable these days? Sadly, the answer is no. While the electronic components are reliable the side is being increasingly let down by the battery itself. The truth is that "they don't build 'em like they used to."

It is becoming more common for batteries to fail while they are just a few months old. They just drop dead. Technicians shake their heads and drop in a new one. Some have theories such as "It's the air-conditioners. They beat the hell out of batteries". Others maintain that batteries don't last because of the simpler construction.

Whatever the reason, it is a ludicrous situation. There is no reason why the average auto battery cannot be made to last three or four years or much longer. Nor need the cost be much higher.

Car makers had better realise that it is no use putting in all the technology if the battery is going to drop dead in six months. The public is being short-changed.

The AM stereo debacle

Earlier this year an announcement was expected from the Department of Communications concerning AM stereo. In an editorial in the October 1983 issue I stated the desirability of deciding on one system. We did not want the same botch-up as occurred in the USA. There, the four competing AM stereo systems have been left to fight it out.

In Australia, the situation is less clear cut. About 30 stereo exciters have been purchased with some stations buying two different systems. Harris is leading in numbers sold. Some 14 stations were running experimental stereo transmissions during May but these were due to stop at the end of the month.

This month, all concerned are due to come together in a working party to consider results so far and make a decision. The committee members are from the Department of Communications, the Federation of Australian Radio Broadcasters, the Special Broadcasting Service, the Public Broadcasting Service of Australia and the Australian Broadcasting Corporation.

Let us hope that they can come to a quick decision. What is important is that they decide on one system. This will remove doubt and let AM stereo broadcasting go ahead. It will also allow the local manufacture of AM stereo tuners to develop which will be good for employment in Australia.

Leo Simpson

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

Copyright. All rights reserved.

Information is furnished in this magazine without responsibility for its ultimate use or for any failure of equipment to operate as expected, or for any damage, loss or injury which may be sustained. Patents may apply to devices or arrangements depicted in this magazine. Material intended for publication is submitted at the sender's risk and while care will be taken, responsibility for any possible loss will not be accepted by "Electronics Australia".

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

GO FOR IT!

Dick Smith Electronics is Australia's Electronics Supermarket bar none! We won't be beaten on value or service, here's why . . .

Amazing Bargain!!

NEW

Hey! Calling all FT101ZD owners - and anyone else looking for an absolute bargain! FV101DM Digital VFO's - original price over $200 ...huge scoop purchase now only $99 each! Standard 5 - 5.5MHz output, 10 memories, optical coupling, digital keypad, etc. etc. - they should be adaptable to suit most HF transceivers. Hurry in for this one - don't say you weren't told!

Cat D-2948

$99

Manufacturer's surplus stock... you reap the benefit!

Giant Rubber Feet Pack

As used by giants everywhere. 25mm diam., 20mm high. With steel insert for strength. Use on b-i-g projects, appliances, jumbo jets, etc.

Pack of 4 for 60c

Cat H-1738

Fantastic Replacement Speaker

7 x 5 inch oval speaker, ideal for cars, etc. Impedance - 8 or 15 ohms. 5W power rating.

Slashed to just $4.50 each!! (Buy 5 or more and they're just $4.00 each!) Cat A-7137

Huge shipment of distressed stock arriving mid June...see next months mags for details and grab some while they last!

Build a deluxe 70cm Preamp Kit

NEW

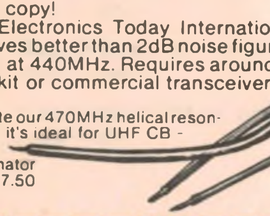
Here's great value: an easy-to-build and even-easier-to-get-going receiver preamp for 70cm. Pull in those stations you never knew were there. It really can make the difference between a noise and a great copy!

As described in Electronics Today International May 1984 issue, achieves better than 2dB noise figure with around 18dB gain at 440MHz. Requires around 12V @ 5mA. Ideal for kit or commercial transceivers.

Cat K-6306

CB Version - substitute our 470MHz helical resonator in above kit and it's ideal for UHF CB - with similar specs!

470Mhz Helical Resonator
Cat L-1860 $7.50



$19.95

NEW

Get a load of these new computer connectors...while stocks last!

9 Pin Plug	P-2684	$2.20
9 Pin Socket	P-2685	$2.90
Backshell to suit	P-2686	$1.95
15 Pin Plug	P-2687	$2.95
15 Pin Socket	P-2688	$3.95
Backshell to suit	P-2689	$3.50

PLUS our existing range:

25 Pin Plug 'D' type	P-2690	$3.95
25 Pin Socket 'D' type	P-2691	$4.75
Backshell to suit	P-2692	$2.5C
57-30360 Printer Plug	P-2680	$19.95
57-403360 Printer Socket	P-2681	$15.95

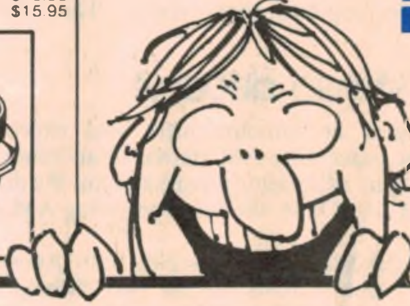
For a Dashing Dashboard!

12V Bezel

Bezel in dashboard tells thief there's an alarm - so he tries another car! Most alarms have flashing circuitry built in - lamp rated at 12V.

Cat S-3510

95¢



$299 'Go anywhere' 2M Hand Held FT203R

Small enough to go in the briefcase, the back-pack, anywhere! Fully detachable battery pack for instant replacement, full 144-148MHz coverage in 10kHz steps plus 5kHz up switch. A must for the amateur on the go! Cat D-3500

Accessories for your FT203R:

Headset Mic/phone
Gives complete hands-free VOX operation. Lightweight and comfy. Cat C-4200 **$29.00**

Speaker Mic
For mobile or base use, gives external PTT too. Ideal for noisy locations. Cat C-1112 **$39.00**

Mounting Bracket
Hangs over car window, holds the FT203R securely with access to all controls. Cat D-3501 **$19.50**

KEYBOARDS!!

UNBELIEVABLE SCOOP PURCHASE!
AIR FREIGHTED DIRECT FROM SILICON VALLEY

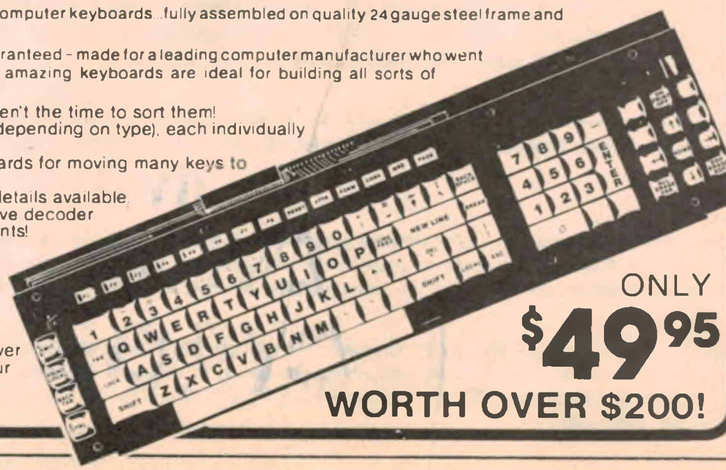
World famous 'Cherry' brand computer keyboards...fully assembled on quality 24 gauge steel frame and fibreglass PCB!

Absolutely brand new and guaranteed - made for a leading computer manufacturer who went broke (don't they all?) these amazing keyboards are ideal for building all sorts of computer projects.

- ★ 4 different types - we haven't the time to sort them!
- ★ Between 77 & 103 keys (depending on type), each individually switched!
- ★ Provision on some keyboards for moving many keys to different locations!
- ★ Matrixed output - matrix details available.
- ★ Some keyboards even have decoder chips and other components!
- ★ Buy two keyboards, use the switches from one to make up a massive 117 key keyboard in some types!

Cost original manufacturer over $100 each . . . worth over $200 normally . . . look at our ridiculous price!

Cat K-3621



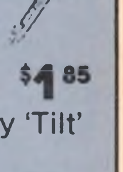
ONLY **$49.95**

WORTH OVER $200!

Alarming Switches!

Reed Switch

The old faithful! Actuated by magnet, extremely reliable switch for all alarm systems. Tiny size is ideal for concealment, too. L-5215



$1.85

Mercury 'Tilt' Switch

For boot/bonnet switches or tow-away sensors, etc. Mercury ball makes contact when tilted.

$1.50 Cat S-1935

Stick it in!

Vehicle Alarm Switch

Normally closed switch opens when door is closed. Ideal for alarms or interior lights, etc. Two in a pack.

Cat L-5256

$1.80

NEW

OWN A VIDEO?

Sick of the lousy sound most videos give you? Now you can build a kit to fix it – and what's more, get synthesised stereo as well!! Yes – a graphic equaliser specifically intended for video use: now you can really get the most from your video!

- Suits ALL VCR's
- Easy-to-build kit.

$49.95

Cat K-3422

TELEX

IT'S OFFICIAL . . .

DICK SMITH ELECTRONICS CONFIRMED NUMBER ONE . . . 250 STORES AND RE-SELLERS ACROSS AUSTRALIA AND NEW ZEALAND . . . 75,000 REGULAR MAIL ORDER CUSTOMERS . . . 1 MILLION DOLLARS SALES EACH WEEK GIVING CUSTOMERS THE ADVANTAGE OF MASSIVE BUYING POWER . . . THE WIDEST RANGE OF PRODUCTS FROM COMPONENTS TO COMPUTERS AND EVERYTHING IN BETWEEN . . .

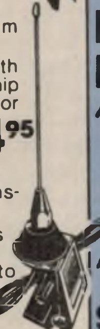
NO OTHER COMPANY COMES CLOSE TO DICK SMITH ELECTRONICS . . . DON'T BE FOOLED BY MISLEADING CLAIMS AND STATEMENTS . . . DICK SMITH ELECTRONICS IS STILL NUMBER ONE IN AUSTRALASIA . . .

MESSAGE ENDS

NEW

Go Mobile . . .

Our kit antennas make it easy! And you'll save heaps by doing it yourself!!



VHF

(suits new 'Commander' 2m transceiver)

Deluxe Gutter Gripper with low-loss co-ax, plus VHF whip & cutting guide ready for two metre mobile.

$24.95

Cat D-4024

UHF

(suits 70cm 'Explorer' transceiver)

Gutter Gripper base plus low-loss co-ax, whip & cutting guide similar to above. A must for 70cm!

Cat D-4014 **$24.95**

No leak! Rechargeable!

12V Gel Cell

What happens if the crook cuts the car battery wire? The alarm goes off – if you have this back-up battery fitted! Cunning isn't it? 2.6Ah cap., 12V.

Amazing value!

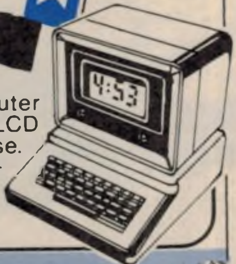
$24.95

Cat S-3320

NEW

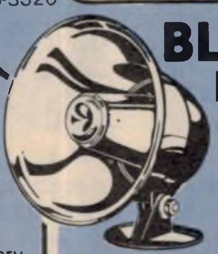
COMPUTER TIME

Want to be a two or three computer family? Try this one! Novelty LCD clock inside a tiny computer-shaped case. What a great gift idea too. Don't miss out – limited stocks.



Cat Y-1039

$4.95



BLOW YOUR HORN!

Make a noise!

Deluxe horn speaker is ideal for alarms. Very efficient, makes a real din with siren in alarm itself. Cat C-2705

$10.25

NEW

BUILD THE BEST CAR ALARM IN AUSTRALIA!

Every possible feature to protect your car – even provision for battery back-up!

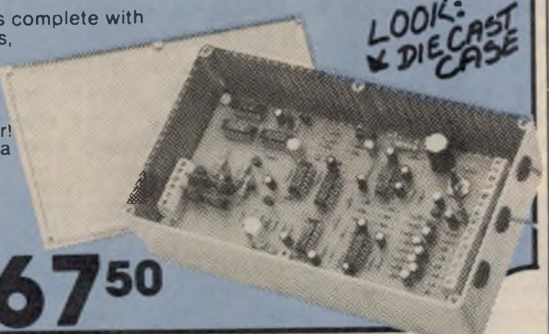
* As described in Electronics Australia May 1984 – scores 9 out of 10 (the BEST commercial units score only 8!)

The Dick Smith Deluxe Car Alarm kit comes complete with a die-cast case – essential for use in a car. Don't buy el cheapo kits in plastic boxes!

And our kit is complete with ALL switches, sensors, dash bezel, front panel and quality horn speaker! Nothing extra to buy!

Cat K-3252

LOOK: DIE CAST CASE



$67.50

AT LAST! TOP QUALITY PASSIVE I/R SENSOR

SWISS MADE

NEW

We've waited for a while to find these top quality units (not like a lot of inferior types you can find elsewhere!) Passive Infra Red sensor is by far the best type of sensor for your alarm – wind, curtains, etc. won't be set off.

Senses body heat from across a room – extremely sensitive and effective!

Add on to any alarm system for real protection!

Cat L-5010

$119

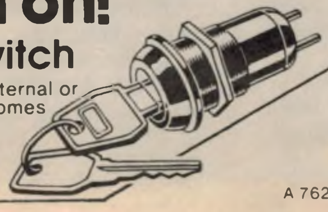
Switch it on!

Barrel Key Switch

Use with any alarm for internal or external key control. Comes complete with two keys.

Cat L-5290

$7.25



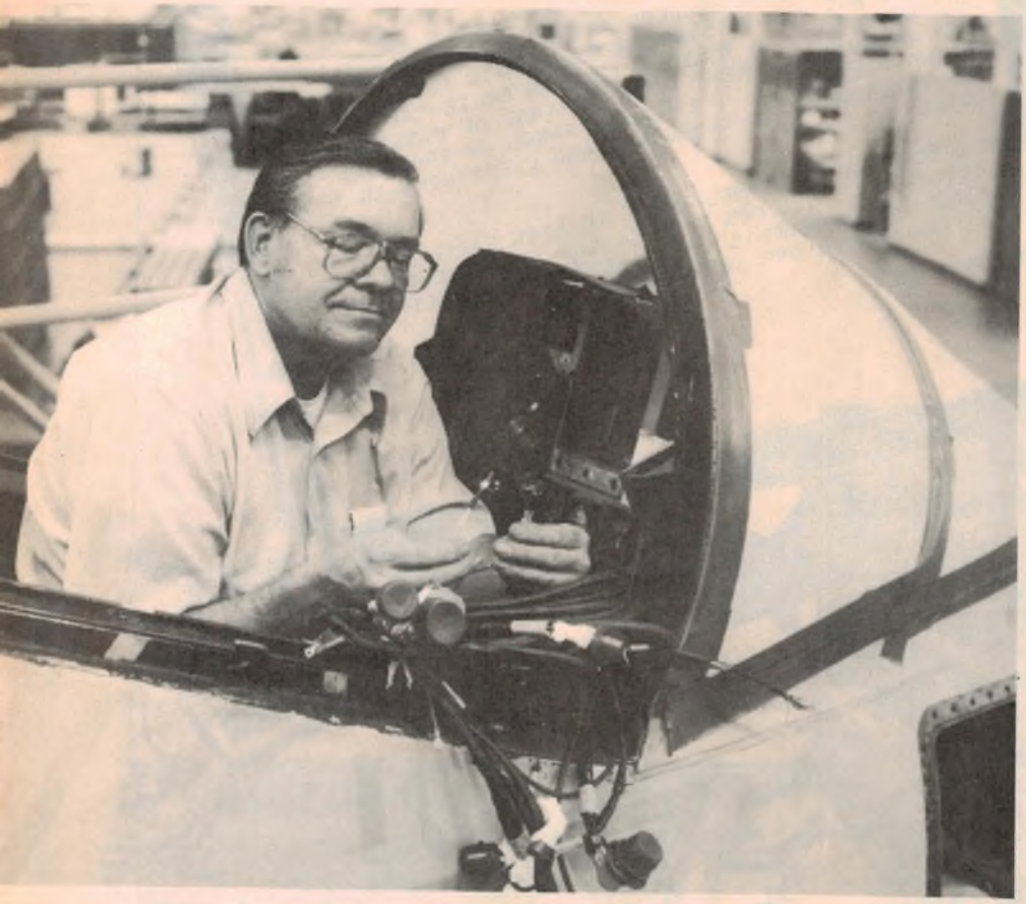
No. 1 in Australasia!

DICK SMITH ELECTRONICS

A 762/KT. GT

See page 108 for address details

News Highlights



First fibre optics for combat aircraft

The McDonnell Douglas Corporation is building the first combat aircraft to be equipped with fibre optics in place of electrical wiring. The fibres are used in the radio equipment of the McDonnell Douglas AV-8B Harrier II, the US Marine Corp version of the British Harrier vertical-takeoff-and-landing jet.

Fibre optics are much lighter and more compact than conventional cables but can transmit immense amounts of information. Data equivalent to a set of encyclopeadias (about 40 million words) can be transmitted over a fibre optics system in just 16 seconds.

Optical fibres are also immune to electrical interference from external sources such as lightning and ground-based and airborne radar transmitters. They do not themselves interfere with other electronics aboard the Harrier.

The photo above shows McDonnell Douglas technician Mr Arkie Hilborn installing fibre optic cables in the cockpit of an AV-8B Harrier at the company's St Louis plant.

Australia Telescope for bicentenary

In December, 1988, on the 200th anniversary of the arrival of the First Fleet, Australia could well set out on another voyage of discovery, reaching across 20 billion years of history from the sensitive receivers of the giant Australia Telescope project.

In 1988, antennas at Culgoora near Narrabri and Siding Spring mountain near Coonabarabran in NSW will be connected by microwave links with the existing 64-metre diameter dish of the Parkes radiotelescope. The result will be an "aperture synthesis" radiotelescope with a range and sensitivity equivalent to a single dish 300 kilometres across.

The project has been organised by the CSIRO Division of Radiophysics with backing from the Federal Department of Science and Technology. It will provide an advanced tool for scientists of the 1990s and into the 21st century. It is one of the most exciting developments in Australia's long history of innovation in radio and telecommunications and as such has been endorsed by The Australian Bicentennial Authority as an official commemorative activity for 1988.

The designers of the $30 million Australia Telescope aim to probe some of

New videodisc player uses solid-state laser

Hitachi has begun advertising, in the United States, a new laser video disc player which uses a semiconductor laser rather than the fragile helium/neon laser tubes of other players.

Hitachi research engineers had to overcome the problem of fluctuations in the output of the laser caused by temperature variations.

Applications of semiconductor lasers in video disc players should allow the production of more compact, reliable units and ultimately a reduction in the price of the players.

Preparations for IREECON '85 underway

IREECON '85 will be the 20th International Convention and Exhibition staged by the Institution of Radio and Electronics Engineers Australia (IREE Australia). The biennial event has grown steadily since its inception in 1938 to become Australia's largest and most comprehensive exhibition of professional electronics equipment.

Even at this early stage much of the floorspace for the exhibition has been allocated, while scores of technical papers are being prepared. The Conventions are held alternately in Sydney and Melbourne, with the 1985 convention to be held in Melbourne around the theme "The Australian Position in the New Era of Communications".

Further information on preparations of IREECON '85 is available from Heather Harriman, Executive Officer, The Institution of Radio and Electronic Engineers Australia, PO Box N127, Grosvenor Street, Sydney, 2000. Phone (02) 29 4051.

Pictured at the endorsement ceremony for the Australia Telescope are Dr David Armstrong (left), General Manager, The Australian Bicentennial Authority, and Dr Robert Frater, Australia Telescope Project Director, CSIRO.

the major problems of modern astrophysics. The flexibility of the system will enable scientists to use a wide range of radio frequencies to explore stellar phenomena.

Dr Andrew Pik of the Radiophysics Division of the CSIRO says, "The Parkes telescope will have outlived its usefulness by the 1990s. But when it becomes part of the Australia Telescope it will gain a new lease of life. It will enable us to delve deeper into the cosmos and to resolve its finer details and thus help to unlock the mysteries of the universe".

Footnote: Culgoora, the main site of the Australia Telescope, is also the site of the CSIRO's radio heliograph, which has worked in collaboration with the Solar Max satellite recently repaired by the crew of the Space Shuttle *Challenger*.

National Semiconductor settles with Government

National Semiconductor Corporation has announced that it has accepted an agreement with the United States government to dispose of civil and criminal liabilities arising from a probe into National's testing and certification of military standard microcircuits supplied between 1978 and 1981.

The agreement covers 40 charges filed by the government charging National with falsely certifying that all required testing on certain military and aerospace devices had been performed. National agreed to pay a $US247,000 fine, costs of $US105,000 and $US1,405,000 in damages and civil penalties to the government.

Charles E. Sporck, president of National Semiconductor, said of the settlement "We will be pleased to finally resolve this entire matter. It is important to us that the Government's investigation did not uncover any instances in which undertested devices had failed in the field".

According to Sporck, after the irregularities in test procedures were discovered in 1982 National implemented strict controls to ensure that all testing would be performed to full military specifications. "This error will not recur. We now follow every jot and every dash of every military specification," he said.

Dual sound TV broadcasting begins

Two television stations, in Sydney and Melbourne, recently began dual-sound, or stereo broadcasting, following approval of alterations to equipment by Mr Michael Duffy, the Minister of Communications.

Announcing the commencement of dual sound broadcasting Mr Duffy said: "The start of stereo broadcasts represents yet another advance in communications technology. At the moment there are only a limited number of stereo receivers on the market, but this number can be expected to increase rapidly. The stereo transmissions will enhance people's enjoyment of such programs as concerts and films. The second sound channel can also enable a station to transmit programs in an alternative language to that on the video version, or provide spoken data".

TCN Channel 9 in Sydney and GTV Channel 9 in Melbourne began stereo transmissions at the end of March.

This new stereo sound TV set from Blaupunkt features a 67cm picture tube.

Since then several other TV stations, including WIN-4, Wollongong, NSW, have been granted approval, and a number of others, including ATN-7, Sydney, are expected to be given approval within a few weeks.

News Highlights

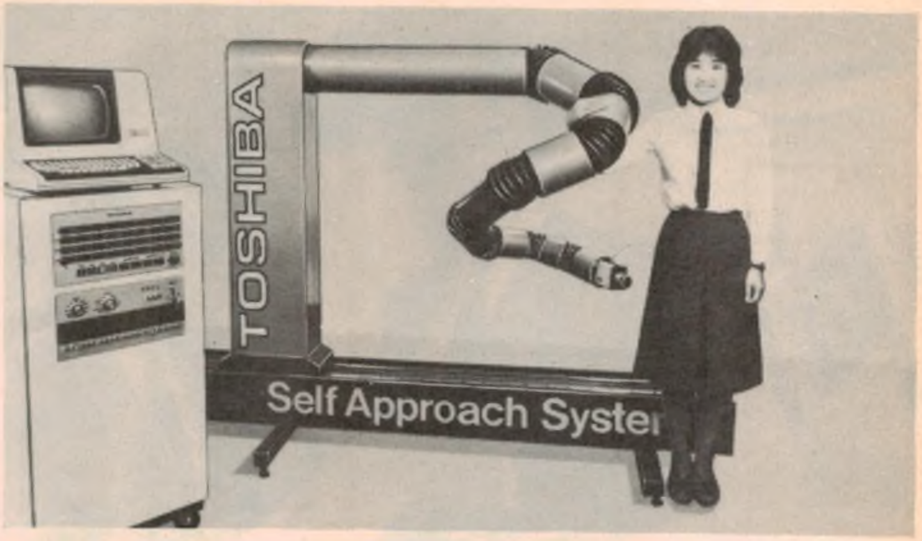
US "supercomputer" R&D

The US Defence Department is budgeting $US600 million for supercomputer research and development over the next five years. Included in the total is funding for a new national software institute to be set up near a major university.

The Department's effort last year to increase support for a major national "fifth generation" computer project has met with little success in Congress. Several influential spokesmen called it a "road show" which appealed only to those already interested in the subject and did nothing to explain the importance of the research to a public "already concerned with cuts for funding of federal social welfare programs".

Solar cell shipments boom

Shipments of photovoltaic solar cell modules boomed last year with an estimated 133% increase. Solar cells with a capacity equivalent to 21.7MW were fabricated and distributed, compared to 9.3MW in 1982. Most of the increase is ascribed to American solar projects financed by tax concessions and the Japanese use of solar cells in consumer products such as calculators.



Robots versus the Japanese workforce

The worm, it seems, is about to turn! The "worm", in this case, is the Japanese worker, and the subject of his wrath is the increasing use of industrial automation. Until recently this area of Japanese industry has appeared, outwardly at least, to be relatively trouble free, but it has suddenly run into a wall of resistance from human workers.

Half-a-million workers in the electrical machinery industry have said they will not co-operate in any more automation schemes unless they receive guarantees on job security, retraining, and safety conditions. The Federation of Electric Machine Workers Unions, representing the workers, wants guidelines on the use of robots written into labour contracts this year, the first time such a demand has been made by a major group of unions.

The unions have called for more consultation before the arrival of new labour-saving robots and are seeking guarantees of job security and work safety. The call for industry-wide guidelines follows one landmark agreement between the management and 74,000 workers at Japan's Nissan Motor Company.

That agreement calls for plans for the use of robots to be shown to workers first, prevents the company from dismissing any worker whose job is taken by a robot, and guarantees that working conditions for humans will not deteriorate in robot factories.

Nissan has nearly 1,000 robots operating in its car factories, and Japan's overall production of industrial robots is expected to grow by 25% this year, with 30,000 automated machines being built.

Expansion of Australian microelectronic research

The Minister for Industry and Commerce, Senator John Button, officially opened new microelectronics research facilities at the Royal Melbourne Institute of Technology in April.

The new facilities have been installed with the assistance of the Commonwealth Government's Special Research Centre scheme.

A Joint Microelectronics Research Centre was established with a $2 million grant to two institutions, the University of NSW and RMIT in February 1982. At RMIT the grant has been used to undertake major improvements to microelectronics laboratories, to purchase key equipment, and to recruit full time research and technical staff.

The RMIT Microelectronics Technology Centre conducts research and development in three main areas: research into semiconductor materials and production processes; development of computer-aided design tools, skills and software for integrated circuit production: And the establishment of a silicon chip manufacturing facility. Researchers have already achieved results of international significance in the areas of ion implantation and the "doping" of silicon, a "stiching" process which improves the adhesion of thin films of metal to other materials, and in the production of gallium arsenide integrated circuits.

The Government funding and the new facilities at RMIT "has given an enormous boost to Australian microelectronics research. It has facilitated the build up of a professional research team, and access to top-class laboratories" says Dr Jim Williams, director of the RMIT Microelectronics Technology Centre.

"By selecting areas of research which are specifically geared towards Australian expertise, and are commensurate with Australian industry, it is possible, for the first time, to both compete and collaborate with leading overseas laboratories. For instance, RMIT has strong collaborative links with Bell Telephone Laboratories and recently IBM announced a major research agreement with the Research Centre at the University of New South Wales. Such international collaboration allows Australian scientists to keep abreast of rapidly changing high technology", he said. (See New Highlights, EA April 1984 for details of the IBM agreement).

MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER

ACTIVE ELECTRONICS

4 KING STREET SANDRINGHAM VICTORIA 3191 PH (03) 561 2103

10% DISCOUNT FOR 10 UP OR MORE OF ONE TYPE SEMICONDUCTOR

20% DISCOUNT FOR 25 UP OR MORE OF ONE TYPE SEMI-CONDUCTOR

7400

7400	.48
7402	.48
7403	.48
7404	.48
7406	.95
7407	.95
7408	.48
7410	.48
7411	.48
7414	.60
7416	.55
7417	.77
7420	.60
7421	.60
7425	.48
7426	.50
7427	.51
7430	.48
7432	.48
7437	.54
7438	.48
7440	.48
7451	.48
7454	.48
7472	.72
7473	.63
7474	.55
7475	.67
7476	.60
7483	.78
7485	.82
7486	.54
7489	4.50
7490	.67
7492	.66
7493	.70
7495	.75
7496	.96
7497	1.50
74107	.84
74123	.72
74125	.65
74154	1.82
74157	.65
74161	.88
74190	1.35
74191	.98
74365	1.20
74366	1.20
74367	1.20
74368	1.20

74LS00

74LS00	.58
74LS01	.48
74LS02	.48
74LS03	.46
74LS04	.48
74LS05	.48
74LS08	.50
74LS10	.46
74LS11	.46
74LS13	.42
74LS14	.65
74LS20	.42
74LS21	.43
74LS27	.46
74LS30	.50
74LS32	.58
74LS33	.42
74LS37	.60
74LS38	.48
74LS42	.67
74LS47	.72
74LS48	.98
74LS51	.48
74LS54	.48
74LS73	.60
74LS74	.72
74LS75	.77
74LS76	.72
74LS83	.78
74LS85	.84
74LS86	.53
74LS90	.72
74LS93	.72
74LS95	.75
74LS109	.74
74LS112	.64
74LS123	.95
74LS125	.67
74LS126	.72
74LS132	.78
74LS138	.82
74LS139	.82
74LS151	.75
74LS153	.72
74LS154	2.20
74LS156	.84
74LS157	.88
74LS160	.96
74LS161	.96
74LS163	.84
74LS164	.84
74LS165	.96
74LS173	.96
74LS175	.75
74LS190	1.30
74LS191	1.15
74LS192	.94
74LS193	.96
74LS194	.96
74LS195	.84
74LS221	.95
74LS240	1.50
74LS241	1.80
74LS244	1.80
74LS245	2.10
74LS251	.80
74LS253	.96
74LS257	.80
74LS258	.80
74LS259	1.80
74LS266	.80
74LS273	1.50
74LS279	.55
74LS283	1.10
74LS365	.75
74LS366	.90
74LS367	.65
74LS368	.65
74LS373	1.70
74LS374	1.70
74LS377	1.80
74LS390	1.10
74LS393	1.10
74LS629	5.50
74LS640	2.20
74LS670	1.70
81LS95	2.40
81LS97	2.40
81LS98	2.40

74F00

74F00	.79
74F02	.79
74F04	.79
74F08	.79
74F10	.98
74F11	.98
74F20	.88
74F32	.96
74F64	.96
74F74	.89
74F86	1.40
74F109	.99
74F138	1.80
74F139	1.90
74F151	1.90
74F153	1.80
74F157	1.90
74F158	1.90
74F175	2.90
74F181	4.50
74F182	3.00
74F189	7.00
74F190	4.20
74F191	4.20
74F194	2.60
74F241	3.50
74F243	4.20
74F244	3.72
74F251	2.35
74F253	2.00
74F257	2.40
74F258	2.40
74F352	2.30
74F353	2.40
74F373	4.20
74F374	4.20

74S00

74S00	.60
74S02	.72
74S03	.62
74S04	.60
74S05	.62
74S08	.60
74S10	.60
74S11	.65
74S20	.60
74S30	.72
74S32	.82
74S40	.90
74S51	.60
74S64	.66
74S74	.70
74S86	.85
74S112	1.10
74S132	.85
74S135	1.90
74S136	2.60
74S138	1.15
74S139	1.35
74S151	1.26
74S153	1.32
74S157	1.32
74S158	1.15
74S161	4.50
74S174	1.50
74S175	1.30
74S188	3.60
74S189	4.70
74S253	1.40
74S257	1.30
74S258	1.40
74S283	5.20
74S287	3.00
74S288	3.50
74S289	5.00

74C00

74C00	.60
74C02	.60
74C04	.60
74C08	.60
74C10	.58
74C14	.78
74C20	.60
74C30	.60
74C32	.58
74C42	2.00
74C48	1.65
74C73	.83
74C74	1.10
74C83	2.05
74C85	2.20
74C86	.60
74C89	5.50
74C90	1.75
74C93	1.80
74C95	1.60
74C107	1.20
74C150	5.50
74C151	4.20
74C154	5.40
74C157	3.10
74C160	1.80
74C161	1.50
74C163	1.50
74C164	2.00
74C165	2.00
74C173	1.50
74C174	1.50
74C175	1.50
74C192	1.70
74C193	1.50
74C195	1.65
74C221	2.55
74C240	3.10
74C244	2.90
74C373	3.60
74C374	3.20
74C914	2.20
74C920	7.50
74C922	5.40
74C923	7.20
74C925	7.80
74C926	7.90
74C927	7.20
74C928	9.00
74C941	2.50

4000

4000	.40
4001	.55
4002	.55
4006	.78
4007	.45
4008	.90
4009	.80
4010	.80
4011	.45
4012	.45
4013	.84
4014	.95
4015	1.10
4016	.60
4017	1.20
4018	.80
4019	.60
4020	1.40
4021	1.20
4022	1.00
4023	.50
4024	.95
4025	.60
4026	1.20
4027	.90
4028	.95
4029	1.20
4030	.60
4034	2.70
4035	1.10
4040	1.30
4042	.90
4043	1.10
4044	1.20
4046	1.50
4047	1.50
4048	.80
4049	1.00
4050	.70
4051	1.20
4053	1.50
4060	1.20
4066	.80
4068	.55
4069	.55
4070	.55
4071	.55
4073	.55
4075	.55
4076	.95
4077	.58
4081	.55
4082	.55
4093	.38
4411	15.00
4502	1.50
4503	1.00
4508	2.50
4510	1.20
4511	1.50
4512	1.50
4514	2.60
4515	1.95
4516	1.50
4518	1.50
4520	1.50
4521	2.60
4526	1.50
4527	1.70
4528	1.70
4538	1.50
4553	4.00
4569	2.70
4583	1.20
4584	.90
4585	1.05
9368	1.70
9370	3.40

LINEAR ETC.

ADC0800	19.50
ADC0804	5.50
ADC0808	15.00
AY-3-1015	6.50
AY-3-8910	10.00
BR1941	11.50
BR1943	12.00
CA3028	2.50
CA3039	2.10
CA3059	5.80
CA3081	1.50
CA3130	1.75
CA3130T	1.95
CA3140	.95
CA3140T	1.92
CA3146	2.70
CA3401	.99
DAC0800	3.95
DAC0808	4.50
DM8121	2.50
DM8130	5.20
DM8131	3.50
DS8869	1.80
DS75110	1.50
DS75150	1.80
DS75154	1.50
DS75451	1.10
DS75452	1.00
DS75453	1.00
DS75454	.66
FD1771	21.00
FD1791	37.00
FD1793	41.00
FD1795	41.00
ICM7555	1.85
L120	3.50
L121	3.50
LF347	2.20
LF351	.65
LF353	1.40
LF356	1.65
LF357	2.60
LF398	4.80
LM10CH	6.50
LM307	.65
LM310	3.60
LM311-14	2.70
LM318	2.70
LM319	2.90
LM322	2.50
LM325	4.80
LM329	1.10
LM334	2.00
LM3352	2.90
LM3362	1.80
LM349	2.16
LM358	.78
LM374	4.80
LM380-8	1.40
LM380-14	1.40
LM381	3.00
LM382	2.30
LM383	2.10
LM386	1.80
LM387	1.60
LM394CH	5.60
LM565	3.20
LM566	2.10
LM567	1.10
LM1830	3.20
LM2917-14	3.50
LM3080	1.30
LM3089	2.90
LM3900	.95
LM3905	2.00
LM3909	1.60
LM3911	2.00
LM3914	4.50
LM3915	4.50
LM3916	4.50
LM4250	2.90
MM5303	6.50
MM5837	3.50
MM58167	14.00
MN3001	13.90
MSM58372	15.00
NE530	2.30
NE558	2.30
NE571	2.80
NE5534	1.85
NE5534AN	2.60
OM321	12.00
OM350	9.30
SAB0600	7.20
SN76477	7.50
SN76488	10.50
TL061	1.40
TL062	1.80
TL071	1.30
TL072	1.65
TL074	3.60
TL075	3.40
TL081	.60
TL082	1.30
TL084	2.70
TR1602	7.10
TR1863	6.70
TR1983	10.00
UA301	.65
UA301H	1.70
UA308	.77
UA311	.89
UA311H	1.50
UA324	.90
UA339	.82
UA348	1.40
UA393	.75
UA555	.55
UA556	1.20
UA710	.75
UA711	.90
UA723	.66
UA723H	1.20
UA725	2.90
UA739	1.20
UA741	.55
UA741H	1.15
UA747	1.40
UA1458	.55
UA1488	.96
UA1489	.96
UA2901	.96
UA3086	.75
UA4136	1.70
UAA180	4.30
ULN2003	1.45
WD1393	64.00
WD1691	17.50
XR2206	5.95
XR2207	5.28
XR2208	4.00
XR2211	6.80
XR2216	2.80
XR2240	3.00
XR2243	2.90
8T26	2.70
8T28	2.80
8T95	2.20
8T96	2.30
8T97	2.30
11C90	14.00
95H90	14.50

MICRO

2102	5.00
2112	8.50
2114	2.80
2532	10.20
2708	5.90
2716	4.40
27128	43.00
2732	6.95
2764	11.40
4116 150NS	3.50
4164 150NS	9.80
6116P3	9.90
6502	10.20
6502A	10.70
6520	4.20
6522	9.00
6522A	11.70
6532	11.80
6545	21.00
6551	17.00
6800	6.70
6802	9.60
6809	14.50
6810	4.20
6820	4.20
6821	3.70
6840	6.60
6844	15.50
6845	14.00
6850	3.50
6852	4.20
6854	10.30
6875	12.00
68B00	9.80
68B21	4.90
68B40	10.50
68B45	17.50
68B50	4.90
68B54	17.00
8080	6.90
8085A	10.90
8155	9.50
8202A	59.00
8203	65.00
8212	3.80
8214	9.50
8216	3.70
8224	4.90
8226	3.70
8228	8.90
8243	9.00
8251A	8.90
8253	6.50
8255A	6.20
8257	12.00
8259	11.00
Z80CPU	5.15
Z80ACPU	5.80
Z80BCPU	11.20
Z80PIO	5.15
Z80APIO	5.60
Z80SIO	14.50
Z80ASIO	15.00
Z80CTC	5.15
Z80ACTC	6.40
Z80DMA	14.60
Z80ADMA	16.00
8741A	39.00
8748-8	35.00
8749	54.00
8755A	39.00

VOLT REGS

LM337T	2.34
LM337K	6.80
LM338K	8.80
LM350K	6.30
LM350T	4.50
LM396K	18.90
LM79L05	.70
LM79L12	.72
LM79L15	.72
SH1605	19.80
UA317T	1.45
UA317K	4.25
UA309K	2.10
UA494	5.00
UA7805	.95
UA7805K	2.16
UA7806	1.00
UA7808	.90
UA7808K	2.40
UA7812	.94
UA7812K	2.50
UA7815	.90
UA7815K	2.40
UA7818	.90
UA7818K	2.40
UA7824	.90
UA7824K	2.40
UA78H05K	8.95
UA78H12K	9.90
UA78HGKC	10.80
UA78L05	.60
UA78L12	.60
UA78L15	.60
UA78P05K	15.70
UA78S40	3.50
UA7905	.95
UA7905K	2.35
UA7908	.96
UA7908K	2.40
UA7912	1.20
UA7912K	2.40
UA7915	1.30
UA7915K	2.40

OPTO

4N25	1.20
4N26	1.20
4N28	1.20
4N32	1.40
4N33	1.50
4N35	1.80
MCT6	1.90
MCT2	1.50
FND500	1.98
FND507	1.80
FND800	4.00
BPW50	2.00
CQY89	.85
MOC3020	3.10
MOC3021	3.10
MAN72A	1.70
MAN74A	1.70
FPT100B	3.40

LEDS

3mm GREEN	.15
3mm RED	.09
3mm YELLOW	.15
5mm GREEN	.15
5mm RED	.09
5mm YELLOW	.15
RECT. RED	.25
RECT. GREEN	.25
RECT. YELLOW	.25

DIODES

IN4148	.04
IN914	.04
IN4002	.08
IN4004	.09
IN4007	.12
IN5404	.28
IN5408	.30
OA47	.43
OA90	.17
P600G	
6A400V	.35
OA91	.30
OA95	.32

BRIDGES

VJ448	
10A400V	2.16
BR154	
15A400V	3.40
BR254	
25A400V	3.80
BR354	
35A400V	4.30
P04	
6A400V	1.50
RS204	
2A400V INLINE	.96
SB204	
2A400V	.75
W04	
1.5A400V	.50

ZENERS

5.1V 1 WATT	.22
5.6V 1 WATT	.22
6.8V 1 WATT	.22
10V 1 WATT	.22
12V 1 WATT	.22
12V 5 WATT	.75
75V 1.3 WATT	.90

TRANSISTORS

AC127	.70
AC128	1.20
AC187	.90
AC188	1.60
AD149	2.70
AD161	2.40
AD162	2.40
BC107	.40
BC108	.40
BC109	.40
BC177	.34
BC178	.34
BC179	.34
BC327	.29
BC328	.29
BC546	.20
BC547	.20
BC548	.20
BC549	.20
BC556	.20
BC557	.20
BC558	.20
BC559	.20
BC637	.45
BC639	.40
BC640	.40
BCY71	.80
BD139	.55
BD140	.55
BD233	.60
BD237	.60
BDV64B	2.80
BDV65B	2.80
BF115	.70
BF167	.75
BF173	.70
BF180	1.10
BF184	.80
BF198	.22
BF199	.22
BF337	.86
BF458	.72
BF459	.87
BF469	.97
BF470	1.20
BFY90	1.20
BU126	2.90
BU208	3.50
BU326A	2.90
BUX80	4.60
MFE121	2.00
MFE131	2.00
MJ802	6.50
MJ15003	5.20
MJ15004	5.20
MJ2955	1.65
MJ4032	9.50
MJ4035	11.20
MJ4502	5.20
MJE340	.80
MJE350	1.30
MJE700	.70
MJE800	.70
MJE2955	2.20
MJE3055	2.20
MPSA05	.22
MPSA06	.22
MPSA14	.24
MPSA56	.21
MPF102	.60
MRF901	3.20
TIP31C	.60
TIP32C	.75
TIP41C	1.10
TIP42C	1.25
TIP120	.84
TIP122	.90
TIP125	1.20
TIP2955	1.90
TIP3055	1.60
2N301	4.50
2N2219A	.60
2N2222A	.60
2N2646	.96
2N2647	2.60
2N2904	.73
2N2905A	.73
2N2906	.73
2N2907A	.60
2N3019	.70
2N3053	.65
2N3054	2.20
2N3055	1.30
2N3440	1.20
2N3441	2.60
2N3566	.20
2N3567	.20
2N3569	.20
2N3640	.20
2N3641	.20
2N3642	.20
2N3643	.20
2N3644	.20
2N3646	.20
2N3704	.25
2N3771	5.00
2N3773	5.50
2N3819	.80
2N3866	1.26
2N3904	.24
2N3906	.24
2N4032	.77
2N4033	.84
2N4250	.22
2N4355	.26
2N4356	.26
2N4360	.80
2N4401	.30
2N4402	.30
2N4403	.30
2N4416	1.40
2N5088	.20
2N5089	.24
2N5179	1.60
2N5190	.90
2N5191	.90
2N5192	1.00
2N5193	.90
2N5195	.90
2N5245	.90
2N5303	4.70
2N5401	.40
2N5457	.80
2N5458	.80
2N5459	.80
2N5461	1.20
2N5485	.80
2N5486	.90
2N5590	16.50
2N5591	18.50
2N5770	.25
2N5777	1.30
2N5944	15.00
2N5946	19.50
2N6027	.80
2N6084	22.00
2N6121	.90
2N6123	.90
2N6125	.90
2N6126	.90
2N6129	1.50
2N6130	1.90
2SC1061	.80
2SD350A	5.00
2SJ49	6.50
2SK134	6.50

SCR & TRIACS

C103D	.85
C106D	.96
C122D	1.80
C122E	2.30
C230D	6.80
SC141D	1.40
SC146D	1.95
SC151D	2.85
ST4	.60

TANTALUM

1UF/35V	.25
22UF/35V	.29
33UF/35V	.29
47UF/35V	.29
1UF/35V	.29
1.5UF/35V	.32
2.2UF/35V	.34
3.3UF/35V	.78
4.7UF/35V	.60
10UF/35V	.80

ELECTRO PCB

1UF/50V	.15
2.2UF/25V	.15
4.7UF/25V	.15
10UF/25V	.15
33UF/25V	.15
47UF/25V	.15
100UF/25V	.20
220UF/25V	.27
330UF/25V	.40
470UF/25V	.50
1000UF/16V	.45
1000UF/25V	.60
2200UF/25V	1.20

ELECTRO AXIAL

47UF/63V	.20
1UF/63V	.20
2.2UF/63V	.20
3.3UF/25V	.20
4.7UF/25V	.22
10UF/16V	.24
10UF/25V	.26
10UF/63V	.28
22UF/25V	.27
22UF/63V	.29
47UF/16V	.26
47UF/25V	.30
47UF/63V	.34
100UF/25V	.36
100UF/63V	.40
220UF/16V	.30
220UF/25V	.40
220UF/63V	.60
470UF/16V	.50
470UF/25V	.55
470UF/63V	.80
1000UF/16V	.65
1000UF/25V	.85
1000UF/35V	1.00
2500UF/16V	1.20
2500UF/25V	1.50
2500UF/35V	1.90
2500UF/50V	2.60
4700UF/35V	3.60

ELECTRO METAL CAN

2500UF/80V	3.50
4000UF/75V	6.50
5600UF/40V	4.50
8000UF/75V	9.00

ELECTRO BIPOLAR

2.2UF/50V	.35
4.7UF/50V	.38
6.8UF/50V	.39
10UF/50V	.40
22UF/50V	.46

GREENCAPS

.001UF/100V	.09
.0015UF/100V	.09
.0022UF/100V	.09
.0033UF/100V	.09
.0039UF/100V	.09
.0047UF/100V	.09
.0056UF/100V	.09
.0068UF/100V	.09
.0082UF/100V	.09
.01UF/100V	.09
.015UF/100V	.12
.022UF/100V	.12
.033UF/100V	.13
.039UF/100V	.13
.047UF/100V	.15
.056UF/100V	.16
.068UF/100V	.18
.082UF/100V	.18
.1UF/100V	.25
.15UF/100V	.26
.22UF/100V	.33
.27UF/100V	.34
.33UF/100V	.40
.47UF/100V	.72
1UF/250V	1.14
2.2UF/250V	2.10
3.3UF/250V	3.40
4.7UF/250V	2.80
6.8UF/250V	4.40
10UF/250V	5.90

GREENCAPS HIGH VOLTAGE

.01UF/630V	.27
.022UF/630V	.27
.033UF/630V	.27
.047UF/630V	.30
.1UF/630V	.56
.22UF/630V	.78
.33UF/630V	.98
.47UF/630V	1.30

CERAMIC

1 PF	.08
1.5PF	.08
2.2PF	.08
2.7PF	.08
3.3PF	.08
3.9PF	.08
4.7PF	.08
5.6PF	.08
6.8PF	.08
8.2PF	.08
10PF	.08
12PF	.08

STYROSEAL

56PF/630V	.25
68PF/630V	.25
82PF/630V	.25
100PF/630V	.25
120PF/630V	.25
150PF/630V	.25
180PF/630V	.25
220PF/630V	.25

* PRICES CORRECT AT TIME OF PUBLICATION BUT SUBJECT TO CHANGE WITHOUT NOTICE.

BANKCARD VIA YOUR PHONE

***NOW YOU CAN BUY YOURSELF COMPONENTS AT PRICES WELL BELOW THE NORMAL RETAIL PRICES. TO SAVE YOURSELF MONEY. SEND YOUR ORDER TODAY.**

ALL COMPONENTS ARE FULL SPEC BY LEADING MANUFACTURERS

ALL PRICES INCLUDE SALES TAX.

POST AND PACKING CHARGES.

POST AND PACKING FOR GOODS SENT BY STANDARD MAIL IN AUSTRALIA ONLY

$3 **$3**

MAIL ORDER ONLY

(NO SHOP SALES)

5¼" SOFT SECTORED

S.Side Double Density
• 525-01 $36/10

D.Side
Double Density
• 550-01 $43/10

MAIL ORDER MAIL ORDER MAIL ORDER

FOR 15¢ PHONE YOUR ORDER TOLL FREE ON 008·999·007

We will immediately confirm stock availability. We will also confirm the very hour your order will be dispatched (over 95% of orders leave the same day). **With Jet Service Delivery we deliver next day to capital cities and suburbs** — Country areas please add 24 to 48 hours. **Available bankcard holders only** — sorry non-bankcard holders must post a cheque or money order — even so, we promise to deliver quicker than any other supplier in Australia.

MICRON SUPER 80

WAS $699 in 1983

FREE CARTON OF PAPER THIS MONTH CAT D1160 (VALUE $39.50)

NOW AN INCREDIBLE **$399**

Your "Super 80" printer will enable you to print **letters, reports, graphics generated pictures**, etc and importantly for the programmer, Hard Copy of **program listings.**
Operating under software control from any general purpose micro-computer the Super 80 features **13 different print types** including emphasizd (LETTER QUALITY). **Bidirectional print action** ensures **smooth, quiet operation.**

228 ASCII Characters, Handles **4"** to **10" Paper**

STANDARD CENTRONICS INTERFACE

D1174 VALUE PACKED AT	$399.00
D1178 SERIAL INTERFACE	$145.00
D1175 SPARE RIBBON	$12.50

PROPORTIONAL JOYSTICK

SELF CENTERING

K9674
$32.50
(ETI DEC '83)

FOR THE BEE!

AT LAST AN ANALOGUE JOYSTICK
Plot X-Y co-ordinates on the screen, sign your name. A great graphics aid. Complete kit **including case,** software example.

TOP QUALITY LINED PRINTER PAPER TRACTOR FEED

AT LAST AT AN AFFORDABLE PRICE

TO SUIT SUPER 80 240mm WIDE	D1160	$39.50
380mm	D1165	$47.50

2000 SHEETS PER BOX

FREE IF PURCHASED WITH PRINTER

DIRECT IMPORT PRICE ON QUALITY JOYSTICKS

SELF CENTERING TYPE ★ HEAVY DUTY SUCTION CUPS — STAYS IN PLACE ★ SILVER PLATED SWITCH CONTACTS ★ PISTOL GRIP ★ VERY RESPONSIVE.

TO SUIT COMMODORE VIC-20, ATARI, etc.

SAVE 1/3

D1410	$12.50
D1420 FOR MICROBEE	$19.50

Superlative

MICRON SERIES II MONITORS

★ 1050 lines resolution at centre screen. ★ 22MHz bandwidth. ★ Video input impedance switch allows networking use. ★ Incredible — repeat Incredible — resolution.

Guaranteed (we mean it) to out perform any other low cost monitor in Australia.

D 1114 Micron Series II Hires	$199.50
D 1115 Micron II Non-Glare Hires	$219.50

SPECIFICATIONS:
Screen — Green phosphor. **Front Controls** — Power on/off, character brightness/intensity, display centering. **Rear Controls** — Background intensity, vertical and horizontal adjustment etc. **Input Impedance** — Switch 75/10K O. **DC Socket** — 12V DC output at 1.1 amp — power your micro direct from the monitor. **Bandwidth** — 10Hz-22MHz. **Resolution** — 1050 lines minimum at centre screen.

"MICROBEE KEYBOARD"

Full 60 Key Qwerty Computer Keyboard exactly the same type as has been used up to now with the famous Microbee Computer. SPST keys. Complete with mounting plate, all key caps etc. Fully assembled. Incredible value — Be Quick!

D1510 .... **$29.95**

Microbee is a registered trademark of Applied Technology Pty. Ltd.

MULTIPROM INTERFACE

44K OF PROGRAM STORAGE

A sensational new kit for the MICROBEE, requires no modification to the computer except for the fitting of a 50 pin expansion socket. This project is easy to build and will allow you to store and software select up to 44 K of eprom storage — acts like a mini disk drive system with the speed of RAM. Extra units may be added to further increase storage.

THE MICROBEE® KIT OF 1984

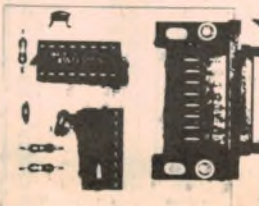
K9673 .... **$99.50**

PARALLEL INTERFACE

BUILD YOUR OWN INTERFACE AND SAVE $$$

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

K9671 .... **$29.95**



INCLUDES CENTRONICS PLUG AND CABLE

BANKCARD HOLDERS — PHONE ALTRONICS TOLL FREE 008·999·007 FOR NEXT DAY JETSERVICE DELIVERY

BANKCARD HOLDERS — PHONE ALTRONICS TOLL FREE 008·999·007 FOR NEXT DAY JETSERVICE DELIVERY

PHONE YOUR ORDER — ALTRONICS TOLL FREE 008-999-007

OR FOR 30¢ POST AN ORDER TO ONE OF ALTRONICS COMPETITIORS

— naturally you won't have a clue as to whether they've got the items you need available. And of course, be prepared to wait, wait, patiently wait sometimes for weeks!
Why waste your valuable cash? Altronics staff are waiting for your call now (up to 6pm eastern standard time).

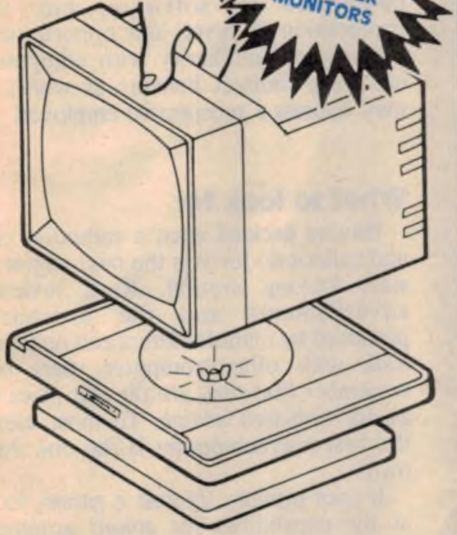
BANKCARD HOLDERS — PHONE ALTRONICS TOLL FREE 008-999-007 FOR NEXT DAY JETSERVICE DELIVERY

UNIVERSAL
MONITOR STAND
WITH PAN & TILT ADJUSTMENT

This brilliant monitor stand enables you to swivel left/right and tilt up/down ie. to position monitor to any desired position. Hence viewing position is enhanced and screen glare eliminated. Our D1100 stand is a professional, sturdy and exceedingly well engineered product designed to physically work with all stand alone monitors. Until now you would have to pay $50 or more —

Altronics direct import price is now under $30.

SUITS ALL STAND ALONE COMPUTER MONITORS



D1100 .... **$29.95**

Also suits portable TV sets eg. in hospital bedside use

FAMOUS J & M BRAND
D RANGE CONNECTORS
SAVE 25% ON BULK QUANTITIES!

EXCLUSIVE TO ALTRONICS AND DEALERS IN AUSTRALIA

	ea.	10 +	25 +
P 0880 DB 9 Male 9 Pin	2.90	2.20	1.95
P 0881 DB 9 Female 9 Pin	2.95	2.70	2.50
P 0882 DB 9 Male PCB Mnt	3.25	3.10	2.98
P 0883 DB 9 Female PCB Mount	3.95	3.75	3.60
P 0889 DB 9 Backshell Cvr	2.00	1.80	2.30
P 0890 DB15 Male 15 Pin	2.95	2.90	2.29
P 0891 DB15 Female 15 Pin	3.50	3.00	2.80
P 0892 DB15 Male PCB Mnt	3.25	3.10	2.98
P 0893 DB15 Female PCB Mount	3.95	3.75	3.60
P 0895 DB15 Backshell Cvr	2.85	2.90	2.30
P 0900 DB25 Male 25 Pin	4.50	3.95	3.60
P 0901 DB25 Female 25 Pin	4.95	4.50	3.98
P 0902 DB25 Male PCB Mnt	4.50	4.10	3.85
P 0903 DB25 Female PCB Mount	5.50	5.00	4.70
P 0905 DB25 Backshell Cvr	2.00	2.50	3.98

MASSIVE SAVINGS
FOR OEM'S!
PHONE OUR WHOLESALE DEPT
(09) 381 7233
ASK FOR STEVE

NEW MODEL DATA CASSETTE
UNCONDITIONALLY GUARANTEED TO SAVE/LOAD THE RAWEST OF DATA EVERYTIME!

D1122 .... only **$49.50**

A recorder designed solely for the purposes of data storage now at an unbelievable price
- SLIDE VOLUME CONTROL **a must** for quick checking of levels
- TAPE COUNTER **a must** for easy location of programmes
- INBUILT PIEZO TRANSDUCER **enables** you to listen audibly to tape
- 6v DC operation. USE WITH M9000 PLUG PACK **ensures** low hum level
- ROBUST CONSTRUCTION OF BOTH INTERNAL MECHANISM'S AND EXTERNAL CASE

BONUS OFFER

10 **FREE** MICRON C20 DATA CASSETTE TAPES (CAT D1141) INCLUDED WITH EVERY DATA CASSETTE PLAYER PURCHASED THIS MONTH

(NOT AVAILABLE FROM DEALERS — SHOP AND MAIL ORDER ONLY)

C20 DATA CASSETTES
Quality MICRON brand
ORDERED SEPARATELY

D1141 .... **$1.50**
(10 UP) ... ONLY **$1.25**

EPROM PROGRAMMER
(ETI JAN 83)

K9668 .... **$55.00**

versatile, low cost and easy to build. Plugs straight into the microbee I/O port. Suitable for 2716, 2732, 2532, 2732A and 2764 Eproms. Burn your games programmes and eliminate cassette loading time.
KIT FEATURES • Sockets for all other IC's • 1 • 2716 supplied — get started straight away • Front Panel and Mains (SEC approved) transformer • 28 pin and 16 pin wire wrap sockets to flush mount personality plugs (2 included) and ZIF socket (included) • DB15 Plug • Complete to last nut and bolt.
(See Review ETI AUGUST 1983)

RADIOTELETYPE DECODER
(ETI APRIL 83)

K9733 .... **$19.50**

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

NEW

MICROBEE® LIGHT PEN
(ETI AUGUST 83)

K9649 .... **$19.95**

PROVIDES DIRECT PERSONAL CONTACT WITH YOUR BEE!

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

FAX-DECODER
(ETI SEPT 83)

K9736 .... **$24.50**

This project allows you to decode the signals of shortwave stations transmitting radio facsimile weather maps, satellite pictures etc and then reproduce them on your dot matrix printer.
- Complete kit of parts includes DB15, Ribbon Cable
- SOFTWARE LISTING

BANKCARD HOLDERS — PHONE ALTRONICS TOLL FREE 008-999-007 FOR NEXT DAY JETSERVICE DELIVERY

FOR DESPATCH P&P CHARGES AND ADDRESS DETAILS PLEASE REFER TO OUR AD ON PAGE 131

Buying your first computer

Many thousands of people have bought computers for the home and perhaps many more would if they knew what they were all about. If you think you'd like a personal computer but are unsure which way to go, read on.

by PETER VERNON

Buying a computer is not a decision to be taken lightly. At the very least a small computer will set you back about $200 and that's without any of the essential accessories, programs and books that go with the hobby. A personal computer can quickly become an open invitation to spend money. How can you be sure this money is well spent?

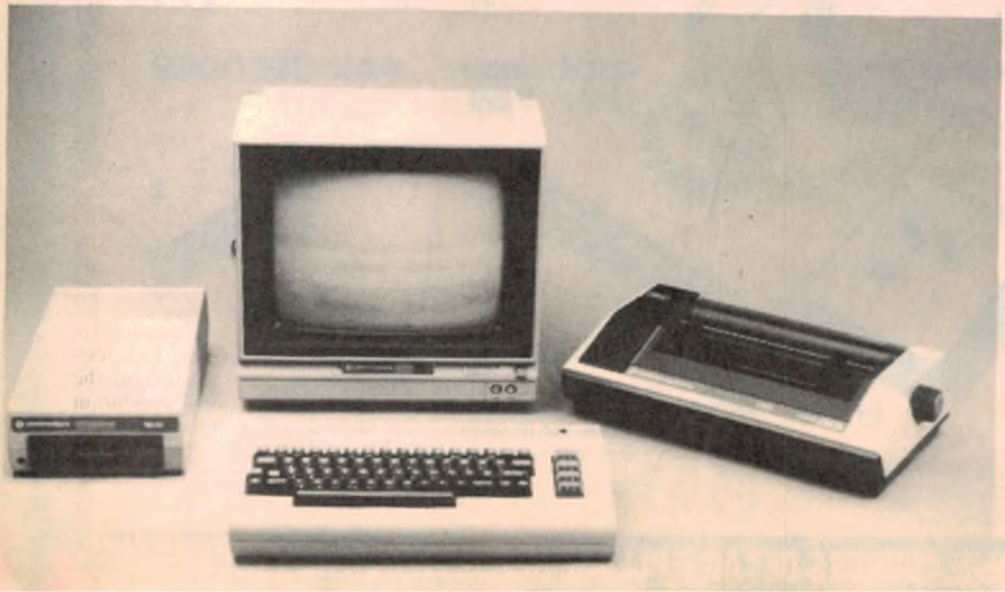
The first step is *not* to rush out to a dealer or computer store. Instead, do some work with pencil and paper to define your own requirements. What do you want a computer to do? The expected applications of a computer define what is required by way of memory size, screen display format, keyboard and accessories.

Personal computer applications

By far the most popular use of a computer in the home is to play games, with educational applications a close second. Word processing, home management, control of household appliances and communications are other uses. With the increasing number of computer clubs, owning a computer can also be an introduction to a large circle of friendly, like-minded people.

There are some things, however, which buying a computer will not do. It will not make you into an expert programmer — no more than buying a piano will make you a musician. Long hours of learning and practice are required to master anything but the simplest programming.

Nor will owning a personal computer guarantee you a job, although it can help. Some people have graduated from a computer club to working with a computer manufacturer or distributor of computers or software, but the competition is fierce and opportunities are scarce. Familiarity with computers can have indirect benefits at work, or may impress a prospective employer!



The Commodore 64 is one of the largest-selling computers in the home market. Features include 16 colour graphics, sound effects and plug-in software cartridges for games and home management applications. While it is a system with a lot of potential considerable programming effort is required to bring out the best in the machine because of the limited Basic language supplied. See EA June, 1983 for an in-depth review.

What to look for

Having decided what a computer can and cannot do for you the next step is to start looking around. Read reviews, advertisments and the brochures produced by manufacturers and retailers. Talk with other computer users but remember that they are the last place to go for unbiased advice. To most users, the best microcomputer is the one they own!

If your primary interest is games, look at the capabilities for colour graphics, sound effects, joystick facilities and available software. Although games programs are sold for computers which do not have a colour display capability, they are intended as adjuncts to other applications. Colour adds immeasurably to the impact of computer games, so if this will be the main use of your computer there is little point in going for a monochrome display.

The features required for educational uses of a computer are similar to those required for a games machine. The best educational software uses colour graphics, sound effects and interaction to maintain the student's interest. Old style "drill and practice" programs are rarely worth buying.

For word processing and information management, colour is not an essential requirement. The ability to display both upper and lower case letters and a reasonably sized text display are much more important.

The VZ-200 from Dick Smith Electronics is one of the lowest-cost systems on the market. It offers low resolution graphics in eight colours and limited sound effects but is a good starter system at around $200. The Tandy MC-10 is comparable. The July, 1983 issue of EA contains a review of the VZ-200.

The standard screen format for business word processing is 25 lines of 80 characters each. Home TV sets, even those converted for direct video entry, just do not have the bandwidth required for a legible display of this line length. It is for this reason that most low cost computers display 32 or 40 characters per line. Longer lines exclude the use of colour.

If colour is not required, a monochrome monitor or converted black and white television receiver can be used. The legibility of the display will depend on the bandwidth of the monitor. Television receivers converted for direct video entry can be used to display 64 character lines, but for a crisp 80-column display a higher priced video monitor will be required.

A video monitor is just one of the "hidden costs" of a personal computer. Prices range from around $200 to over $700 for a 34cm (diagonal) colour unit, although the experienced electronics enthusiast can save some of the cost by converting a surplus television set, as described in the August, 1983 issue of EA. As well as allowing full time use of a computer, a video monitor generally provides a sharper picture and is less prone to interference than a television set driven by an RF modulator.

Note however that some computers limit the choice of methods. Some, like the VZ-200 and Commodore 64, provide both modulated RF video and direct video output, while others such as the TRS-80 Color Computer provide only a modulated RF output, and cannot be used with a monitor unless the case is opened (voiding the warranty) and additional connections made. Others, such as the VIC-20 and TI-99/4A require an RF modulator in the form of an external box, usually supplied with the computer.

Naturally, a printer is also required for word processing applications. We won't go into the relative merits of dot matrix, thermal and daisywheel printers here, other than to point out that a printer can cost much more than the computer itself. Unless word processing is going to be you main application it is not necessary to purchase a printer immediately. Wait until the need becomes evident.

More important, however, is a place to connect the printer. A surprisingly large number of personal computers are not equipped with either parallel or serial ports but require separate "printer cards" and communications interfaces as an extra cost option. Other computers can

Tandy's TRS-80 Color Computer is available with one of two versions of Basic. Extended Color Basic is require to make use of the computer's sound and high resolution graphics capabilities. Other features include plug-in cartridge software and a range of disk operating systems.

Buying your first computer

be used only with a printer from the same manufacturer because they use a non-standard interface. Since these printers are usually more expensive than standard types, another extra cost is involved.

If your main use for a computer is to learn about hardware and design techniques, access to the circuitry of the computer is important. Adding your own devices to a computer is one of the best ways to develop an understanding of the principles of computer engineering. If this is impossible, either because the system is not readily expandable or there is no information available on the expansion facilities, the computer is not suitable for the electronics hobbyist.

Documentation is important here, however. The mere presence of an expansion port or cartridge connector is not enough unless there is sufficient information available to allow the use of the facilities. At the very least, a description of the pin-outs of the connector and the allocation of memory is required.

Discontinued last year by TI because of marketing problems, the Texas Instruments TI-99/4A is currently available at bargain prices. Features include excellent colour graphics (including 32 sprites) and sound effects, and a very good version of the Logo language. Some software in plug-in cartridges is still obtainable at dealers and the computer is supported by a very active users group with branches around Australia. This system was reviewed in the December, 1982 issue of EA.

Graphics — what's available

Graphics capability depends on two factors; the number of different colours which can be displayed on the screen and the resolution of the display. Resolution is usually expressed as the number of dots or "pixels" which can be displayed across the screen by the number which can be displayed vertically. (Pixel stands for picture element.) The more dots horizontally and vertically, the smaller the size of each dot and the greater the detail which can be displayed.

For systems costing less than $500, 16 colours and a resolution of 256 (horizontal) by 192 (vertical) are reasonable. Like most aspects of personal computers however, graphics capabilities can be expressed in many ways, some of them ambiguous. A reference to 16 colours, for example, always includes black and white as colours. There are also trade-offs between colour and resolution. Some computers restrict the use of colour in high resolution displays because of memory or processing limitations.

Computers such as the VZ-200, TRS-80 Color Computer and the MC-10 provide low resolution "chunky graphics" and boast eight colours. In actuality, the low resolution graphics mode only allows four colours to be displayed simultaneously, selected from one of two sets. Since the background of

The CAT computer from Dick Smith Electronics is one of the newest on the market. For $699 it offers limited Apple II compatibility and enhanced graphics and sound, while a $99 "soft emulator" is available to allow the CAT with a disk drive to run the majority of Apple II software. A detailed review of this system appeared in EA in May, 1984.

The Atari XL computer system forms a compatible range from the 600 to the 800 and up. The family is known for extensive colour graphics, ease of use and the availability of a wide range of software and peripheral equipment. The 600XL shown here comes with 16K of RAM, and is expandable to 64K.

the display must be one of these colours, actually only three colours are available from graphics displays.

The TRS-80 Color Computer has a higher resolution (256 × 192) graphics mode, but only two colours are available in this mode. Of the popular personal computers only the Atari, VIC 20, Commodore 64 and Texas Instruments TI-99/4A allow 16 or more colours with relatively high resolution.

Another factor contributing to ease of programming for games is the availability of "sprites"; blocks of graphics which can be defined and moved independently of the remainder of the display. Because sprites ease the task of creating animated displays they can allow "arcade quality" video games programs to be written, even in a slow language such as Basic. Used with assembly language, they allow effects which frequently surpass dedicated video games machines.

Music and sound effects

Sound effects add considerably to the impact of computer games, quite apart from the opportunities provided for learning music theory. Computer circuits for producing sound can be divided into two types — so-called "single bit" sound and those that use a separate sound generator chip.

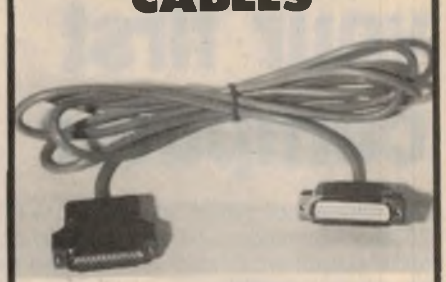
Single bit sound, as the name implies, uses one line of an output port to drive a transistor amplifier and speaker. Some systems use more than one line, however, driving and rudimentary digital to analog converter. The significant point is that the frequency and duration of the sound is controlled by the microprocessor, so all other operations come to a stand-still while sound is produced. Simultaneous sound and movement, for instance, can only be programmed with difficulty.

Computers using dedicated sound generator chips, such as the Commodore 64's "Sound Interface Device" (SID), provide a wider range of sounds, including white noise, and produce sounds simultaneously with video displays and other processing. Often the volume of the sound can also be controlled by software, unlike the single bit approach.

The other factor to be considered is the means of sound output. Methods range from incorporating an internal speaker (as in the Apple II and lookalikes) to modulating the sound onto the RF video carrier (as with the Tandy Color Computer and Commodore machines). When computers which use this method are connected to a video monitor the sound is lost unless the monitor includes a speaker and provision is made for a separate audio connection.

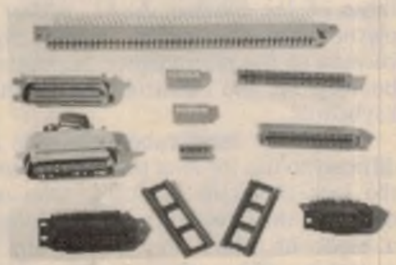
Few direct entry video monitors include an audio input (one exception is the Dick Smith monitor, actually a converted portable television set). For

PRINTER and TERMINAL
CABLES



All Serial $18.00
All Parallel $32.00
suit
OSBORNE, IBM, COMMODORE,
APPLE, KAYPRO, TANDY, etc

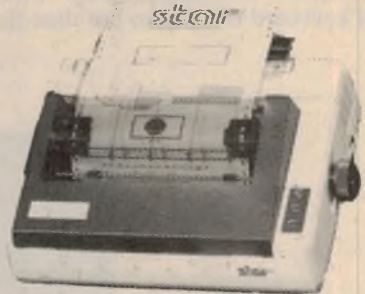
CONNECTORS
SOCKETS and CABLES



QUALITY GOLD CONNECTORS

25-way male	$2.40	36-way ribbon	$10.00
25-way female	$2.80	36-way soldier	$12.00
25-way ribbon	$9.00	40-way edge	$ 8.00
25-way coyers	$2.80	26-way edge	$ 6.50

PRINTERS



120 CPS DOT MATRIX
SAME PRICE AS 80 CPS
ONLY $545.00 incl Tax and Cable

PLEASE SUPPLY THE FOLLOWING:

. . . .
. . . .
. . . .
. . . .

BANKCARD No. . . . .
Add 10% P&P minimum $2.50

ARBITER ELECTRONICS
Shop 82, Stafford City,
Stafford Road,
Brisbane, Qld 4053

Buying your first computer

The MPF-III provides Apple II compatibility in a compact, low profile design with detachable keyboard. Features include an 80-column display, 64K RAM, printer and cassette ports and an Apple compatible hardware expansion slot. As yet however, no colour graphics are available. The February 1984 issue of Electronics Australia has a review of the system.

this reason, computers such as the VIC 20 and Commodore 64 have a separate audio output which can be connected to an external amplifier.

Keyboards

The type of keyboard available on a personal computer also affects its usefulness for a variety of roles. Generally keyboards are of three types; flat plastic membrane switches, such as those of the Sinclair ZX81, rubber or plastic buttons (so called "chiclet" style, because of the resemblance to pellets of bubblegum), and full-stroke "typewriter" keyboards.

Flat plastic membrane keyboards are difficult to use for long periods becaus of the lack of tactile feedback. One user described the sensation as "like typing on a block of wood". In an attempt to overcome this, most such systems provide an audible "beep" to indicate that a keystroke has been registered.

Half-way between flat keyboards and full typewriter style are "pushbutton" keyboards, as used by the TRS-80 Color Computer and the IBM PCjr. This type of keyboard is easier to use than the flat type and is more suitable for applications around the home.

Apart from the style of a keyboard there are very few guidelines which can be laid down. Separate numeric keypads, while convenient on office computers used for large scale data processing, are of little use on a personal computer. Far better is a cluster of cursor control keys and special function keys which can be re-defined by the user.

As long as a keyboard is comfortable there is very little to choose between alternative offerings. Any keyboard used for more than a month tends to become a natural arrangement, and one quickly becomes familiar with various quirks and foibles.

Software

The availability and method of loading software is one of the most important aspects of a computer to be used in the home. By far the best method is the solid-state ROM cartridge, which avoids the problems and delays caused by loading a program from disk or cassette.

Most of the popular low cost computers for home use are designed to accept program cartridges, but cartridges

The Australian-made MicroBee computer has attracted a lot of attention from home and educational users. This is one of the few low cost machines to offer text displays of more than 40 characters per line (almost essential for word processing) and is supplied with a range of software. The photograph shows the start-up menu of WordBee, the MicroBee's built-in word processor. The MicroBee IC model was reviewed in EA in November 1983.

MicroProfessor™

MPF-III

THE LATEST TECHNOLOGY IN 64K MICRO COMPUTERS DUAL PROCESSORS — 6502 and Z80 RUN APPLE IIe and CP/M SOFTWARE

• SMALL BUSINESS • • EDUCATION • • HOME • • HOBBY •

STANDARD FEATURES

- Runs 8 languages
- Upper and lower case
- Detachable keyboard with 90 keys
- 40/80 column (keyboard selectable)
- Centronics printer interface
- 38 tone sound generation chip
- Powerful editing features
- 4 additional expansion slots
- One key basic command entry
- 12 programmable function keys
- Numeric keypad
- RF modulator
- Cassette interface
- High and low resolution colour graphics
- 64K, RAM 24K ROM
- Comprehensive operation manual

COMPUTER AND KEYBOARD
FOR ONLY

$699*

ASK ABOUT OUR 2 PACKAGE DEALS

ACT WINCHESTER AND NETWORKING AVAILABLE

Comprehensive operational manual and programming manual supplied with each computer.
Technical reference manual available.

3 MONTHS FULL WARRANTY COMPLETE BACK UP OF SPARES AND SERVICE FACILITIES GUARANTEED BY EMONA FOR A MINIMUM OF THREE YEARS

SOFTWARE AVAILABLE
OVER 200 software programmes are readily available with a broad range of applications from business to entertainment.

* plus Sales Tax

EMTEK EX-80

Printer Bargain

$290*

- 80 characters/sec
- Dot matrix
- Bit image graphics
- Bi-directional
- Single sheet or continuous Tractor Feed
- Centronics parallel: interface (serial interface optional)
- Graphics

Print Types

† Enlarged
† Italic
† Compressed
† Underlining
† Double strike
† Sub script
† Superscript

TOP QUALITY DISC DRIVES to suit APPLE and IBM DUAL TEC DRIVES

$678*

- 5¼'' diskettes
- 40 track/drive
- Track 0 sensor
- 250 Kbytes storage/drive
- Direct DC drive motor
- Safe media protection
- Fast track to track access time
- Half track capability

ALSO AVAILABLE IN SINGLE STAND ALONE VERSION

SAKATA SP 1000

$399*

For the office the Sakate SP-1000 offers 100 CPS speed as well as the features below to make your office application more efficient.

- Clearly formed dot matrix characters — 9-11 dots
- 12 variations of character printing within the same line including graphic printing
- Paper cutting edge 2cm from printing position
- Print-on fanfold, single sheet and roll paper
- Back feeding of paper
- Bi-directional printing
- Operator replaceable print head (no special tools required)
- Longer ribbon life (2.5 million characters)
- Centronics parallel and RS-232C Serial interfaces both included.

EMONA COMPUTERS PTY LTD
"THE TECHNOLOGY HOUSE"

2nd Floor, National Australia Bank Bldg,
661 George St., Sydney, N.S.W.
Ph: (02) 212 4815 or 212 3463 Tlx: 74500

ALSO AVAILABLE FROM:

NSW GED, Gladesville 816 2211
LST Computers, Crows Nest 43 2771
ACT Electronic Components P/L 80 4654
VIC Radio Parts Group 329 7888
Advanced Technology Computers, 233 9733
WA Hinco Engineering P/L 38 4477
TAS George Harvey Electronics, Hobart, Launceston 34 2233
SA International Communications Systems P/L 47 3688
QLD Baltec Systems 369 5400

MICROPROFESSOR REG TRADEMARK OF MULTITECH INDUSTRIAL CORP APPLE Reg Trade Mark of APPLE Computers Inc. CP/M Reg Trade Mark of Digital Research Inc

at the leading edge

3″ COMPACT FLOPPY GRABS LEAD IN STANDARDS RACE

Chinon Industries of Japan recently joined the ranks of companies supporting the CF-standard. This compact 250KB (500KB in flippy mode) storage unit features low power consumption and 5¼″ compatible operation. Chinon's CF031 has a 3mS track-to-track access time and uses standard Compact Floppy media. Schools and remote recording applications will benefit from the rigid jacket and dust protection features of Compact Floppy disks.

GENERAL INSTRUMENTS' SPEECH RECOGNITION CHIP SPEAKS FOR ITSELF

Claimed to be the only real-time linear-predictive-coding-analysis chip on the market, this chip, when teamed with a micro-processor, manages both recognition and synthesis with just one reconfigurable filter. Known as the SP1000, the combo chip will work with most micro-processors and will also work with no hardware interface with the 6502 device.

WESTERN DIGITAL CORP. RIDES THE IEEE STD 488 BUS

A general purpose interface bus (GPIB) controller performs the interface function between the micro-processor and the GPIB. Western Digital's WD9914 is a second source for TI's TMS9914A. The chip automatically handles talker, listener and controller operational modes, relieving the micro-processor from bus protocol maintenance. The WD9914 features system controller service request, serial/parallel polling device, clear trigger and DMA facilities. Look for this one early 1984.

IBM® PC STYLE KEYBOARDS TO TRUE DIN PROFILE

Advanced Input Devices' packaged and encoded keyboard features ergonomically designed tactile feel keys and comes complete with curly cord. Measuring a mere 30mm in height to the home row of keys, the Ergokey Tm ED-184-243 also incorporates a two position angle adjuster. This keyboard is the vanguard for the Ergokey Tm series and is predicted to cost less than $200 plus tax in small quantities.

daneva australia pty ltd
66 Bay Rd., Sandringham, Vic. 3191
P.O. Box 114, Sandringham, Vic. 3191
Telephone: 598-5622. Telex: AA344939

Sydney: (02) E&M Electronics 51-5880
Adelaide: (08) DC Electronics 223-6946
Perth: (09) Micro Controls 445-2544
Brisbane: (07) Ballec 369-5900

daneva

®Registered trademark — International Business Machines, Inc.

Buying your first computer

intended for one type of machine are not transferable to another. The range of programs available in this form may also be limited, so it is best to assess the variety and cost of program cartridges available for a particular computer before committing yourself to a purchase.

Other programs may be distributed on disk or cassette, and in any case you'll need some form of "mass storage" to permanently retain copies of your own programs and data. The lowest cost method is to use a standard cassette recorder. Disk drives are faster, but more expensive, and are better left until you have some experience with the computer and come to feel the need for faster response time and greater storage capacity.

Be aware that some computers cannot use an ordinary cassette recorder. They require a specialised device made by the computer manufacturer and often selling for twice the price of a budget portable cassette player. The Commodore VIC 20 and 64 and the Spectravideo machines follow this practice. The VZ-200 also requires a comparatively expensive cassette player for reliable performance.

Memory size and the choice of a processor

Surprisingly, the size of a computer's programmable memory is not as important as it first appears. Most personal computer systems are provided with enough memory for typical applications, while those using software ROM cartridges can run programs without reducing the size of RAM.

Because of the low cost of dynamic RAM chips, memory sizes of 16K are most common, with expansion in increments of 16K. One "K" is 1024 bytes or characters, but because Basic programs are usually stored in a compressed form, more space is available than would first appear. Machine language programs, of course, are even more compact.

16K of memory is adequate for programming and educational applications. Word processing may require more, as a single typed page may contain around 2400 characters, limiting in-memory storage to around seven pages of text in 16K.

The Spectravideo SV-318 offers colour graphics and sound effects and a built-in joystick for $399. The graphics mode features 32 "sprites" or patterns which can be defined and moved around the screen independently of the remainder of the display, easing the task of writing fast-moving games and other display programs. The larger SV-328 does not have the built-in joystick but offers a larger, full-stroke keyboard. See EA for February 1984 for a review of the SV-318.

As important as the absolute size of a computer's memory is the use made of it. All computer operating systems require some RAM for storage of temporary variables and for display memory. What matters is "usable memory", which can be quite different from the total memory advertised. The Commodore 64, for example, is commonly advertised as a 64K system, but in fact only around 31K is usable from Basic.

The important distinction to be aware of is the difference between RAM and ROM. RAM, or Random Access Memory, holds the user's programs and data. ROM holds the computer's operating system and (usually) a Basic interpreter.

Read Only Memory size can vary between two models of the same computer. Many machines, such as the TRS-80 Color Computer or the TI-99/4A, offer two versions of Basic, one standard and the other an extra-cost "Extended" version which is required to make effective use of the computer's graphics and sound capabilities. You should be aware of which version you are getting for your money, as the most advanced facilities are usually only available with Extended Basic.

So far no mention has been made of the varieties of microprocessor chips which form the basis of all personal computers. There is a good reason for this — if a computer has the capabilities that you want, it doesn't matter which microprocessor it uses. Debates on the merits of the 6502 or Z80, or 8-bit versus 16-bit processors are irrelevant to the actual applications of a computer in the home. If a machine does the job that you want it to do, what more can you ask?

In conclusion

A computer console, cassette recorder and a television set are enough to get you started in personal computing. It is only a start, though not the end of the road (or the expense). If you intend to keep up the hobby, look for an expandable system which is well supported by software supplies and publishers.

Consider joining a computer user group, possibly even before you purchase your own computer. As a source of advice and assistance, for a subscription of around $20 per year, such groups are worth their weight in microchips!

In the end however, the decision on what sort of computer to buy is your own. The more time you put into defining your own requirements and applications, the easier the final choice will be.

4 STATION INTERCOMS

PRICES SLASHED!!

Battery operated wire connected intercoms. The economical low noise way of communicating.

Complete with connecting wire - 1 master and 3 slaves.

NORMALLY $39.95 THIS MONTH ONLY $29.95 - SAVE $10

Cat. AI-5504

CONDUCTIVE PLASTIC BAGS

Manufacturer's distress stock - you Reap the Benefit!

Jaycar has made a scoop purchase of heavy duty conductive plastic bags with inbuilt zipper closer.
Each bag measures a generous 280 high x 205 wide. They will accommodate complete S-100 boards, RAM cards etc. You can store your precious ICs in them safely. (The bag would hold hundreds of ICs).
Quantities strictly limited. First in first served.
Cat. ZB-9990

1-4 BAGS $2.00
5-9 BAGS $1.50
10 Up BAGS $1.00
(each)

50% REDUCTION ON THIS PRICE

10" ELECTRIC GUITAR SPEAKER

Quality Pioneer brand - check the specs! Check the price!!
HURRY

Impedance	8 ohms
Voice Coil dia	1½"
Power Rating	60W (RMS)
Resonant Frequency	80Hz
Sensitivity	98(dB/W)
Response	80Hz - 7,000Hz
Total Flux	61,100 Maxwell
Flux Density	8,300 Gauss
Net Weight	1,540 grams

ONLY $29.95

SCOOP!

8" CEILING GRILLES

Will they ever be this cheap again?

Once again - a massive scoop purchase with a difference. We have purchased a very large quantity of 'reject' grilles. They are rejects because they have small flaws in the mouldings. Most people however cannot pick the flaws if allowed to examine the grille. Imagine what the flaws look like *9 feet up* on the ceiling! Naturally we are offering a massive saving over normal units which we also sell. Exactly the same units (sans flaws) have been sold throughout Australia in the 10's of 000's. The perfect ones sell for around $2.95 - at least one company sells them for well over $3.00.
Cat AX-3560

FROM 99¢

PRICES INCLUDE TAX
P.A. INSTALLERS - GO FOR IT!

TAKES STANDARD 8" SPEAKERS

WHAT PRICE US?

1-4 UNITS $1.50
5-19 UNITS $1.25
20-49 UNITS $1.15
50 + UNITS 99¢

MICROBEE KEYBOARD

Full 60 key QWERTY Computer keyboard exactly the same type as has been used up to now with the famous MicroBee Computer. SPST keys. Complete with mounting plate, all key caps etc. Fully assembled - incredible value.
Cat. XA-5500

ONLY $29.95

240V CASSETTE HEAD DEMAGNETISER

We have made a massive scoop purchase of this popular item. **Normally $8.50 each**

$5.95 - SAVE $2.55

MASSIVE SAVING

Cat. AC-1600

MINI BREADBOARD

BARGAIN TIME

390 HOLES, perfect for small projects. Measures 80 x 60 mm. Several units can be made to lock together for larger breadboard configurations. Sel-adhesive back.

NORMALLY $6.95 $4.95 SAVE $2

Cat. PB-8808

NEW!!!

4½ DIGIT LCD DPM 60

★ 200mV fsd ★ Digital Hold ★ Bandgap Reference ★ 10uV Resolution ★

A new 4½ digit LCD DPM offering levels of performance, low current consumption and compact size never previously available. The DPM 60 features auto-zero, auto-polarity, a logic switched 200mV or 2V fsd, digital hold, programmable decimal points and a 1mA current consumption. Automatic low battery indication and 'continuity' flags are built into the 10mm 4½ digit display. The DPM-60 can be readily scaled by the user to indicate many different units, amps, volts, ohms etc. Supplied complete with fixing bezel, clips and connector. The DPM 60 will suit many applications calling for low-cost, high accuracy measurements in portable or bench instruments.
Cat. QP-5520

LOW BATTERY CONTINUITY
-1895.7

SPECIFICATIONS:
- ★ Accuracy 0.01% ± 1 digit
- ★ Linearity ± 1 digit
- ★ Sample/Sec - 1.6
- ★ Temperature stability - 50ppm/°C typical
- ★ Temperature range - 0-35°C
- ★ Supply voltage - 7.5 to 15V
- ★ Supply current - 1mA typical
- ★ Maximum DC input voltage - ±20V

LESS $10 JUNE
$79.95
Usually $89.95

UHF AMPLIFIER SENSATION

AMATEURS PLEASE NOTE!

15 WATTS @ 12V 420 MHz

50% OFF!!

SAVE $20!!

Jaycar has purchased a quantity of genuine Brand New MOTOROLA Brand MHW-710-1 UHF Power Amplifier modules. These units are designed for industrial and commercial FM transmitters!
The unit (pictured) is a rugged, tuned train of RF Power Amplifier transistors featuring thin film gold metal metallization, laser trimmed Nichrome resistors and MOS capacitors. The MHW-710-1 bolts to any flat surface (metal) to assist heat dissipation.

~~$39.95~~

Includes FREE amateur TV transmitter circuit and full data on device!!

ONLY $19.95

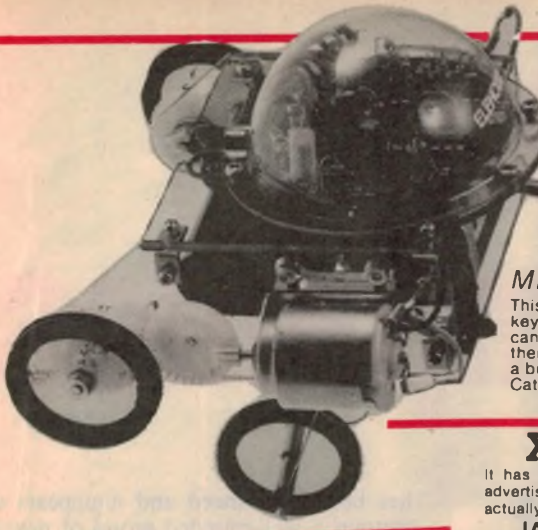
Low Cost DATA CASSETTE Player

- Mains or battery operated
- Special instructions for loading instructions into computer
- Tape counter - A MUST!
- Works as audio recorder/player as well
- Inbuilt condenser microphone
- LED recording indicator!

Cat. XC-4905

ONLY $39.95

STAGGERING VALUE!!



MICROBOTS® BACK!

We have secured another shipment of the two most popular Micro Robot kits. **SEE REVIEW IN EA MARCH '84!**

PIPER MOUSE

This 'microbot' is powered by 2 DC motors that drive wheels. When special ultrasonic whistle is blown, the unit goes left, right, straight ahead according to your command. Complete, including perspex dome cover! Be a Pied Piper! Cat. KJ-6680 **ONLY $39.95**

NOW $34.95
SAVE $5.00

MEMOCON CRAWLER

This robot is controlled by a keyboard (which is supplied). The keyboard plugs into the robot. Up to 256 discrete commands can be entered into the robots memory (RAM). The robot will then move according to programmed instructions. Lights and a buzzer can also be programmed to operate as well. Cat. KJ-6686 **ONLY $79.95**

NOW $69.95
SAVE $10.00

MICROBEE SOFTWARE SELLOUT

FIRST EVER SALE OF MICROBEE SOFTWARE!!

Save around **35%** off normal prices. Once again, if buying by mail order, please specify 2nd and 3rd alternatives so that you can avoid disappointment.

QUANTITIES ARE STRICTLY LIMITED

Cat. No	DESCRIPTION	WAS	SALE PRICE
XS7003	Mytek Monitor	$14.95	$9.95
XS7502	Microbee Concentration	$14.95	$9.95
XS7504	Microbee Z Trek	$14.95	$9.95
XS7505	Microbee Edpak 1	$24.95	$16.50
XS7508	Microbee Work a Bee	$19.95	$12.95
XS7517	Microbee Escape from Colditz	$14.95	$9.95
XS7520	Microbee Keyboard Tutorial	$14.95	$9.95
XS7521	Microbee Busy Calc	$14.95	$9.95
XS7522	Microbee Data Base	$14.95	$9.95
XS7523	Microbee Busy Bee CAI	$9.00	$5.95
XS7524	Microbee Wumpus	$14.95	$9.95
XS7526	Microbee Seadog	$14.95	$9.95
XS7527	Microbee Yahtze	$14.95	$9.95
XS7528	Morse Code Tutor B	$14.95	$9.95
XS7529	Prospector	$14.95	$9.95
XS7530	Programming Hints	$14.95	$9.95
XS7534	Graphic Life Tool Kit	$14.95	$9.95
XS7535	Millikans Experiment	$14.95	$9.95
XS7536	Cannibals & Missionaries	$14.95	$9.95
XS7541	Vipor Microbee	$14.95	$9.95
XS7542	Pools & Lotto Microbee	$14.95	$9.95
XS7545	Destroyer Microbee	$14.95	$9.95
XS7546	Coulombs Law Microbee	$14.95	$9.95
XS8000	Microbee Texted	$14.95	$9.95
XS8009	DXlog	$15.95	$10.95
XS8203	Cheapie	$15.95	$10.95
XS8404	Forth	$47.50	$29.50

XIDEX FLOPPIES

It has been brought to our attention that one major advertiser is showing a picture of XIDEX floppies but actually selling a cheaper floppy in small qauntities.

JAYCAR ONLY STOCKS XIDEX

The XIDEX disks are supplied in a magnificent snap-shut case when purchased in boxes of 10.

Cat. XC-4770 5¼" double sided double density soft sector.................................. **1-9 $5.95 ea**

Box of 10 $55.00

Cat. XC-4775 5¼" single sided double density soft sectored .... **1-9 $5.50 each**

Box of 10 $53.50

DAISY WHEEL SENSATION!!

Unbelievable price break-through for a letter-quality PRINTER!!

KEY FEATURES

- ★ Amazing LOW PRICE
- ★ 20 CPI speed
- ★ QUME Daisy Wheel Compatibility
- ★ Word Processor standard character set
- ★ Special technology to prevent "prism notch"
- ★ Centronics standard interface

GRAB ONE NOW WHILE THEY LAST! THEY COMPARE WITH $2000 PRINTERS BUT ONLY COST A FRACTION - HURRY!

Cat. XP-4620

ONLY $699

SPECIFICATIONS

Printing System:	96 spoke daisy wheel (QUME WP compatible)
Printing Speed:	20 characters per second
Character Pitch:	1/10 inch, 1/12 inch
Print Length:	12 inches
No. of Characters per line:	120 characters at 1/10 inch pitch, 144 characters at 1/12 inch pitch
Horizontal Min. Pitch:	1/120 inch
Platen Length:	13 inches
Min. Line Feed Pitch:	1/48 inch
Paper Feed System:	Friction feed
Copy Capability:	Original +3 copies
Impression Control:	Automatic 8 levels
Ribbon:	Multi strike type ribbon cartridge (QUME MULTISTRIKE IV, FABRIC IV compatible)
Ribbon Life:	400 000 characters
Interface:	8 bits narallel (CENTRONICS compatible).
Noise:	58od
Memory Buffer:	256 characters
Logic Seeking:	128 characters
Line Feed:	1 second per line (Shannon format)
Carriage Return:	0.66 second
Power Consumption:	Idling 40W, Operation 80W
Dimensions:	500(W) x 350(D) x 170(H)mm
Weight:	9.5 kg

Jaycar Incorporating **ELECTRONIC AGENCIES**

SHOWROOMS

SYDNEY
117 YORK STREET - PHONE: (02) 264 6688 and (02) 267 1614
TELEX: 72293

CARLINGFORD
Cnr CARLINGFORD & PENNANT HILLS ROAD - PHONE: (02)

CONCORD
115 - 117 PARRAMATTA ROAD - PHONE: (02) 745 3077

HURSTVILLE 121 FOREST ROAD - PHONE: (02) 570 7000

NUMBER 1 FOR KITS

POST AND PACKING CHARGES
$5 - $9.99 ($1.50) $10 - $24.99 ($3.20)
$25 - $49.99 ($4.50) $50 - $99.99 ($6.50)
$100 - $198 ($8.00) Over $199 ($10)
"Free INSURANCE for Road & Registered Post over $200"
All heavy or bulky items (over 20kg.) sent Comet Road Freight $12.00 anywhere in Australia.

SHOP HOURS CARLINGFORD, CONCORD & HURSTVILLE
Mon - Fri 9am - 5.30pm: Sat - 9am - 12pm: Thurs night 8.30pm (Not Concord)
SHOP HOURS SYDNEY
Mon - Fri 8.30am - 5.30pm. Sat - 8.30am - 12pm. Thurs night 8.30pm
MAIL ORDERS AND CORRESPONDENCE: P.O. Box 185, Concord, 2137

Mail Order By BANKCARD Via Your Phone

Venture capital for new companies

The development of new ideas and products is often hampered by a lack of money. Recent efforts by the Federal Government to establish a venture capital market in Australia will change this situation.

by MICHAEL WILKINS

The prize money has been announced, the referees are in place, the rules of play have been set and the potential players are ready to take centre stage — Australia's fledgling venture capital market is almost set to go. But what will the establishment of this market mean to the average man in the street who has a good idea and an entrepreneurial nature? What, too, will it mean to home inventors who have discovered a new product or service, but need the finance to bring it to market?

What is venture capital?

Before starting any discussion of initiatives or incentives, I think that it is important to understand what is meant by the term "venture capital". Venture capital is just what the name suggests — capital which is available for investment in worthwhile ventures. However, it is more than that — it is risk capital which is invested in companies or products which would not normally be eligible for financing by a bank or finance company. Often, these funds are invested in little more than a person or an idea.

The establishment of a venture capital market in Australia is a direct result of the Federal Government's desire for the nation to adopt a more aggressive role as an exporter of high technology products. They appear to have recognised that traditional heavy manufacturing industries can no longer provide the stimulus that our economy needs and, accordingly, have focused their attention on the development of so-called sunrise industries.

Overseas experience, particularly in the US and UK, has shown that one of the best ways to nurture the development of new high-tech products is through the operation of an efficient venture capital market. This market ensures that sufficient funds are available to develop and bring to market new and innovative products. It also helps to demonstrate to potential entrepreneurs the benefits to be derived from owning their own business and from taking a chance to back a product that they believe in.

Venture investors also need to be encouraged to take a chance. As they are making significant funds available for investment in untried persons or products, they naturally expect a correspondingly higher rate of return. However, these high returns are not always achieved and, in cases where a product is a failure, their total investment is lost. Recognising this fact, the Federal Government has introduced a series of incentives designed to encourage people to provide funds for use in venture investments.

These incentives take the form of taxation deductions and will be available to persons or companies who subscribe funds to venture capital investment companies. These companies are to be known as Management and Investment Companies (MIC's) and will be administered by a Government formed MIC Licensing Board (MICLB).

The initial membership of this Board has been announced and it appears to contain a well-rounded group of people drawn from all walks of life. The Government has indicated that $40 million worth of taxation deductions will be allowed in the first year and this amount should be extended in the second year of operation of this scheme.

These MIC's will be required to provide capital and, if necessary, management expertise to suitable "Eligible Businesses". The eligibility of businesses in which an MIC proposes to invest must be certified by the MICLB prior to this investment being made and a series of criteria have been established for this purpose. Basically, Eligible Businesses must be primarily engaged in one of the following fields: manufacturing; agriculture, forestry or fishing; producing postal, teleprinter, telephone or telegraph communications services; architectural services; computer software; consultant engineering services; traded educational and training services; scientific and technical services; data processing services.

In addition to these criteria, there are requirements for growth potential and company size. In order to be designated as an Eligible Business, a company must have:

The author is a specialist in venture finance with the Sydney chartered accountants firm Deloitte, Haskins & Sells.

- A projected average annual sales growth of more than 20% over the next three years of operation; and
- Less than 100 employees or less than $6 million in net assets.

If you feel that you and your product meet these criteria (and you must admit they are very wide) then read on. Even if you don't quite measure up to these requirements, continue reading — there's more good news.

Most companies and persons who have indicated that they have funds to invest in the venture capital market will not be constrained by the Government's criteria. What they will, however, be looking for is a person or product which they believe is viable and which has a reasonable chance of success.

The best way to make contact with a venture capitalist is through an introduction which can usually be arranged by a chartered accountant or solicitor. But before making this contact, be sure that you understand the information requirements that venture investors have and the products in which they are prepared to invest.

A business plan

Almost without exception, prospective investors will require a business plan. This document is a concise summary of your overall strategy in regard to your product, the amount of funding needed to develop and support that product, and the persons who will assist you to ensure that your product will be a success. Ideally it should include:

- a complete description of the product and its manufacture;
- resumes of all people involved in the project, including those who are to be involved in the day-to-day running of the business;
- market statistics (eg market size and segmentation);
- information regarding potential competitors and their products;
- details regarding potential customers (eg persons who have indicated a need for and an interest in purchasing your product);
- research and development information.
- regulations or laws (including relevant patent and copyright information) which may affect your product;
- type and amount or funding required and the uses which are to be made of it.

As much of the information to be included in a business plan is of a highly complex nature, particularly in regard to the financial projections, it is not uncommon for a consultant to be employed to assist with its development. A chartered accountant can usually assist with this preparation, or can arrange to introduce you to persons who can assist you.

What about research?

If you are thinking of seeking venture financing to develop your product, it is useful to be aware of the stages at which venture capitalists will become involved. Due to the limited amount of funds presently available in Australia for venture investment, large quantities of research and development (R&D) funds (seed capital) are not available. Rather, venture capitalists will be more willing to examine proposals which are based on a proven working model or prototype of the item which is to be produced. They are more likely to become involved with a product which has already been technically proven as they believe these products will have a better chance of success.

Recognising the need to promote the development of products at their conceptual or R&D stage, the Federal Government and various State Governments have made available a number of grant and loan schemes. Probably the best known of these is the Industrial Research and Development Grant which provides up to $60,000 for eligible expenditure on research and development projects.

A number of similar grants and subsidies are available and a chartered accountant will be able to advise you regarding the steps necessary to obtain these.

In conclusion

What does all of this mean for the person with a good idea or product and the desire to develop it? It means that now, more than ever, is the time to seek funds to develop these products. Through a series of direct incentive grants and the encouragement that is being given to the establishment of a venture capital market, the Federal Government is actively seeking to place Australia in the forefront of the development of new technology.

The Government, in its plan to encourage Australian innovation, appears to have catered for all types of products at all stages of development. The criteria as to what constitutes an Eligible Business is exceedingly broad and the incentives being offered to people willing to invest in MICs are very generous.

Recognising, however, that these MICs may not always provide finance for ideas which are still on the drawing board or in their early stages of development, the Government has established R&D and numerous other encouragement schemes. As mentioned earlier, now is the time to reap the benefits made available by the provision of these sources of finance. All that is needed is a supply of innovators who are willing to take a chance on themselves and their product and who have the desire and character to succeed!

ROD IRVING ELECTRONICS

425 HIGH ST, NORTHCOTE 3070 VIC PHONE (03) 489 8866

GREAT KITS FROM ROD IRVING ELECTRONICS

PARABOLIC MICROPHONE $15

Build a low cost parabola, along with a high gain headphone amplifier to help when listening to those natural activities such as babbling brooks, singing birds or perhaps even more sinister noises. The current cost of components for this project is around $15 including sales tax, but not the cost of batteries or headphones.

EA NOVEMBER '83

TV PATTERN GENERATOR $25

Make sure your TV is up to the mark with this low cost Pattern Generator which uses just seven ICs and gives three patterns: Dot, crosshatch and blank raster. The current cost of parts for this project is approximately $25 which includes sales tax but not the cost of a modulator or 9V mains plugpack.

EA NOVEMBER '83

GREAT VALUE

ETI-268 NICAD FLOAT CHARGER

$9.00 ETI MARCH '83

Keep your NiCad batteries in tip-top condition with this cheap, simple charger.

ETI-1512 ELECTRIC FENCE TESTER

$24.50

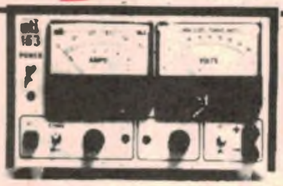
ETI FEB '83

No more checking the 'feel' of a fence with a blade of grass (and maybe ending on your . . .) This project tells you how much your fence energiser delivers and can be used for fault-finding on a fence.

ETI-1516 MODEL ENGINE IGNITION SYSTEM $41.50

ETI JUNE '83

Get sure starts every time and no more glow plug burnouts on your model engines.



ETI MAY '83

ETI-163 LAB SUPPLY $169

ON SPECIAL THIS MONTH

Fully variable 0–40 V current limited 0–5 A supply with both voltage and current metering (two ranges: 0–0.5 A/0–5 A). This employs a conventional series pass regulator, not a switchmode type with its attendant problems, but dissipation is reduced by a unique relay switching system switching between taps on the transformer secondary.

ETI-668 MICROBEE EPROM PROGRAMMER $47.50

ETI FEB '83

Simple, low cost programmer for the MicroBee can program 2716s, 2732s and 2764s.

ETI-153 TEMP PROBE

$19.95

ETI JUNE '83

Can measure temperature from −50°C to +150°C. It simply plugs into your multimeter—great for digital multimeters. Accuracy of 0.1°C resolution of 0.1°C.

ETI MAY '83

ETI-323 HEADLIGHT DELAY UNIT $17.50

Park your car and turn off the lights. Can't see where you're going? Press the button and the headlights come on to light your way, switching off automatically after 50 seconds. This is a simple, easy to build, low cost project.

ETI APRIL '83

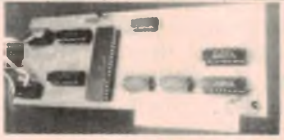
ETI-1515 DRILL/BLENDER SPEED CONTROLLER $27.50

This project provides a full range of speed control for appliances having "universal" ac motors. Once the speed is set, the motor will maintain that speed from no-load to heavy-load. Great for drills, blenders, grinders, etc.

ETI-162 30 V/1 A FULLY PROTECTED POWER SUPPLY $47.50

ETI DEC '83

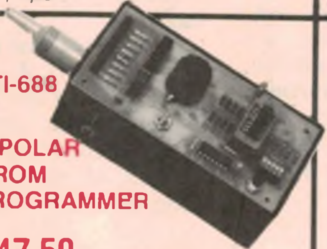
The last power supply we did was the phenomenally popular ETI-131. This low cost supply features full protection, output variation from 0 V to 30 V and selectable current limit. Both voltage and current metering is provided.



ETI-654 APPLE II ANALOGUE/DIGITAL INTERFACE

$159.00 ETI MARCH '83

This project will give your Apple a set of 8-bit digital inputs and outputs plus one analogue input and one analogue output. Applications include: driving a robot, recording science experiment results, etc. (digital only shown).



ETI-688 BIPOLAR PROM PROGRAMMER

$47.50 ETI JUNE '83

Every digital workshop should have one! Can be used to program the popular fusible-link PROMs like the 74S188/288 82S23 and 82S123 etc.

ETI-461 GENERAL PURPOSE BALANCED INPUT PREAMP $20.00

ETI DEC '83

This project can be used as a balanced mic amp with low impedance input, a low or high impedance input differential amplifier or a balanced input instrumentation amplifier.

ETI-164 ZENER TESTER

$9.50 ETI MAY '83

A simple, low cost add-on for your multimeter. This checks zeners and reads out the zener voltage directly on your multimeter. It can also check LEDs and ordinary diodes.

ETI-334 AUTO TESTER

$17.00 ETI JAN '83

Just the thing to keep in the glovebox or toolkit to find those nasty electrical bugaboos that occur at awkward times. Simple to build, simple to use.

ETI-335 PUSHBUTTON-PROGRAMMABLE WIPER CONTROLLER

$28.50 ETI MARCH '83

No more fiddling with knobs and not getting the delay between wipes that you want—this windscreen wiper controller is simply 'programmed' with two pushbuttons to provide the wiping delay you need.

ETI APRIL '83

ETI-733 RADIOTELETYPE CONVERTER FOR THE MICROBEE $20.00

Have your computer print the latest news from the internation shortwave news service. Just hook up this project between your shortwave receiver's audio output and the MicroBee's parallel port. A simple bit of software does the decoding. Can be hooked up to other computers too.

48-50 A'BECKETT ST, MELBOURNE 3000 VIC **BANKCARD WELCOME** PHONE (03) 347 9251

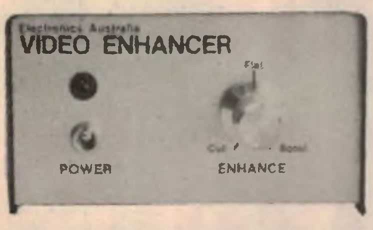
Mail Order Delivery Instructions: Minimum Pack and Post $3.00 for Australia Post. Please allow extra for bigger orders and Certified, Airmail or Registered Post. Minimum order is $5.00. Please address orders to Mail Order Department, PO BOX 235, NORTHCOTE, 3070, VICTORIA. PHONE (03) 481 1436.

ROD IRVING ELECTRONICS

425 HIGH ST, NORTHCOTE 3070 VIC   PHONE (03) 489 8866

100's SOLD

VIDEO ENHANCER $35



Like tone controls in a hifi amplifier, touch up the signal with this Video Enhancer.

EA OCTOBER 83

1000's SOLD

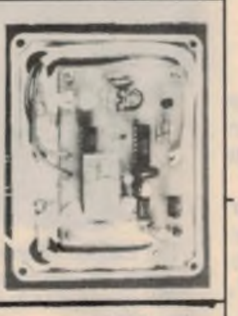
TRANSISTOR TESTER $15

Have you ever desoldered a suspect transistor, only to find that it checks OK? Troubleshooting exercises are often hindered by this type of false alarm, but many of them could be avoided with an "in-circuit" component tester such as the EA Handy Tester

EA SEPTEMBER 83

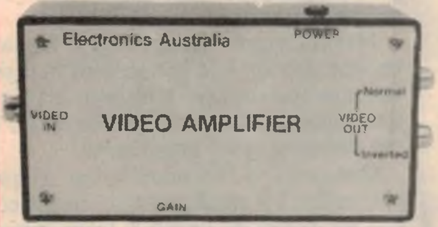
CAR ALARM

$29.00



This Car Alarm uses the battery earth strap as a sensor to detect when a "courtesy" light or other electrical load occurs when a thief enters a vehicle. The circuitry is simple and immune from false triggering problems. ETI July 81

VIDEO AMPLIFIER $15



EA AUG 83

Bothered by smeary colours, signal beats and RF interference on your computer display? Throw away that cheap and nasty RF modulator and use a direct video connection instead. It's much better. The Video Amplifier features adjustable gain and provides both normal and inverted outputs. Power is derived from a 12V DC plugpack supply.

INCLUDES JIFFY BAG

LOW OHMS METER

$34.50

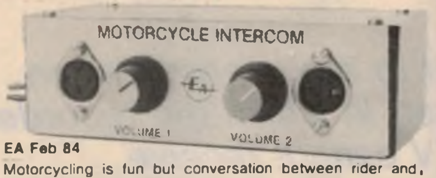
How many times have you cursed your Multimeter when you had to measure a low-value resistance. Well alas, with the "Low Ohms Meter" you can solve those old problems and in fact measure resistance from 100 Ohms down to 0.005 Ohms. ETI 158 November 81

NAIL FINDER $10

Essential for the home handyman the Nail Finder will help locate timber studs behind Gyprock or plasterboard wall surfaces as well as locating pipes and wiring buried in walls

EA OCTOBER 83

MOTORCYCLE INTERCOM $40



EA Feb 84

Motorcycling is fun but conversation between rider and, passenger is usually just not possible. Build this intercom and you can converse with your passenger at any time while you are on the move.

OVER 300 SOLD

SLIDE CROSS FADER

PHONE MINDER $25

EA Feb 84

Dubbed the Phone Minder, this handy gadget functions as both a bell extender and paging unit, or can perform either function separately.

±12V RAILS FOR LAB POWER SUPPLY

EA July 1983

$13

An inexpensive addition to the 50V 5A Lab Power Supply which should prove its worth many times over. It provides additonal fixed ±12V outputs for lower power applications

Driveway Sentry

$32

Activated by your car's headlights, the Driveway Sentry will turn on a driveway or garage light so that you can make a safe exit from your car on the darkest of nights. At the end of five minutes, it will automatically turn the light off again.

SPEED SENTRY $21

EA OCTOBER 83

Paying speeding fines can be a painful business. Build this Speed Sentry and avoid further pains in the wallet.

50V 5A LABORATORY POWER SUPPLY

New switchmode supply can deliver anywhere from three to 50V DC and currents of 5A at 35V or lower. Highly efficient design.

EA May, June 1983   82 PS5   **$140.00**

CAR IGNITION KILLER

Our kit includes the metal box   **$16.95**   EA Feb 84

Most car burglar alarms are easily circumvented, but not our cunning "Ignition Killer". This sneaky antitheft device uses a 555 timer to place an intermittent short circuit across the points. Until disabled by its hidden switch the circuit effectively makes the car undriveable — a sure deterrent to thieves!

Electric fence $19.50

Check our prices

SEPTEMBER EA 1982

Mains or battery powered, this electric fence controller is both inexpensive and versatile. Based on an automotive ignition coil, it should prove an adequate deterrent to all manner of livestock. Additionally, its operation conforms to the relevant clauses of Australian Standard 3129.

EA GUITAR BOOSTER

$17.50

JUNE EA 1982

48-50 A'BECKETT ST, MELBOURNE 3000 VIC   PHONE (03) 347 9251

Mail Order Delivery Instructions: Minimum Pack and Post $3.00 for Australia Post. Please allow extra for bigger orders and Certified, Airmail or Registered Post. Minimum order is $5.00. Please address orders to Mail Order Department, PO Box 235, NORTHCOTE, 3070, VICTORIA. PHONE (03) 481 1436.

A novel all-in-one video player/monitor

Who could possibly want to buy a combination video recorder and TV set, in which the recorder cannot record and the TV cannot receive television stations? According to a small company in Sydney, there are quite a few customers out in the marketplace ready and waiting to pay good money for just such a product.

by NEVILLE WILLIAMS

The Labelle "Showman", a traditional point-of-sale AV unit using film strip and audio tape. The screen size is about the same as that of the VS-1.

The Company concerned, Tracker Electronics, has specialised to date in servicing audio visual equipment, primarily for major clients such as the AVES Group and Telex Australia. In the process, they have become increasingly aware of video-based AV (Audio Visual) equipment, with its potential — and its limitations.

One such limitation caught the eye of David Digger, co-founder of Tracker Electronics. He noted that representatives needing to show a video tape to a client had to rely on portable equipment providing, typically, a 13cm (diag) picture.

When a larger picture was required for a larger audience, representatives appeared to have no option but to take along a VCR and a separate TV receiver, clear a space to put them, connect cables, push buttons — and hope everything worked. No one, it seemed, had come up with a larger-screen composite video player/monitor designed for AV situations.

David Digger wondered why? Could it be that nobody had got around to it yet? Perhaps the concept had been a bit too specialised for large companies and a bit too demanding for small ones!

Questions in the marketplace seemed to confirm the need and also suggested a further potential demand from schools and colleges. Most educational institutions, these days, have VCRs and monitors, sometimes separate, sometimes trolley mounted, sometimes in wired systems. The problem is that they are not always available or accessable for brief, spontaneous use. It would be quite a boon if a teacher could pick up a self-contained video playback unit and use it at any time in a classroom for a five or ten minute video segment.

Should such a unit be designed for playback only or retain the ability to receive and record TV programs off air? On balance, it seemed likely that the units would be used, most of the time, to play back tapes recorded elsewhere — professionally or privately. A playback-

Greg Roberts (left) and David Digger with the new Tracker VS-1 video player/monitor.

only unit should be simpler to operate, cheaper to manufacture and, as AV equipment, might attract only 20% sales tax as against 32½% for a receiver/recorder.

It seemed like an opening and a challenge for Tracker Electronics — one that they felt they had the background and the ability to meet.

In his younger days, David Digger had been trained in Britain as an engineer but, somewhere along the line, he took a step sideways into photography. For a while, he took technical pictures for industrial and commercial engineering firms but later spent seven years touring the world as a professional photographic expert on board luxury liners. There he met his future wife, and the English/American duo decided to make their home in Australia in 1971.

Digger took a job as Sales Manager of a struggling photographic company, made an abortive take-over bid for it, and then started his own company, importing and servicing photographic equipment. It was successful enough but it was tough going and Digger began to look with growing interest at the audio visual field.

It was about then that he met up with Michael Herts, a very experienced electronic service technician and, in 1979, the two jointly formed a new company: Tracker Electronics. Their concept was to provide complete servicing for audio visual equipment, particularly as operated by large companies. Having one organisation responsible for the total service would avoid the confusion of having different technicians looking at different sections of an installation or of intergrated equipment.

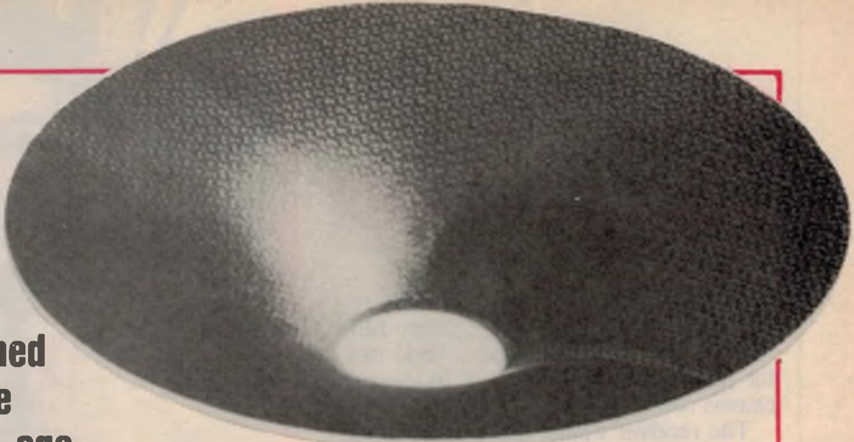
The concept proved sound, contracts followed and Tracker Electronics was on its way. But with the new venture came the awareness of a need for a different kind of audio-video unit and the challenge to expand into manufacture and marketing. Digger and Herts asked questions, looked into the possibilities and decided to give it a go!

In fact, it turned out to be a tough assignment, with size and weight posing early problems. According to David Digger, their first effort weighed the best part of 20kg, even before they had fitted all the parts!

There were problems, too, arising from the concept of operating a VCR, not merely very close to a receiver, but within the same cabinet. The greatest single difficulty facing Michael Herts was in preventing harmonics from the receiver's 50Hz field deflection system from penetrating the video and audio input circuits of the VCR.

They found a way around the size and weight problem by bringing together a standard Sharp 34cm TV receiver and

---



Designed for the digital age

New Sansui speaker cone

Described as a product for the digital age, a new loudspeaker cone developed by Sansui is claimed to be the lightest and strongest yet, outperforming not only traditional paper-based cones but other typed ot multi-layer or "sandwich" construction.

Sansui point out that, in principle, loudspeaker cones must be as light and as rigid as possible if they are to propagate a wide range of frequencies efficiently, without themselves absorbing drive energy or producing spurious sound by reason of surface vibration modes.

With the development of suitable materials and high-performance adhesives, loudspeaker manufacturers have been able to borrow sandwich construction technology from aircraft and boat builders and apply it to loudspeaker cones, particularly those for low-end and mid-range transducers.

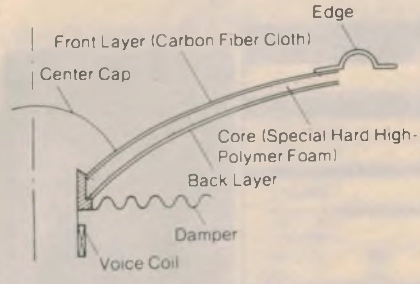
A variety of materials have been used for the outer skin and inner core of sandwich cones including metal alloys (aluminium, titanium, etc) compound plastics and processed paper, along with aluminium honeycomb, paper honeycomb and foam plastic.

According to Sansui, a major problem of many of the combinations is that they can only be produced as a flat disc or a simple cone. They cannot be given a smooth, continuous curve — a shape that, of itself, tends to increase rigidity and inhibit structural resonance.

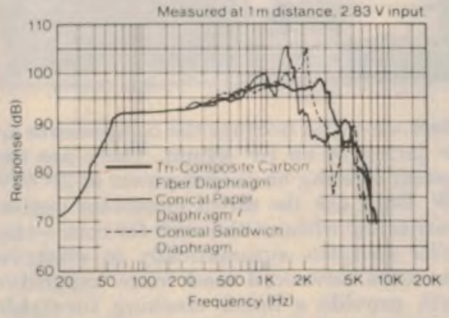
The new cone developed by Sansui has a core of hard, high-polymer plastic foam which is ductile at high temperatures and capable of being formed into the desired shape. It has an airtight surface and good adhesion characteristics.

For the surface layers, Sansui has used a pure carbon fibre cloth bonded to and taking the shape of the core. Since the core is airtight, porosity of the carbon fibre cloth is of no consequence. Weight of the cone according to Sansui is only half that of other comparable but conventional honeycomb diaphragms, while the rigidity is about 350 times that of paper.

They claim that the cone is unique in both design and performance. Because of the convex ("curvilinear") shape, the "tri-composite carbon fibre diaphragm" has fewer peaks and a smoother response than comparable convex cones, of either paper or sandwich construction.



Cross-section of the new Sansui Tri-composite carbon fibre diaphragm.



Comparative frequency response for three different types of cone.

Video player/monitor

National's NV-100A portable VCR — probably the smallest and lightest full-facility VCR available and a good one for portable use by reason of its diecast chassis construction.

The receiver was stripped of its tuner and control panel, and the loudspeaker re-positioned to create a space for the VCR. Part of the side of the cabinet had to be cut away to provide access of the cassette but, that done, the VCR mounted naturally into place.

Internal modifications to the NV-100 limit its use to playback only, an internal connection providing direct signal feed to the video circuitry of the receiver. A separate small supply, mounted inside the receiver cabinet, powers the VCR and obviates any conflict between the direct video feed and the live-chassis design of the receiver.

Because the deflection yoke of the Sharp receiver is unshielded, it was necessary to provide extra shielding for the VCR and to resort to other circuit tricks to obviate interference effects.

Says Michael Herts: "People sometimes say: 'You just pushed a portable VCR into a Sharp receiver' but, believe me, there was a lot more to it than that."

The new Tracker Electronics VS-1 composite video player/monitor uses VHS format cassettes, conforming to the Pal D colour system. Overall dimensions are quoted as 446 × 315 × 361mm and the all-up weight as 13kg. Power consumption for receiver and VCR total 67W (at 240VAC). An inverter is available which allows the complete unit to operate from a 12V vehicular supply.

The monitor controls are grouped mainly at the top and rear of the cabinet, while the VCR controls are accessable from the front. Provision for remote control of the VCR has been retained, as also has the "RF Out", allowing the video signal to be fed, if desired, to an external TV receiver or video system via VHF channel 1.

Current price of the VS-1 is quoted as $2850 including sales tax.

In marketing the VS-1, Tracker Electronics will have the full support of the AVES Group which, for more than 20 years, has been heavily involved in the production of software for the industrial sales, training and education side of the audio visual industry.

At a function to launch the VS-1, Managing Director of the AVES Group, Greg Roberts, had this to say:

"Increasingly, we felt hampered by the clumsiness, the lack of portability of the video hardware available to satisfy the market we were servicing.

"We knew that a truly portable desk top video system would open up areas which up till now have remained untapped."

Betamovie helping to boost format sales

According to Mr Haranobu Murakami, Managing Director of Sony Australia, his company is doubly pleased with the reception accorded to Betamovie, its unique combination video camera/recorder. Not only is Betamovie proving popular in its own right but it has helped to boost the Beta format's share of the Australian home video market by 8% during the last quarter of 1983. He stressed Sony's continuing commitment to the format, its acceptance in commercial and Government circles and the impending introduction of Beta hifi-stereo sound. Betamovie is compatible with all Beta format VCRs released in Australia and is being sold under their own brand names by both Sanyo and Toshiba.

Pictured above is Technics' new 315 system, so called because the components are all 315mm wide — the same size as the jacket of an LP album. There are two versions at present, the Series 66 (illustrated) offering an output power of 2×40W RMS and the Series 44, offering 2×20W. Both use the direct connector system which links all components (except the turntable) without the need for connecting wires. In addition, the Series 66 amplifier switches automatically to whatever input source is activated. It also uses more advanced (and more expensive) components than the Series 44 but both provide a linear tracking turntable, AM/FM-stereo tuner, cassette deck, amplifier and loudspeakers, with optional graphic equaliser and equipment rack. Both can be used with the 315mm wide SL-P7 compact disc player. (Details from all Technics dealers).

Rust proof tape

3M Australia has just released five new audio cassette tapes for the consumer market, headed up by the new metal-coated Scotch "XSM-IV" and backed by an unconditional warranty.

According to David Henderson, 3M Home Products Marketing Manager, the formulation used for Scotch XSM-IV provides greater protection for the pure metal particles, inhibiting rusting effects, particularly along the edges where the tape has been slit and the binder parted.

Other cassettes in the new range include the "XSI", a dual-layer high performance tape for standard bias and the "XSII", a dual-layer cobalt-doped formulation for "chrome" bias and equalisation.

The "BX" and "CX" are "workaday" cassettes for use in portable and car players, the CX being an interesting combination of a hardy tape with performance not far short of the audiophile class.

That prediction appears already to be heading towards fulfillment. At last contact Greg Roberts said:

"We have confirmed sales for such diverse organisations as the Yellow Pages Directories in Melbourne, a large medical equipment distributor, two TV stations and the sales department of a national newspaper. The newspaper company and the medical company plan to use the VS-1 as a sales aid overseas, including a Trade Fair on the China mainland.

"As well, the Army is interested in evaluating the VS-1 for use in combat training programs.

[Tracker Electronics and the AVES Group are both located at 29 Albany St, Crows Nest, NSW 2065. Phone numbers: Tracker Electronics (02) 439 1349; The AVES Group (02) 439 1455]

LIKE TO GET AN AMATEUR RADIO CERTIFICATE? IT'S MUCH EASIER WITH PROFESSIONAL HELP.

If something's worth doing, it's worth doing well. So don't waste your valuable spare time finding your own way through the Amateur Radio maze. Ask Stott's instead. We have top professional instructors, who'll make sure your time is well spent on your way to an operator's certificate. You'll have individual attention, working at your own speed, in the comfort of your own home. Any queries will be answered personally, and promptly.

So don't delay. Mail the coupon for full details.

Over and out.

Stotts
CORRESPONDENCE COLLEGE
The name to trust in correspondence education.

Please send me free, and without obligation, full details of the following courses:

________________ (PLEASE PRINT)

____

MR. MRS. MISS ________________ AGE ____

ADDRESS ________________

________________ POSTCODE ____

Stott's undertake that no sales counsellor will visit you.

Melbourne, 159 Flinders Lane, 3000 Tel: 63 6212
Sydney, 383 George Street, 2000 Tel: 29 2445
Brisbane, Suite 3, 65 Mary Street, 4000 Tel: 221 3972
Adelaide, 85 Pirie Street, 5000 Tel: 223 3700
W. Perth, 25 Richardson Street, 6005 Tel: 322 5481
Hobart, 150 Collins Street, 7000 Tel: 34 2399
New Zealand, Box No 30 990, Lower Hutt Tel: 676 592

The Stott's range of courses in Amateur Radio is:

Novice Amateur Operator's Certificate of Proficiency.
Amateur Operator's Certificate of Proficiency.
Amateur Operator's Limited Certificate of Proficiency.
Radio for Amateurs

ALA/ST4467/EA6/84

Dick Smith

COMPU

For range and value, we can't be beaten!

Come on in to Dick Smith Electronics COMPUTER CITY for the very best!

You'll find a computer to suit your needs – from the beginner to the business user . . . and everything in between.

You'll find friendly, helpful staff – experts in their fields. They'll be able to answer your questions with authority and accuracy.

You'll find our computers on display – working – where you can try them out. Nothing beats actual 'hands on' experience.

But most of all, you'll find the reassurance of dealing with Australia's leading computer retailer – 50,000 owners can't be wrong – with the technical back-up, the service back-up and the software back-up that the department stores simply can't match.

Trust Dick Smith Electronics COMPUTER CITY for YOUR computer.

The Challenger

The IBM PC compatible that beats the IBM . . . on price, on performance, on features, on expandability . . . on everything!

The Challenger is the computer for the small to medium size business (it has 10 times the memory of Dick Smith Electronics first mainframe computer!)

But it's more than that: because it is compatible with IBM PC software and hardware, it makes a superb scientific or industrial computer . . . or even a low-cost IBM terminal. And you'll save a fortune!

The CAT

Why waste hundreds of dollars buying an Apple computer when you can buy The Cat . . . Dick Smith Electronics' latest computer masterpiece! It's twice as fast as the Apple IIe. It has a bigger and better BASIC. A larger keyboard. Super hi-res colour graphics. More sound channels. Just compare the two computers and judge for yourself! (Ask for our free comparison brochure).

Compatible with most Apple IIe software. The Cat is THE computer for education, for the student at home, for the hobbyist, for dedicated functions in industry . . . even for the small business.

As Electronics Australia Magazine says 'Dick Smith Electronics has come up with a winner with the CAT personal computer'.

VZ-200

The ideal computer for the beginner who wants a computer to grow with: Dick Smith Electronics incredible VZ-200. It's the low-cost way to go computing – without buying an 'orphan' or 'dumped' computer with no back-up.

The VZ-200 has a great range of low-cost software from games to small business utilities. And it's also very popular with amateur radio operators because of its very low noise level.

If you're starting out, you'll start out best with a VZ-200.

THE NEW DICK SMITH CHALLENGER

System Unit

The 'works' of the computer . . . keyboard, CPU, 128K RAM, input/output ports, etc. Ideal for cassette-based applications as it is with nothing more to buy. Includes Centronics parallel printer port, cassette port, joystick & light pen ports plus RF, video and RGB outputs.

Cat X-8600 All this for only . . . **$995**

Expansion Unit

Far more than mere expansion!

As well as three IBM compatible expansion slots plus two true 16-bit slots, you get twin slimline disk drives and an RS-232C communications port.

PLUS free software!

We also include a range of quality software worth over $1800 . . . Microsoft MS-DOS & GW Disk BASIC, Perfect Writer, Perfect Filer and Perfect Calc PLUS user manuals! Cat X-8610

Expansion unit and software . . . **$1995**

This makes the Challenger more than a match to the IBM PC – much more. Yet the IBM PC expanded to this level costs well over $7000. Compare the Challenger – and $ave!

TOTAL SYSTEM ONLY . . . $2990

YOU SAVE OVER $4000 ON THE IBM PC!!!

Electronics

THE cat™

DICK SMITH PERSONAL COMPUTER

Apple IIe compatibility . . . but half the price! That's The CAT.

It's the best of both worlds: the very latest and most powerful hardware, plus the ability to run a very broad range of tried-and -proven software.

And because we import direct, there's no middleman to force up the price. It really is outstanding value for money. Again from EA: "If you want a machine which is compatible with the Apple II and which is supported by a reputable dealer, the CAT with emulator is good value".

Check the CAT out at your nearest Dick Smith Computer City. It purrs.

Cat X-7500

$699

That's far less than half the price of the Apple with similar features!

NEW!

OVER 19,000 ALREADY SOLD!

VZ-200
Computer Package

Our already great value VZ-200 is now even better! We've put together a package of the 'most asked for' bits and pieces - and slashed the price! Yes, you can still buy a VZ-200 without the extras for only $169 Reduced from $199!) but take a look at what else you get . . .

- **VZ-200 COLOUR COMPUTER** — USUALLY **$169.00**
  Complete with USER manual, BASIC manual & Demonstration Cassette. Ready to plug into your TV set. Cat X-7200
- **DATASETTE** — **$69.50**
  Specially designed recorder for loading and saving programs Cat X-7207
- **16K RAM EXPANSION MODULE** — **$79.00**
  Expands your memory to 24K which is essential for serious programming. Cat X-7205
- **INTRODUCTION TO COMPUTER BOOK** — **$9.95**
  A step by step guide to using your new VZ-200 computer Cat B-7200
- **6 PROGRAMS** — **$75.00**
  A selection of ANY 6 software tapes normally $12.50 each
  (X-7241 Learjet or X-7249 Air Traffic Control not included)

TOTAL PRICE USUALLY $402

Package price **$299**

SAVE even more!

Need a printer? We'll throw in one of our fantastic 4 colour printer/plotters and a printer interface for just $200 extra! Normally these items sell for over $270 . . . so multiply your savings on the VZ-200 total package!

DICK SMITH ELECTRONICS

For address details see page 108.

A 762/KT

Dick Smith

COMPU

Hardware and Software – we've got the goods !

Check our great range of quality computer software: all thoroughly checked by our quality control department.

And this is just the start – more is coming all the time. Programs for business, for education, for enjoyment . . . come to Dick Smith Electronics Computer City.

Most programs are available for a 'hands on' fiddle so you can put them through their paces.

And remember, if we haven't got the program you want, the Challenger and The Cat are compatible with a staggering range of software from other sources.

We don't force you on to one supplier with inflated prices!

Trust Dick Smith Electronics Computer City.

Challenger Hardware

10Mb Hard Disk Drive – all the memory you'll need !

Wow! What value . . a 10Mb I^2 Disk System for the Challenger (or even the IBM PC!) for less than $2500! Unbelievable? Not from Dick Smith Electronics Computer City!

If you're really serious about computing – business or professional users especially – you'll really appreciate the lightning fast response time, the storage possible, ultra-reliable computing that only a Winchester can give you!

Just 146 x 210 x 387 mm, bootable from the Challenger or IBM PC.

A must for your system!

Cat X-8620

$2499

Challenger Printer Cable **$69**

Cat X-8614

Challenger Software

Utilities

X-8750 ELECTRIC PENCIL – An easy to use yet sophisticated word processing program. Function keys definable up to 16 keystrokes of any key combination. Colour available for colour monitor. Underline and bold on screen. Menus give quick and easy reference to all system operations. Manual and Quick Reference Card included. **$199.00**

Educational

X-8650 MICROSOFT FLIGHT SIMULATOR – The best program of its type in the world. A highly accurate simulation of flight in a single-engine aircraft. Adaptable to any interest or ability level! **$85.00**

X-8700 ALLIGATOR MIX – Encourages children to practice basic addition and subtraction skills while playing an exciting, fast paced arcade game. Has options for skill level, problem range and run time. For all ages. **$49.95**

X-8702 DRAGON MIX – As for Alligator Mix, but this time concentrates on multiplication and division skills. **$49.95**

X-8710 SNOOPER TROOPS 1 – (As per CAT software) **$67.95**

Adventure & Arcade Games

X-8651 STYX – Fantastic Arcade game action! The swirling STYX has laid seige on the vast expanse of your playing field. Stake your claim and force the STYX into a corner! **$49.95**

X-8652 DIGGER – Search for buried treasures of shining gold and sparkling emeralds. With chomping jaws, your Digger Mobile must tunnel out mazes and outsmart the Nobbins! **$49.95**

X-8653 CONQUEST – Transcend the limits of time into a prehistoric era to assume your place as King of the Falcons. Your conquest begins as you swoop down to destroy the mighty pterodactyls. **$49.95**

X-8654 ZORK I – The definitive adventure game with monstrous scope. The game takes you through a cavernous underground complex – treasures, enchantment and more! Split screen all text display. **$59.95**

X-8655 DEADLINE – When you take on Deadline, you're pitting yourself against a 12 hour time limit to solve one of the cleverest and most baffling cases in the detective game. **$75.95**

X-8656 SUSPENDED – (As per CAT software) **$75.95**

X-8658 WARP FACTOR – An entire star fleet awaits your command ! The Warp Factor is what every space-war fan has been waiting for – the ability to command a star fleet in realistic battle simulation. **$57.95**

X-8660 TEMPLE OF APSHAI – A role-playing game that catapaults you into a world of magic and monsters – doomed cities and damsels in distress. More than a game, it's an alter-ego experience. Computer Game of the Year! **$65.95**

X-8662 ULYSSES – The King has assigned you the task of retrieving the legendary Golden Fleece. On your voyages you will encounter the wicked "Sirens", Cyclops, Pluto and the magnificent Pegasus! **$57.95**

X-8664 APPLE PANIC – (As per CAT software) **$42.95**

X-8666 FROGGER – The official arcade game. Get across the highway without getting run over, and across the river avoiding deadly snakes, otters, crocodiles and the treacherous diving turtles. **$48.95**

Cassette Software

X-8649 STARSHIP CHALLENGER – **$19.95**

X-8704 TYPING TUTOR – **$19.95**

Electronics

CAT Software

Utilities

* X-7570 Z80 & CPM DISK & MANUAL – Turns your CAT into a Z80 processor – gives you access to the enormous range of CPM software! **$449.00**

X-7600 VISICALC – The powerful electronic spreadsheet that can calculate and display the answers to involved problems you could have spent hours doing by hand. Easy to learn, easy to use. **$428.00**

X-7568 HOW TO PROGRAM IN APPLESOFT™ BASIC – Using these 12 self-paced lessons you will learn to program in the popular BASIC computer language. Learn BASIC in two nights or two months! Unique "Let's Talk" feature allows easy review of prior material or skips to new lessons. **$69.95**

X-7720 FLYING COLOURS – Turn your screen into a canvas as you create drawings, designs and graphics, and choose your colour from a pallette on the screen! Plus you can save your creations on disk! **$69.95**

Educational

X-7650 SNOOPER TROOPS 1 – Someone is haunting the old Cable Mansion. It's up to you to find out who. But don't get caught! Full colour graphics & sound. Helps children learn to take notes, draw maps, classify information & develops vocabulary and reasoning skills. **$64.95**

X-7654 MOST AMAZING THING – A learning game where players must use strategy and learning skills in order to discover the location and identity of the most amazing thing. Great educational value! **$54.95**

Adventure & Arcade Games

X-7700 REACH FOR THE STARS – A fast-paced exciting challenge for up to four players. Three levels of play. Expand and develop your empire, but watch for other empires – they may wipe you out! **$34.95**

X-7702 ZAXXON (Official version) – The arcade game you must see to believe. Pilot your aircraft through a 3-dimension-like battlefield complete with enemy aircraft, fuel tanks, concealed missles and tanks. **$59.95**

X-7704 SUSPENDED – In cryogenic suspension for half a millenium, you are woken up to deal with an emergency. Strategically manipulate six robots, each having a distinct perception of the world to solve a myriad of realistic and original problems! **$74.95**

X-7706 SPY'S DEMISE – Arcade type action. Piece together a KGB encoded message which is the key to a fortune in valuable computer data. Avoid the embassy guards as you gather the clues to crack the code! **$29.95**

X-7712 APPLE PANIC – Great arcade game action. Destroy the apples chasing you by digging holes in the floor and knocking them through. Be quick though – they may crawl out and get you! **$39.95**

X-7714 PLASMANIA – Arcade type action game. A secret serum shrinks you and your submarine, and you're injected into the patients bloodstream. Fight past antibodies and bacteria. Will the patient survive? **$49.95**

X-7716 WAY OUT – With compass and Map makers your task is to find your WAYOUT of the selected maze. But which way is the wind blowing, and is the Cleptangle creeping up from behind? **$44.95**

X-7716 SARGON III – The Computer Chess champion! Sargon III will play at your level from beginner up through Grand Master. Outstanding display of the chess board. **$49.95**

* Arriving End June

VZ-200 Software

Financial

X-7261 Portfolio Management	**$12.50**
X-7262 Discounted Cash Flow Analysis	**$12.50**
X-7263 Financial Ratio Analysis	**$12.50**

Educational

X-7251 Statistics 1	**$12.50**
X-7252 Statistics 2	**$12.50**
X-7253 Matrix	**$12.50**
X-7254 Golf/Tennis Lesson	**$12.50**
X-7255 Introduction to BASIC	**$12.50**
X-7256 Elementary Geometry	**$12.50**
X-7257 Speed Reading	**$12.50**
X-7258 Typing Teacher	**$12.50**
X-7259 Mailing List	**$12.50**
X-7280 Hex Utilities	**$12.50**
X-7285 Spellomatic 1 & 2	**$12.50**
X-7286 Spellomatic 3 & 4	**$12.50**
X-7287 Flashcard 1 & 2	**$12.50**
X-7288 Flashcard 3 & 4	**$12.50**

Adventure & Arcade Games

X-7231 Matchbox	**$12.50**
X-7232 Poker	**$12.50**
X-7233 Hangman	**$12.50**
X-7234 Slot Machine	**$12.50**
X-7235 Blackjack	**$12.50**
X-7236 Circus	**$12.50**
X-7237 Biorhythm	**$12.50**
X-7238 Horse Racing	**$12.50**
X-7239 VZ-Invaders	**$12.50**
X-7240 Dynasty Derby	**$12.50**
X-7242 VZ Ghost Hunt	**$12.50**
X-7243 Hoppy	**$12.50**
X-7244 Super Snake	**$12.50**
X-7245 Knights/Dragons	**$12.50**
X-7247 Star Blaster	**$12.50**
X-7248 Asteroids	**$12.50**
X-7264 Tennis	**$12.50**
X-7266 Planet Patrol	**$12.50**
X-7268 Ladder Challenge	**$12.50**
X-7270 VZ Panic	**$12.50**

Plus

X-7249 Air Traffic Controller	**$19.95**
X-7241 Learjet	**$19.95**

Coming Soon

WORD PROCESSOR (TO SUIT VZ-200)

DICK SMITH ELECTRONICS

For address details see page 108

A762/LL

Electronics Australia reviews

Yamaha's $599 compact disc player

Recently released, the Yamaha CD-X1 is the first compact disc player to break the $600 price barrier. Does it represent a reduction in the previously high compact disc player standards or have there been manufacturing breakthroughs?

Up until recently, compact disc players have been priced for the well-heeled few. Even the Yamaha CD-1 was a really top-priced model and so not too many found their way into Australia. But now the picture has changed with the release of this new model Yamaha.

Removing the top cover of the CD-X1 gives a few clues on how the price has been reduced. For a start, the chassis is virtually all plastic. Apart from the steel covers for the top and underside, there is very little metal used in the construction.

At first sight even the transport mechanism appears to be made entirely of plastic too. Closer examination reveals that the pliantly mounted transport baseplate is of punched steel. All the gears for the transport mechanism are also plastic which is a factor in their quiet running.

This all means that while the initial tooling cost for the CD-X1 may have been very high, labour cost must be much lower than for competitive models.

Not only has the labour cost been reduced in the chassis and transport, there is also considerably less electronic componentry. Much of this reduction has been achieved by the production of two new large scale integrated circuits. The degree to which this integration has proceeded can be seen by looking at the boards. There aren't very many IC's in the whole unit.

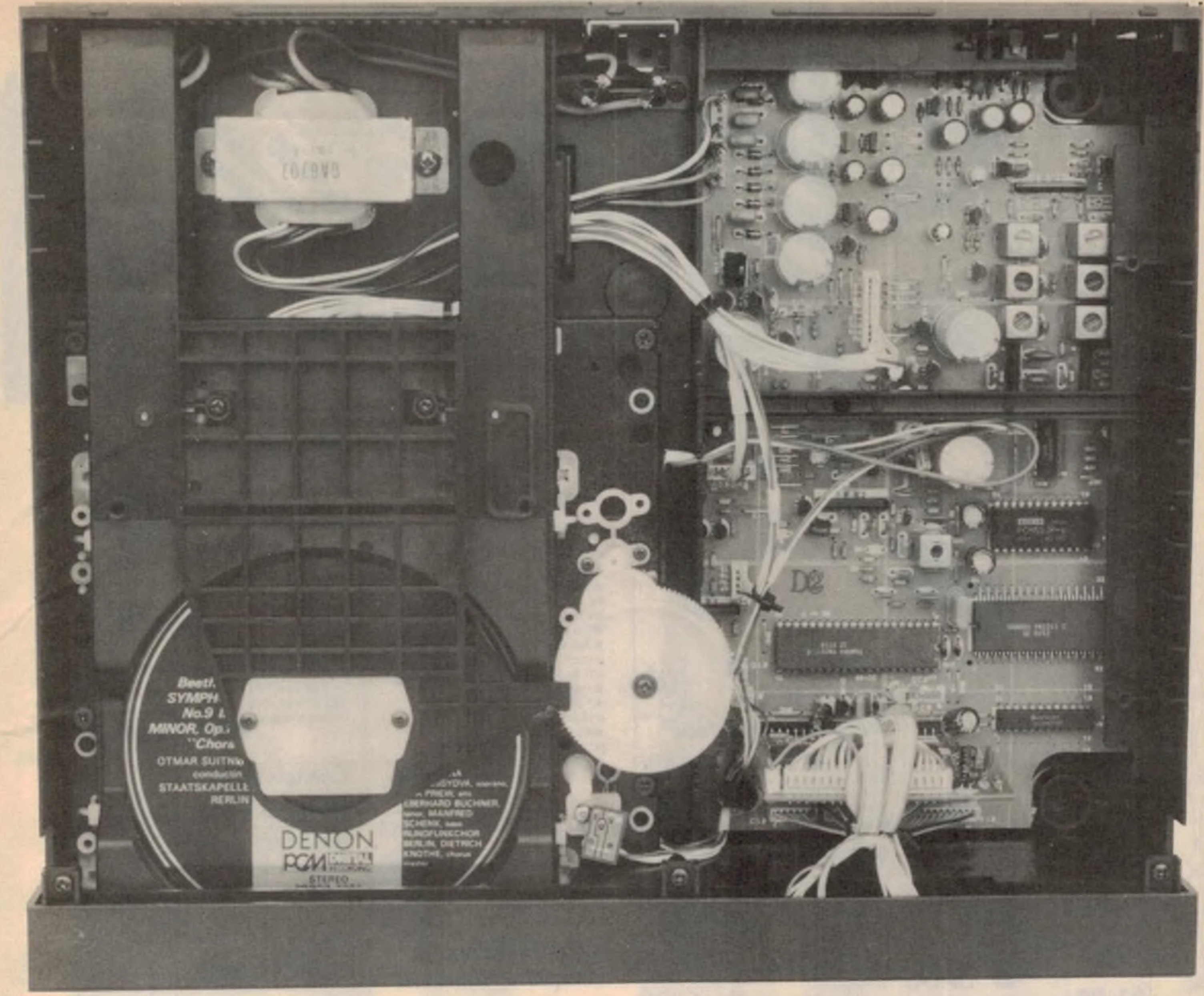
This does not mean that corners have been cut in the electronic design. The digital to analog conversion method is 16-bit linear rather than the 14-bit conversion used by some makes. As well, Yamaha have used an over-sampling method to double sampling rate to 88.2kHz. This is claimed to increase the resolution while enabling a fairly simple 7th order LC filter to remove the residual sampling signal.

Besides making the CD-X1 very light, at only 3.6kg, the predominantly plastic construction makes it relatively easy for the machine to comply with the standards for double insulation. As such, the CD-X1 is fitted with a two-core mains flex.

In emphasising the light plastic construction we don't want to give the impression that the Yamaha is in any way cheap or "tacky". It isn't. It looks and is well finished and offers the full range of operational features, as we shall see.

Styling of the new Yamaha CD-X1 is

The Yamaha CD-X1 is well finished and offers the full range of operational features.



subdued, in the Yamaha manner, with an overall matt charcoal finish. Panel lighting is also subdued with digital displays for track selection and playing time.

Overall dimensions of the CD-X1 are 340mm wide, 290mm deep and 92mm high. As is becoming the norm, the CD-X1 is a front-loading drawer type machine. This has the advantage of producing a machine with a low profile but it does mean that the disc is well out of sight of the user.

The number of controls is certainly not overwhelming and so the Yamaha is very easy to drive without having to peruse the owner's manual in great and laborious detail.

One step which must be carried out before use is that the transport screws on the underside of the deck must be removed. These three screws lock the laser mechanism in place to avoid damage while in transit. No damage would result if an attempt was made to use the machine while the screws are in place but the machine cannot play discs.

One problem which arises with most compact disc players is where do you store the locking screws? In most households they are likely to be misplaced and lost which is a problem if the deck subsequently must be transported for any distance.

We would like to see Yamaha and other compact disc manufacturers either do away with the need for locking screws or provide a means of storing them within the machine itself.

Record changer manufacturers solved a similar problem many years ago so we can see no real difficulty this time around.

Control features

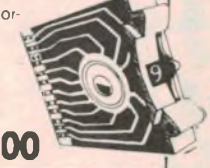
On the lefthand side of the control panel is a push-on, push-off power switch. When power is first applied a soft green light under the disc drawer flashes on and off for a few seconds as the mechanism tests for the presence of a disc in the drawer. Finding none, the light is extinguished and the unit becomes quiescent with just the faintest of panel lighting to tell that it is waiting.

Pushing the open/close button then causes the drawer to slide out rapidly to accept a disc. Just drop the disc in, push the same button again and the drawer slides back. The green indicator then flashes a couple of times while the mechanism cues up to the first track and then the machine is ready to play.

As the cueing up is taking place, the machine briefly displays the number of tracks on the disc and the total playing time. Pressing the play/pause button then initiates the first track within about two seconds. A fairly bright green "play" indicator then lights up and the elapsed time of the disc track is displayed continuously.

At any point the user can press the "check/RT" button to find out the total remaining playing time.

1 pole/10 position thumbwheel switch



Selling for around ⅓ normal cost. Very high quality construction. Limited stock

$2.25 each

10 for $20.00

Quality LEDs at Tiny Prices

Super quality 3mm LEDs from Stanley at knockout prices. Only in bags of 100 at this price

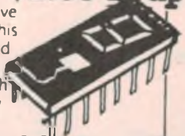
$6.00 for 100

What a Bargain

Fantastic TI TIL308 display – Amazing features

$1.75 each

$1.50 10up



This incredible display chip has thousands of uses. The experimenter and constructor will have thousands of uses for this amazing display. 27" red 7 segment display has BCD to 7 segment latch decoder driver circuitry and BCD to buffered BCD output. LED testing and LED blanking or chip enable is also built in. Left hand decimal point

COMPLETE WITH DATA

12 Digit LED Display – Experimenter's Delight

These superb 7 segment displays have thousands of uses. Each digit is 7 segment with right hand decimal point. Eight inputs for segments and 12 inputs for digits (cathodes) Anodes are internally connected. They were selling for $1.50 each. Reduced this month – grab 'em now!!

only $1.00

DATA INCLUDED

240V AC Open Frame Motors – going fast

These gutsy universal type motors have thousands of uses. Grab a few while they last

only $2.00

Tiny Price on these amazing Tiny lamps

We are selling these amazing little lamps for only 10% of their original price. 12V/60mA and a tiny 5½mm high by 2½mm wide. Perfect for miniature projects, modellers, regulators etc

only $10 for 100

TV Balun at ½ price

300Ω to 75Ω balun if you're fitting 300Ω ribbon to you TV set. Don't pay $2.00!!

only 85c each

10 for $7.50

100 metre rolls of Speaker Cable

Grab a few rolls of speaker cable. Normally selling for $12.00 a roll. Get them now and save!!

only $8.00

Stupendous Savings on Edge Connectors

98 way, double sided. 1" pitch wire wrap type. Never again at this price.

only 95c each

10 for $8.50

Micro Switches at Micro Prices

Top quality Cherry brand microswitches at giveaway prices. 15A/250V AC rating. Normally open contact with lever

only 75c each

10 for $6.00

Monster Trimpot Pack

100 mixed values and types. These normally sell for 30c to 50c each. Grab a few packs for the spares draws and always have them on hand

only $5.00

Monster Tagstrip Pack

50 assorted tagstrips. Thousands of uses. Some of our competitors are selling them for $1.00 each!! They must be kidding!!!

only $2.50

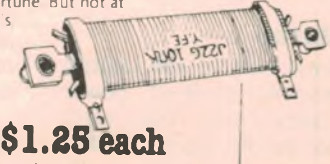
16µF/100V Bipolar Electros at Tiny Prices

These PC mount bipolar electros normally sell for around $1.00 each. We've made a scoop purchase so you get them at a tiny price. In packs of 20 only at this price!!

20 for $2.00

10 Ω Power Resistors at Puny Prices

These 10Ω/ 25W power resistors are perfect for making up dummy loads, attenuators for speakers etc., etc.. Normally they cost a fortune. But not at Sheridan's



only $1.25 each

10 for $10.00

Revolutionary Talking Car Alarm

We've all heard conventional car alarms go off. The fact is, most people ignore them – while the thief makes off with your car!! This revolutionary alarm uses the world's first voice synthesized system

Features:

★ protects your whole car including the boot, bonnet and stereo

★ No external key

★ Automatic arming (when ignition turned off) and reset

★ Exit and entry delay

★ Fully self contained and tamper proof

★ Panic switch

Normally selling for $199.00

At Sheridan's

only $159

150 Ω/25W rheostats

Massive savings on these ceramic body 1/4" shaft rheostats. Ideal for speaker attentuators etc. Normally selling for around $12.00 each

only $1.20 each

complete with knob

Telephone No-Nos

Genuine Plugs and Sockets

The real thing at bargain prices

Plug $2.25

Socket $3.50

4 core Cable

25c per metre

By Public Demand!!

Microprocessor Tick Tocks

Enthusiasts get out your soldering irons. These amazing OKI MSM5832RS microprocessor controlled clock calenders are back in stock. You'll spend hours learning about all their functions

only $9

Applications Manual

14 pages packed with applications ideas and technical specs

only $2.00

Crystals to suit

only $2.00 each

Bournes Resistor Networks

Knockout prices on these handy networks

All are 10 pin SIL

Values: 1KΩ, 100Ω, 220Ω, 330Ω

only 40c each

300V/150A Stud Rectifiers below Wholesale

Case style DO 30

Scoop purchase of these very useful high power recifiers from International Rectifier. 300V **reverse or forward** voltage. They are brand new current stock selling below current wholesale. Limited stock. Death to High Prices!!

only $8.00 each

5 (any type) $35

SHERIDAN ELECTRONICS

164-166 Redfern Street,
Redfern NSW 2106.
Ph: (02) 699 5922, 699 6912
Mail Orders: PO Box 229
Redfern NSW 2016

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

Trading Hours

Mon-Fri	9am-5.30pm
Thurs.	9am-7pm
Saturday	9am-12noon

Note. We accept both Bankcard and American Express. However we cannot give quantity discounts on credit purchases or account orders. Minimum for account orders is $50.00. Minimum order is $10.00

All prices include sales tax

Yahama's $599 compact disc player

Full music search facilities are provided by four touch-buttons. You can rapidly step forward or back through the track numbers to arrive at a given selection. And if you want to find a given musical phrase you can fast forward or reverse while listening to very rapid bursts of music — it's just like the cue and review facilities on some cassette decks.

Using these buttons while in the pause mode can cover a minute's worth of program in just one second, which is pretty fast. But the way it works it can be used to cue very easily. When you first touch the advance button it works slowly for the first three seconds and then speeds up, so with just a couple of touches you can quickly find the selection and cue it to play — release the pause and the music starts immediately.

When you have found the wanted musical phrase you can set the Yamaha to repeat it continuously by touching the two repeat buttons. All very simple.

Full memory facilities are also provided. The CD-X1 can store up to 23 selections. Again, the facility is easy to use.

We don't have the space to fully detail the playing facilities but the foregoing should be enough to give an idea of the capabilities and features of the CD-X1.

About the only features which have been left out when compared to much more expensive players are remote control, a headphone socket and an output level control. At the price of this deck, this is no hardship.

How does it work?

First and foremost, the CD-X1 is quiet. Depending on how loud you are playing the music, you may have difficulty hearing the deck running at all. Of course with the volume turned off and in a quiet room you will hear it but it is not troublesome. When changing tracks it makes a slight whirring noise and when the disc comes to a stop you can hear a slight rubbing noise.

The loudest mechanical noise it makes is when the drawer slides in or out but even this cannot be criticised.

Control legends could have been made a little more legible. As it is, Yamaha must think that their buyers have even keener eyesight than their hearing. The lighting is on the dim side too and could be increased quite a lot before it became obtrusive. Not that this is a really major point because you quickly become familiar with the CD-X1 and thereafter seldom need to read the control labels.

Some decks are very sensitive to the slightest bump and will jump tracks easily. The Yamaha was good in this respect and required a fairly deliberate bump to make it jump tracks. We would rate it as one of the better decks in this regard.

The Yamaha handles disc defects well too. To test this aspect, we used the Philips No 4A defect test disc. This includes track interruptions up to 900μm wide in the form of simulated scratches and black dots and also has a simulated fingerprint. The Yamaha sailed through all these without so much as one audible hiccough.

While this is the first compact disc player we have tested using the defect disc we are aware that most decks produced to date cannot achieve this.

Lab tests substantially confirm the specifications which are shown in a panel accompanying this review. Noise and harmonic distortion is quoted as .005% at 1kHz at 0dB and we obtained a result very close to that in both channels. From there it rose very gradually to 0.3% at 15kHz and thereafter to 0.22% at 20kHz.

The high result at 20kHz is not really a distortion product but is an artefact of the CD-X1's filter circuit and was actually a very low level sine wave at 24.1kHz. This is similar to the result produced by a number of other compact disc players.

Separation between channels was quoted as 90dB at 1kHz. We measured 87dB at 100Hz and 1kHz and 77dB at 10kHz; figures you could hardly complain about.

On the other hand we did feel that the CD-X1 could have been made quieter with very little extra refinement. Hum was 89dB down with respect to 0dB reference level while residual noise was 97dB down, a much more respectable figure. While we did not investigate the

Continued on page 150

Specifications

Frequency response	5-20,000Hz ±0.5dB
Dynamic range	More than 95dB
S/N ratio	More than 95dB
Harmonic distortion	Less than .005% (1kHz, 0dB)
Channel separation	More than 90dB
Wow & Flutter	Unmeasurable
Power consumption	20W
Output volts	2V (at 0dB)

IAN J. TRUSCOTT'S

CORNER BAYSWATER AND EASTFIELD ROADS,
CROYDON, VICTORIA, 3136.

(03) 723 3860

ELECTRONIC WORLD

SPECIALISING IN SALES AND SERVICE TO —

CAR RADIOS

C.B.

AND **MARINE**

CONTACT US FOR ALL YOUR 27MHZ AND 477MHZ REQUIREMENTS

OUR VAST RANGE OF COMPONENTS TO SUIT THE ELECTRONIC ENTHUSIAST INCLUDES: RESISTORS — CAPACITORS — IC's — POTENTIOMETERS —HEAT SINKS — CABINETS — PLUGS AND SOCKETS OF MOST KINDS.

WE ALSO STOCK A RANGE OF TEST AND ASSEMBLY GEAR
TO HELP THE HOBBY TYPE ELECTRONIC BUFF

WE ARE SPECIALISTS IN TV, STEREO AND MOST ELECTRICAL REPAIRS.

1984 - BIG BROTHER IS HERE!

TELECOM APPROVED **NEW**

- A SOLID STATE TELEPHONE DIALLER/ALARM AT LAST!

This is one of the most significant products that we have seen for many years. It is a true "1984" product!!
What we are talking about is basically an alarm device that will telephone you (and two others as well) locally, SDT even ISD if your premises are broken into, is burning or even if the freezer has broken down! It does *not* use a tape recorder it is microprocessor generated and controlled. It is a 3 zone device as well i.e. it will give you a **separate message** to indicate the nature of any one of up to 3 separate faults.

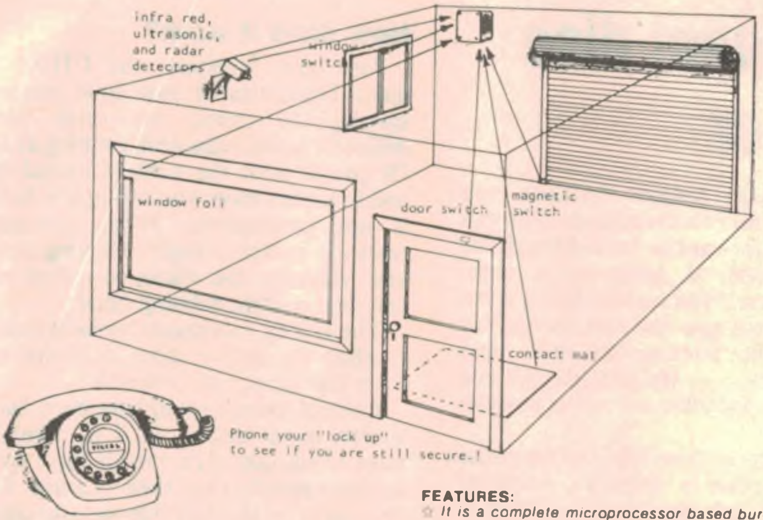
TWO MODELS ARE AVAILABLE
1) DIALLER ONLY
2) DIALLER WITH POWER SUPPLY

and complete composite control module with N.O. and N.C. inputs, delay etc. This unit has a tamper proof steel box with space for a backup battery. (Charger is Included in price).

BOTH UNITS PLUG STRAIGHT INTO A TELEPHONE SOCKET!

Cat. LA-5120 - Full alarm/control unit	**$399**
Cat. LA-5130 - 4 zone dialler only	**$299**

Both units are supplied in a metal cabinet.



Phone your "lock up" to see if you are still secure.!

OPERATION OF DIALLER

○ When ALARMED the following takes place:- ○ The unit "grabs" the Telecom line from all other extensions ○ The dialler listens for "Dial Tone", when it hears the dial tone it dials out ○ Will even dial out an STD number or even from a switchboard (0 access) ○ After dialling the unit listens for "Ringing Tone" when it stops it:- will give a "bleep" message (the number of bleeps indicating the zone or zones alarmed) - will repeat bleep message and close down ○ If no dial tone is detected, the unit will go "off line" again and then try again (like replacing the receiver and then picking it up again) ○ If the line is engaged or none answers after a short time period the dialler will close down and dial the next number that is programmed in (a maximum of 6 attempts) ○ The units have 4 input zones which can be connected for all operating from N.O. contacts (or +12V dropping to less than ½V) or for all operating from N.C. contacts (or ½V rising to +12V) ○ A No AC signal is available which can be looped into a NO zone to give indication of supply failure (provided that the standby battery is fitted) ○ A Normally Closed contact is fitted to the case, to dial out if the unit is tampered with ○ The units have a return channel so that you can dial the unit up from a remote location and it will send bleeps indicating the last message that was transmitted. ○ Will operate with the following sensors:- N/C contacts - window foil - window/door switches, N/O contacts - mats, heat detectors, or operated and the contacts from Ultra-Sonic, radar, IR detectors and from most sector control units. ○ Operates from 12V AC or 13.6V DC (for recharging 12V battery) (or mains LA-5120)

FEATURES:

☆ It is a complete microprocessor based burglar alarm control unit with integral dialler, with facilities for 3 alarm zones and 1 test zone. ☆ It has the following zone options:- i) Delay zone for entry/exit with 30 second delay before dialling out and bringing in the alarm relay, unless switched 'off with a key switch, before this. ii) Instant zone, after the arming delay will dial out immediately and bring the alarm relay in. iii) Silent zone, will dial out but not bring relay in - option 1 can be switched 'OFF' with the unit - option 2 or a 24 hour panic or armed hold-up button iv) Test zone will ring in and tell you alarm is working at weekends etc. ☆ Can be programmed or re-programmed for all standard security receivers ☆ Unit is reset every time system is switched 'OFF' ☆ Can be installed by handyman ☆ No flashing lights to alert intruder ☆ Will phone up to 3 - 12 digit telephone numbers, silent zone can ring a 4th number (i.e. armed hold-up alarm could go to the shop next door and not an empty home) ☆ Will even phone STD Nos interstate ☆ Can signal fridge failure, mains failure, or fire etc.

NEW!!

LARGE COLOUR LED DISPLAYS!

- Jaycar is proud to announce a NEW range of 7 segment LED displays featuring LARGE digits and alternate colours!

NOTE THE LOW PRICES!!

Cat. No	DESCRIPTION	1-9	10+
ZD1870	0.4"(10mm) Com Anode Red	$1.00	0.95
ZD1875	0.6"(15mm) Comm Anode Red	$2.50	$2.25
ZD1880	0.6"(15mm) Comm Cath Green	$2.95	$2.50
ZD1885	0.6"(15mm) Comm Cath Yellow	$2.95	$2.50
ZD1890	12x15mm rect diff block Red	$1.50	$1.25
ZD1891	12x15mm rect diff light block Red	$1.80	$1.60
ZD1892	12x15mm rect diff light block Yellow	$1.80	$1.60

The light blocks are simply a rectangular block of diffused light. They can be seen over great distances and are generally used as status indicators.
All devices have connection data supplied.

NEW!!

UHF TUNER MODULE

This factory made unit enables you to cover the entire Australian UHF Band. The fundamental output frequency is actually around 35MHz, not VHF channel 1 as previously stated. A strong 'image' at VHF channel 1 appears, however. This enables the unit to connect straight to the antenna input of many VHF sets to enable UHF reception. The knob and reduction coil mechanism gives direct UHF channel readout!!

USES:
- **Can convert VHF (only) TV's to VHF/UHF**
- **Enables you to watch UHF output VCR's on VHF TV!**
- **Ditto for home computers & video games**

Supplied with connection instructions and power supply info.

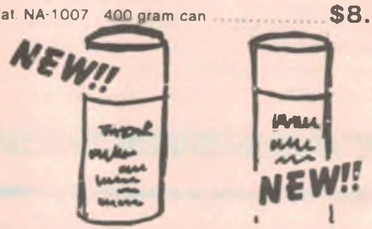
DON'T PAY HUNDREDS OF DOLLARS TO UPGRADE YOUR PERFECTLY GOOD VHF TV TO AN EXPENSIVE UHF SET!!

Cat. DM-9000 UHF Tuner Module	**$34.50**
Cat. DM-9002 Knob and Dial to suit	**$5.45**

VIDEO HEAD CLEANING SPRAY -

A-F Spray whilst designed for cleaning metal surfaces and leaving no residue it is absolutely ideal for cleaning video heads. It comes with an extension tube to get to remote spots. Leaves absolutely no residue and blasts away grime with no danger of scratching. A sound investment in VCR care. Also great for audio heads of course.

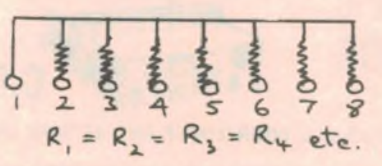
Cat. NA-1007 400 gram can	**$8.95**



PCB CLEANING SOLVENT

It may not be obvious, but many circuit problems occur when flux and other residues (even finger prints) remain on the PCB causing 'leakage' between tracks. If you work RF, high input impedance (i.e. FET OP amps etc), Ioniser or other circuits PCB cleanliness is a MUST.
The Jaycar PCB Cleaning Solvent is a spray that dissolves all flux residue and grime leaving the track work and board absolutely clean. We then recommend that you "tropicalise" the underside with spray-on lacquer. (Also available Cat. NA-1002 350 gram can $8.95).

Cat. NA-1008 454 gram can	**$8.95**



ASK FOR A NEW CATALOGUE!!

Mail Order customers, if you have not seen our new catalogue, boy are you missing out! If, (or when) you next buy from us by mail order just ask for a catalogue. It will be sent FREE with your order!If you have one and want one for a friend, that's fine too! Just ask!

NEW!!

DESK TOP MAGNIFIER

Superb magnifying glass 90mm diameter mounted in a chrome ring supported on a 240mm flexible gooseneck. A sturdy cast base supports the unit.
Ideal for checking solder joints, PCB cracks, component identification etc. High magnification over large area will pick up tiniest flaws! A must in every serious workshop.
Cat. QM-3500

$29.95

NEW!!

RESISTOR NETWORKS

STAGGERING LOW PRICES

Jaycar has secured a massive scoop purchase of quality resistor networks at unbelievable prices!!
The networks are wired as per schematic illustration, and all values in each device are the same. As very few hobby circuits feature networks at the moment, we feel that this product will only appeal to the service and OEM industry. If you are a user of resistor networks, send us a note and we will send you a specific list of stock with prices.
(We have probably the largest stocks and range in Australia). In the meantime we offer a "service pack" of networks at a bargain basement price. Each pack contains 50 assorted networks (Single-in-line packaged) in resistor values ranging from 680R to 1 Meg. (At least two of each network).

COST OF THE PACK?

ONLY $10!!

Cat. RR-3380

JUNE ONLY SAVE 15%
ONLY $84.50

NEW!!!

HEART RATE MONITOR

Not a kit. Built, tested and guaranteed.
This fully self-contained unit enables you to monitor your pulse rate - anywhere!!
The unit features large, easy to read LED display and comfortable finger grip pulse sensor.
An exclusive feature is the bracket that enables you to mount the unit to tubular objects such as a bike (or exercise bike), weight training equipment etc.
NOW you can monitor your heartbeat accurately and easily while *in the middle* of exercise!!
The comprehensive booklet gives you explicit instructions on use of the monitor as well as mounting guidelines.
Once again this is a beautifully presented piece of equipment. Included, are mounting bracket, vinyl case, instructions and 9V battery.
Cat. QM-6110

● ● ● ● ● ● ● ●

"JET PHONE" ADAPTOR - NEW

- IDEAL FOR AIR TRAVELLERS!!

How many times do you travel by air? If you are a regular traveller in economy, you will be undoubtedly familiar with the plastic 'pneumatic' type of stereo headphones. Well, we think that they are hopeless!!
They are uncomfortable (in our opinion) and unless you get a good fit, the sound quality is poor. Wouldn't it be nice to be able to use your OWN high quality headphones in flight?

NOW YOU CAN!!

The Jaycar AA-2040 JET PHONE ADAPTOR plugs into the two air sockets on the armrest. You then plug your headphones into the adaptor for comfortable Hi Fi sound!!

BRILLIANT AND INEXPENSIVE!!

ONLY $8.95

MORAY FLOW SENSORS BACK - BACK IN STOCK!!!

The original unit as used in the EA Car Computer (Aug '82) Due to pressure of demand another batch of genuine MORAY fuel flow sensors has been acquired. Despite devaluation of the Australian $ and inflation, we can STILL bring them to you at our August 1982 price of $59!! Each unit is individually calibrated and comes complete with data

Cat. XC-2020	**$59**
"T" piece for fuel bypass systems. Cat. XC-2021	**$3.95**

REGULATED POWER SUPPLIES (3rd Edition)

The newest, most comprehensive discussion of internal architecture and operation of the latest solid-state regulators. Thoroughly explains when regulated supplies are needed and how to incorporate them into your design projects. Discusses modern practical circuitry including linear and switching circuits and late ICs. A valuable asset for any technician or engineer involved in servicing or design.
424 Pages. 5½ x 8½. soft.
Cat. BS-0526 **$27.95**

SMOKE DETECTORS BACK!!

BARGAIN OF THE CENTURY

Once again we have made a scoop purchase of ionisation chamber type smoke detectors.
When we had this product before we sold many thousands at our ridiculously low prices. We sold out of course but NOW THEY'RE BACK!!
The smoke detector is completely self-contained, is round and measures a compact 115mm diameter and 40mm deep. Fixing screws and masonry plugs are provided along with 9V battery and very comprehensive instruction manual.
The "Smoke Sentry" once sold for **$49** and frankly was a flop at that price. Despite the fact that every home should have at least one, people considered that their children and their own lives were not worth that amount.
But now you have NO EXCUSE! Once again Jaycar has made a MASSIVE SCOOP PURCHASE of SMOKE DETECTORS below importers COST! We pass the savings on to you!
If you missed out before HURRY this time. Don't be disappointed!!
Cat. LA-5090

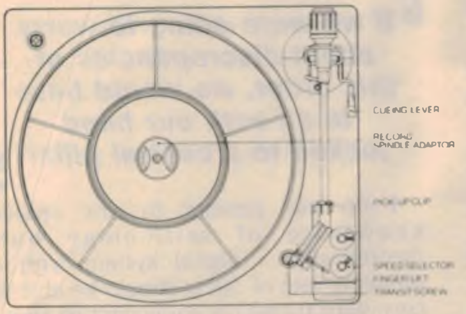
1-9 Pcs
$19.95
10+
$17.95

MASSIVE PRICE BREAKTHROUGH!

ELECTRONIC BELT DRIVE TURNTABLE

BSR QUALITY

Jaycar has made a sensational purchase of **Belt Drive Turntables - BELOW** Manufacturers Cost!!
Because of our buy we can pass them on to you at a **MASSIVE SAVING.**
The Turntables are made in England by B.S.R. They are unmounted and suitable for Disco Consoles, 3-in-1's etc. They are also ideal as replacements for existing 3-in-1 sets. (See specifications).
But there is an aspect that is **really amazing!** You can work the Turntable from 9-12V DC. This means that you can run the unit from a car or truck!! (The AA0292 model can of course run on 240V mains).
The Turntable features quality Belt Drive operation, lightweight Transcription type arm, Cueing facility and Stereo Ceramic cartridge with Diamond Stylus. The platter has calibration markings to check speed. A simple neon on 240V will "strobe" to the markings). Whilst the 33 & 45 rpm speed has been accurately set in the factory, you have the facility to make pitch adjustments underneath the turntable.
The DC Motor Drive (as used in the best turntables) is electronically controlled!!
Each unit comes with complete instructions.
Quantity limited! You will have to hurry to avoid disappointment.



SPECIFICATIONS:

- ★ Dimensions 330(W) x 285(D) x 60(H)mm overall
- ★ Platter diameter 280mm
- ★ 2 speed - 33 & 45 rpm (internally adjustable)
- ★ Pick-up arm counterbalanced type with cueing facility
- ★ Pick-up ceramic (stereo) with diamond stylus
- ★ Turntable operation - auto stop, will return to rest automatically. Turntable chassis is sprung on all corners with transit screws & clips
- ★ Output stereo RCA sockets underneath unit
- ★ Weight 1.5kg

Check the price! Cat. AA-0290
(Requires 9-12V DC @ 500mA)

ONLY $29.95

240V version - (includes 12V 500mA adaptor)

Cat. AA-0292 **ONLY $39.95**

(Due to the weight of the unit post and packing is $5 NOT $4.50).

● ●

Jaycar Incorporating
ELECTRONIC AGENCIES

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

NUMBER 1 FOR KITS

POST AND PACKING CHARGES

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

"Free INSURANCE for Road & Registered Post over $200"
All heavy or bulky items (over 20kg.) sent Comet Road Freight $12.00 anywhere in Australia.

SHOP HOURS CARLINGFORD, CONCORD & HURSTVILLE
Mon – Fri 9am – 5.30pm: Sat – 9am – 12pm: Thurs night 8.30pm (Not Concord)
SHOP HOURS SYDNEY
Mon – Fri 8.30am – 5,30pm. Sat – 8.30am – 12pm: Thurs night 8.30pm
MAIL ORDERS AND CORRESPONDENCE: P.O. Box 185, Concord, 2137

Mail Order By
BANKCARD
Via Your Phone

The 'New Wave' of reviewers

If reader feedback to recent remarks is any criterion, the "Golden Ear" set, who express their views so freely in British hifi magazines, are not exactly overburdened with fans in Australia. Many and varied are the cracks that I hear, mostly at the expense of our tweedy cousins.

FORUM

Conducted by Neville Williams

As I remarked on a previous occasion, their ideas would be taken a lot more seriously if they were presented in reasoned terms, more appropriate to what are supposedly refinements to an already commendable system.

But no! Rarely are the writers satisfied to note a small but subtle improvement; that's much too tame. They fiddle with this or that and suddenly a whole new world of sound is revealed — expressed in terms that are totally out of proportion to what they have done. For the most part, any possible merit in their observation is discarded along with the language in which it is expressed.

Those responsible tend to be written off in not very complimentary terms.

One tongue-in-cheek theory is that the aforesaid writers and correspondents have got caught up in a nation-wide leg-pulling competition. The more outrageous their claim and the more convincingly it is stated, the greater is the number of points awarded. The outright winner has yet to be named but, in the meantime, those who qualify for consideration win the right to have their submissions published!

> ***'The more outrageous their claim and the more convincingly it is stated, the greater is the number of points awarded'***

While accepting that this is where it all started, someone else has suggested that many of the statements have been put — and subsequently defended — with such fervour that they are being accepted as dogma, with the "competitors" well and truly hoisted with their own petard.

One well known Sydney hifi dealer won't have a bar of all this. He maintains that, although there might appear to be a small army of way-out golden-eared correspondents in Britain, there's really only about half a dozen of them — all busily churning out articles and letters to the Editor under different names!

"Why would they want to do this?"

"That's easy", someone else chortles. "The British hifi industry can't compete with Japanese mass-produced products, so they rubbish them.

"They rubbish copper wire, PC boards, transistors, ICs and all the things the Japanese rely on. They make out a case for doing it some other way and then make a quid on the strength of it!"

"It's ridiculous" says a local manufacturer of loudspeaker systems.

"Would you believe that I've had systems back for service in which the owners have replaced my original, perfectly adequate leads with little bits of supposedly special cable?

"How crazy can they get?"

While it affords the participants a certain amusement, it is a bit sad for those of us who can look back on an era when the British hifi industry led the world; when it was characterised by enthusiasts and contributors of a very different breed: Gilbert Briggs of Wharfedale; Arthur Haddy of Decca; Percy Wilson of "Gramophone" fame; Peter Walker of Acoustical Quad; Henry Hartley of Hartley Loudspeakers; Stanley Kelly with his ribbon loudspeakers; Harold Leak with his "sandwich" system; and many others, not forgetting "Wireless World's" inimitable "Free Grid".

One might almost repeat the classic lament: "They don't make 'em like that any more!"

In a letter set out in a separate panel, B.C. of Darwin takes up one of the matters raised in our March issue, namely the policy of some Japanese manufacturers to use a single, switched D/A decoding chip in their CD players, and not to bother about restoring the original time relationship between the time-interleaved left and right channels. Could the resulting 11.34 microsecond lag in one channel upset the stereo image and prejudice the overall sound quality?

Responding to this, we drew attention to a diagram from Matsushita (National-Panasonic) which indicated that this order of time lag was totally negligible; that it would result, for example, from a discrepancy of a mere 3mm in the position of a loudspeaker — or the head — in a symmetrical listening situation.

If we were going to worry about discrepancies of this order, we would have to sit with our head locked to a central pillar; hence the original jocular reference to "the man in the iron mask".

I hadn't thought about headphone listening but, as B.C. points out, an 11-microsecond time lag in one channel could be compensated for by inserting a 3mm foam spacer between the opposite phone and the ear. But let's not call it a foam spacer, or a sponge rubber pad, or anything else as common as that. Let's call it a "Japanese Compact Disc Phase Corrector".

B.C.'s reference to this, and the basis on which it's selling price should be determined will not be lost on those who take note of the adverts and the write-ups for hifi products of arguable merit.

But, enough of that for the moment.

In his letter, B.C. goes on to debate the adequacy of the 44.1kHz sampling rate used for present-day compact discs. Scaling up from his experience with seismic signals, he feels that the sampling rate for hifi audio should not be less than 100kHz.

> ***'If we were going to worry about discrepancies of this order, we would have to sit with our head locked to a central pillar'***

I do not pretend to any special knowledge of seismology but, theoretically, a digital system with a sampling rate of 50Hz should be able to cope with transients equivalent to about 22Hz. If the engineers did have a figure of 10Hz in mind, their 5-times sampling rate would have allowed for cyclic phenomena of up to 10Hz, plus a margin for some distortion content.

The claim that seismologists could pick the difference between digital and analog signals seems clearly to indicate that the original signals contained transients faster than 22Hz, and that their presence or absence was evident on inspection. Even so, the system designers

have a few things to sort out!

Dear Neville,

As a regular reader of your "Forum", I found your comments on "BBC fingers time lag" (March '84) very interesting.

I wonder if the "golden eared" people are actually listening to compact discs through regular hifi systems or whether, perchance, they are listening through headphones.

If the latter is the case, your "man in the iron mask" concept is especially applicable and we should, maybe, look at marketing a piece of 3mm thick sponge rubber as a "Japanese Compact Disc Phase Corrector". It could sell for anything up to $100, as any improvement in this high class hifi field should logically cost a small percentage (1%-2%) of the value of the total system.

I might just rush off to my local patent office with this one!

On quite another subject, I had experience in a previous job with digitising seismic signals: .001 to 10Hz at 16 bits. The engineers selected a sampling rate of five times the highest usable frequency for the output filter — hence 50Hz at 48db/octave.

The seismologists maintained that they could always distinguish a digital signal from analog, not by dynamic range or noise floor but by transient response. They claimed that 5 samples per cycle was not high enought but, by reason of the 24-hour monitoring and economy of storage, it was left at that.

On this basis, I don't see how a sampling rate of less than 5 x 20kHz can be justified for hifi sound. I am told that the figure of 5 was chosen because of aliasing considerations. Food for thought, don't you think?

One other thing comes to mind, as I write, namely the issue of playing stereo channels in mono mode. My practice when adjusting the azimuth of stereo tape heads was to set up in mono mode and adjust for maximum output — and hence minimum phase shift.

This was taken a step further in our digital tape driver by having a 4-bit buffer on the output of the read amplifier circuits and variable delays on the record circuits. So the problem has been known about for years:

Maybe the use of a single, switched D/A converter was a cost-saving decision by the Nippon manufacturers: "The customers won't know, so why worry about it?" I'm willing to bet that we see later model Nippon players with modified boards.

Keep up the good work but, in the meantime, I must nip off to the Patents Office!

B.C. (Darwin, NT)

opted for a restricted bandwidth as an economy measure for recording, presumably on the basis that the vital information was concentrated mainly between .001 and 10Hz.

The comparison between seismic and audio signals breaks down at this point. If we accept that, by definition, an audio signal is one that is audible, then the upper limit, even for humans with exceptional hearing, is about 17kHz. Far from having a restricted bandwidth, the CD system, which is consistently measured as flat to 20kHz, has bandwidth to spare.

It may indeed be possible, with test equipment, to identify supersonic output from some musical instruments and to demonstrate that it is or is not preserved by recording equipment of one kind or another. But that is not relevant to the listening experience unless it can be shown unequivocally that human beings are in some way responsive to supersonic energy — in this case to energy beyond 20kHz.

We debated this subject a few months ago, without any revelation to that effect.

In short, I doubt that B.C.'s observations about seismic equipment give any cause to question CD practice, although I am sure that there will be plenty more arguments to come.

(It is interesting to note, in this connection, that Doug Sax of Sheffield Labs in California, a long-time opponent of digital sound, has recently modified his views. While still rejecting certain compact disc practice, he says that recent experience with the Sony/Nakamichi PCM-F1 recorder "tells me my expressed opinions regarding a 44kHz 16-bit system will have to be revised.")

Finally, and reverting to his earlier point, B.C. offers a bet that Japanese manufacturers will go over to the use of dual D/A converters and 11-microsecond buffers. I certainly wouldn't put up money against him.

> **' It has all been picked over, seized upon and proffered in fragmentary fashion as possible explanation for allegedly "sweeter" sound '**

The Japanese are nothing, if not pragmatic. Having demonstrated to their own satisfaction that an 11-microsecond delay in one channel was of no consequence, they would not have hesitated to omit the apparently redundant circuitry.

But, if they sense that the decision is being used to their disadvantage, I wouldn't expect them to dig their heels in and doggedly defend their position, no matter how justified. They'll simply come up with a bigger and better IC and offer the ultimate in left/right signal matching — x% better than anybody else's!

They're experts in saving phase!

Getting back to the original theme, I seem to have collected — or been given — quite a clutch of clippings about connectors and leads, the merits or otherwise of various metals, purity, polarity and so on.

Looking at them, I get the impression that the writers have spent hours poring over unfamiliar textbooks, searching for differences between metals, even to their atomic number, the physical shape of conductors, the influence and chemistry of insulation and so on.

It has all been picked over, seized upon and proffered in fragmentary fashion as possible explanation for allegedly "sweeter" sound — irrespective of whether the characteristics have the slightest relevance to audio frequency applications.

Kilo, Mega and Giga are all Hertz, so what's the difference?

It has become so tedious that, for the present, I prefer to let the wafflers waffle on. If something startling emerges, fair enough but, in the meantime, I'll stay with what is accepted and demonstrable "good practice".

I do, however, want to add a few remarks about two other aspects of "golden ear" theorising, namely opposition to PC (printed circuit) boards and the use of valve rather than solid-state technology.

PC boards were taken up by the electronics industry more or less

MAIL ORDER MAIL ORDER MAIL ORDER

Why buy from a mail order only house
when we have two shops for convenience
and a highly efficient mail order service?

5% off for order over $100
10% off over $500: 12% off over $1000
OFFER APPLIES TO ITEMS ON THIS PAGE ONLY

7400	
7400	40
7402	40
7403	40
7404	40
7406	2 50
7407	40
7408	40
7410	40
7411	40
7413	40
7414	80
7416	50
7417	50
7420	40
7421	40
7423	40
7425	50
7426	40
7427	50
7430	40
7432	50
7437	50
7438	50
7440	40
7442	60
7444	89
7445	1 00
7446	1 00
7447	80
7448	1 16
7451	40
7454	40
7470	42
7472	40
7473	48
7474	40
7475	54
7476	40
7483	.75
7485	75
7486	70
7489	4 90
7490	70
7492	70
7493	75
7495	75
7496	60
7497	99
74107	60
74122	60
74123	70
74125	40
74126	57
74145	.75
74147	1 95
74148	90
74150	1 29
74151	60
74153	50
74154	1 45
74155	80
74156	83
74157	80
74160	1 12
74161	80
74162	1 20
74163	80
74164	80
74165	79
74166	99
74167	2 20
74174	59
74175	60
74176	1 20
74177	1 10
74180	70
74182	1 05
74184	3 50
74190	59
74191	99
74192	69
74193	79
74194	70
74195	70
74196	70
74197	70
74198	1 45
74199	1 60
74221	2 50
74251	1 35
74279	60
74283	69
74290	62
74293	85
74298	66
74365	83
74366	83
74367	.83
74368	83
74LS00	
74LS00	40
74LS01	40
74LS02	40
74LS03	40
74LS04	60
74LS05	40
74LS08	60
74LS10	25
74LS11	40
74LS12	40
74LS13	40
74LS14	40
74LS20	40
74LS21	40
74LS26	40
74LS27	.40
74LS30	.40
74LS32	.40
74LS33	.40
74LS37	40
74LS38	40
74LS40	40
74LS42	.45
74LS47	.54
74LS48	49
74LS49	1 50
74LS51	.40
74LS54	40
74LS55	.40
74LS73	40
74LS74	40
74LS75	.44
74LS76	.44
74LS83	49
74LS85	41
74LS86	31
74LS90	60
74LS92	55
74LS93	44
74LS95	60
74LS96	80
74LS107	44
74LS109	38
74LS112	39
74LS122	59
74LS123	61
74LS125	40
74LS126	53
74LS132	45
74LS136	40
74LS138	90
74LS139	90
74LS151	47
74LS152	55
74LS153	80
74LS154	1 30
74LS155	52
74LS156	45
74LS157	43
74LS158	40
74LS160	59
74LS161	52
74LS163	56
74LS164	80
74LS165	65
74LS170	79
74LS173	61
74LS174	90
74LS175	80
74LS190	83
74LS191	79
74LS192	60
74LS193	80
74LS194	
74LS195	80
74LS197	80
74LS221	80
74LS240	1 80
74LS241	1.85
74LS242	1 90
74LS243	1 90
74LS244	1 95
74LS245	2 10
74LS248	52
74LS249	82
74LS251	55
74LS253	52
74LS257	90
74LS258	47
74LS259	79
74LS266	39
74LS273	89
74LS279	44
74LS283	56
74LS290	50
74LS293	80
74LS298	60
74LS352	80
74LS365	80
74LS366	60
74LS367	60
74LS368	60
74LS373	1 80
74LS374	1 80
74LS375	49
74LS377	1 10
74LS378	52
74LS390	69
74LS393	70
74LS447	72
74LS629	4 90
74LS640	1 70
74LS670	99
81LS95	1 85
81LS96	1 85
81LS97	1 85
81LS98	1 85
74F00	
74F00	70
74F02	70
74F04	70
74F08	70
74F10	75
74F11	75
74F20	75
74F32	75
74F64	75
74F74	85
74F86	1 10
74F109	96
74F138	1 58
74F139	1.58
74F151	1 58
74F153	1.58
74F157	1 58
74F158	1.58
74F175	2 50
74F181	4 35
74F182	2 30
74F189	6 80
74F190	3.60
74F191	3 60
74F194	2 16
74F241	3 15
74F243	3 92
74F244	3 15
74F251	1 75
74F253	1 75
74F257	1.75
74F258	1 75
74F350	3.20
74F352	1.75
74F353	1 75
74F373	3.60
74F374	3 60
74F399	2.50
74F521	3 80
74F533	3 60
74F534	3 60
74S00	
74S00	40
74S02	47
74S03	45
74S04	40
74S05	44
74S08	44
74S10	44
74S11	42
74S15	59
74S20	42
74S30	47
74S32	49
74S40	.50
74S51	42
74S64	45
74S74	.50
74S86	58
74S112	68
74S113	78
74S132	58
74S133	45
74S135	1 20
74S136	2 20
74S138	78
74S139	88
74S140	80
74S151	65
74S153	65
74S157	80
74S158	78
74S161	4 50
74S174	78
74S175	85
74S188	2 80
74S189	2 85
74S194	1 50
74S242	3 95
74S253	85
74S257	93
74S258	99
74S283	1 60
74S287	2 50
74S288	2 40
74S289	3 10
74C00	
74C00	60
74C02	60
74C04	60
74C08	60
74C10	
74C14	80
74C20	60
74C30	60
74C32	60
74C42	1 25
74C48	1 65
74C73	90
74C74	1 00
74C83	2 10
74C85	1 40
74C86	60
74C89	3 70
74C90	1 40
74C93	1 40
74C95	1 50
74C107	1 05
74C150	3 40
74C151	2 90
74C154	4 65
74C157	2 60
74C160	1 30
74C161	1 05
74C162	1 25
74C163	1.20
74C164	1 50
74C165	1 65
74C173	1 00
74C174	1 00
74C175	90
74C192	1 55
74C193	95
74C195	1 65
74C200	12 95
74C221	2 65
74C240	3 35
74C244	2 60
74C373	2.60
74C374	2.50
74C901	85
74C902	80
74C904	.77
74C906	.75
74C907	.75
74C908	1.50
74C910	12.50
74C911	11.85
74C912	12 50
74C914	2 20
74C915	1 95
74C917	12.00
74C918	1 80
74C920	5.50
74C922	5 60
74C923	5.40
74C925	7 50
74C926	7 90
74C927	6 80
74C928	8 50
74C929	4.20
74C930	4 20
74C941	2 25
74C989	8.60
4000	
4000	50
4001	.50
4002	50
4006	80
4007	50
4008	70
4009	66
4010	62
4011	50
4012	50
4013	31
4014	80
4015	65
4016	60
4017	1.00
4018	78
4019	60
4020	60
4021	79
4022	66
4023	40
4024	56
4025	40
4026	98
4027	60
4028	69
4029	84
4030	60
4031	3 25
4033	1 80
4034	1 80
4035	90
4040	1 00
4041	1 00
4042	60
4043	80
4044	1.00
4046	1 50
4047	1 00
4048	50
4049	50
4050	50
4051	72
4052	1 15
4053	80
4055	2 20
4060	1 00
4063	1 10
4066	80
4068	60
4069	60
4070	60
4071	60
4072	60
4073	60
4075	60
4076	1 00
4077	60
4081	60
4082	60
4085	60
4086	60
4089	2 10
4093	40
4094	90
4099	1 20
4104	2 30
4160	80
4161	1 10
4163	1 10
4174	80
4175	80
4194	80
4409	5 60
4411	10 50
4419	3 40
4469	13 50
4495	2 80
4500	5 80
4502	88
4503	68
4507	60
4508	1 20
4510	80
4511	80
4512	70
4514	1 70
4515	1 95
4516	1 00
4518	1 00
4519	1 00
4520	1.00
4521	2 00
4522	1.14
4526	1 90
4527	1 00
4528	84
4529	1 24
4531	1 04
4532	95
4534	6 00
4538	1.10
4539	60
4541	1 10
4543	94
4553	3 00
4555	60
4556	65
4558	1 40
4560	2 50
4569	2 10
4572	60
4583	1 00
4584	.70
4585	.82
4599	4 20
9000	
9300	60
9302	1.10
9304	.62
9307	1.50
9308	1 90
9309	64
9310	88
9311	1 69
9312	54
9314	59
9316	78
9318	1 40
9320	5 00
9321	88
9322	55
9324	78
9328	99
9334	1.18
9338	1 30
9340	2 85
9368	1 18
9370	94
LINEAR ETC.	
AD570	55 00
AD7524	12 10
ADC0800	14 90
ADC0804	5 50
ADC0808	12 60
ADC0809	8 00
ADC0817	13 60
ADC1210	58 00
AY-3-1015	6 50
AY-3-8910	10 00
BR1941	11 50
BR1943	12.00
CA3028	1 90
CA3036	4 50
CA3039	1 60
CA3059	6 50
CA3081	99
CA3130	1 40
CA3130T	1.95
CA2140	80
CA3140T	1 95
CA3146	2 20
CA3401	99
DAC0800	3 20
DAC0808	2 50
DAC1220	12 50
DM8121	2 50
DM8130	5 20
DM8131	2 95
DM8309	64
DM8310	88
DM8312	54
DM8316	78
DS8820	2 50
DS8830	2 70
DS8833	2 90
DS8836	2 50
DS8859	2 05
DS8869	1 80
DS75107	80
DS75108	1 20
DS75110	1 20
DS75150	1 20
DS75154	95
DS75451	60
DS75452	45
DS75453	80
DS75454	66
FD1771	19 00
FD1791	36 00
FD1793	30 00
FD1795	35 00
ICL7106	13 50
ICL7107	17 00
ICL7660	4 80
ICM7217A	17 50
ICM7218A	18 00
ICM7555	1 90
ICM7556	2 70
LF347	1 95
LF351	60
LF353	90
LF356	1 25
LF357	1 25
LF398	3 95
LF398H	6.50
LF13741	.72
LH0002	10 90
LH00042CH	9 50
LH0070-1H	15 90
LH0071-1H	17 45
LM10CH	6 50
LM304H	2 95
LM307	.50
LM310	1 95
LM311-14	1 20
LM318	1.75
LM319	1 95
LM322	1 95
LM325	4 50
LM329	80
LM334	1 60
LM335Z	1 50
LM336Z	1 50
LM349	1.65
LM358	.80
LM358AN	1 40
LM374	4 80
LM377	2 10
LM380-8	1 20
LM380-14	1 40
LM381	1 80
LM382	1 50
LM383	1 95
LM386	.72
LM387	80
LM394CH	5.80
LM565	89
LM566	2 00
LM567	90
LM1830	3 20
LM1886	6 00
LM1889	2 40
LM2917-14	2.10
LM3080	1 20
LM3089	2 90
LM3524	2 98
LM3900	1 00
LM3905	1 50
LM3909	1 50
LM3911	2 00
LM3914	4 95
LM3915	4 75
LM3916	4 80
LM4250	3 00
MC1350	1 38
MC1406	9 00
MC1445	3 90
MC1456	1.60
MC1466	13 50
MC1494	7 40
MC1495	7 20
MC1496	3 90
MC3340	1 40
MC3370	3 70
MC3470	9 00
MC3486	3 30
MC10116	1 40
MCM66740	16 00
MM5303	6 50
MM5837	2 50
MM58167	11 50
MN3001	14 50
MSM58372	12 50
NE530	2.30
NE558	1 90
NE571	2 90
NE5534	1.75
NE5534AN	2 50
OM321	10 10
OM335	17 50
OM350	9 50
SA80600	6 50
SN76477	5 65
SN76488	7 40
TA7205	2 80
TCA220	8 50
TL061	1 10
TL062	1 55
TL071	80
TL072	1 50
TL074	2 85
TL075	3 20
TL081	60
TL082	1 20
TL084	2.35
TR1602	7 30
TR1863	6 70
TR1983	9 00
UA301	48
UA301H	1 35
UA305H	1 25
UA308	58
UA311	62
UA311H	1 30
UA324	90
UA339	45
UA348	1 40
UA393	52
UA555	60
UA556	90
UA709	58
UA710	75
UA711	60
UA723	49
UA723H	1.30
UA725	2 50
UA739	99
UA741	60
UA741H	1 15
UA747	98
UA1458	50
UA1488	70
UA1489	.70
UA2901	60
UA3086	.50
UA4136	1 20
UAA170	4.60
UAA180	4 60
ULN2003	1.25
WD1393	65.00
WD1691	17 50
XR2206	5.95
XR2207	5 00
XR2208	3 20
XR2211	6 90
XR2216	2 80
XR2240	3 00
XR2243	3 00
8T26	1.80
8T28	2 40
8T95	1 60
8T96	1 80
8T97	1.95
IIC90	12 50
95H90	7 00
MICRO	
2102	1.50
2112	7 50
2114	2 95
2532	11 75
2564	16 50
2708	5 90
2716	4 50
27128	39 00
2732	5 40
2764	9.50
2816	12 50
2911	32 00
2912	22 00
2920	108 00
4116 15ONS	2 95
4164 15ONS	7 50
6116P3	6 80
6502	9 45
6502A	9 80
6505	12 00
6507	8 64
6520	2 99
6522	7 90
6522A	10 80
6532	10 70
6545	19 80
6551	13 80
6800	4 90
6802	6.50
6808	4 50
6809	14 00
6810	3.20
6820	2 85
6821	2 70
6840	5 80
6844	11 50
6845	11 50
6847	7 50
6850	2 50
6852	2 70
6854	8 80
6875	12 50
68A09	29 50
68B00	6 50
68B21	3 90
68B40	7 80
68B45	16 50
68B50	3 40
68B54	12 00
8080	6 90
8085A	5 90
8086	53 00
8088	42 00
8155	5 20
8156	5 50
8185	35 00
8202A	57 00
8203	57.00
8206	117.00
8212	1 60
8214	1 80
8216	1 65
8224	4 50
8226	1 80
8228	3 50
8231	285 00
8237	42 00
8238	10 80
8243	3 00
8251A	4 90
8253	5 60
8255A	3 50
8257	6 50
8259	4 70
8271	97 00
8272	30 00
8273	59 00
8274	44 00
8275	45 00
8276	24 00
8282	8 40
8283	8 40
8284	10 40
8286	8 40
8287	8 40
8288	25.00
8289	32 00
8291A	43 00
8292	35 00
8293	25 80
Z80CPU	4 90
Z80ACPU	5 90
Z80BCPU	11.00
Z80P10	4 40
Z80AP10	5 80
Z80S10	12 70
Z80CAS10	16 00
Z80CTC	5 00
Z80ACTC	6 50
Z80DMA	14 50
Z80ADMA	17 00
8741A	36 00
8748 8	26 00
8749	55.00
8755A	35 00
VOLT REGS	
LM309H	3 90
LM317HVK	7 50
LM3371	1.50
LM337HVK	12 00
LM337K	6 50
LM338K	8.00
LM350K	6 30
LM3501	4 50
LM396K	18 90
LM79L05	.70
LM79L12	60
LM79L15	.60
SH1605	14 00
UA317T	1 50
UA317K	2 60
UA309K	1 70
UA494	3 20
UA7805	65
UA7805K	1 65
UA7806	75
UA7808	65
UA7808K	1 65
UA7812	65
UA7812K	1 65
UA7815	65
UA7815K	1 65
UA7818	.70
UA7818K	1 70
UA7824	65
UA7824K	1 70
UA78H05K	7 50
UA78H12K	9 20
UA78HGKC	9 80
UA78L05	40
UA78L12	40
UA78L15	40
UA78M05	60
UA78M12	60
UA78P05K	15 70
UA78540	2 80
UA7905	72
UA7905K	1 85
UA7908	72
UA7908K	1 85
UA7912	72
UA7912K	1 85
UA7915	.90
UA7915K	1 85
UA79HGKC	16 00
UA79M05	65
UA79M12	65
OPTO	
4N25	98
4N26	98
4N28	98
4N32	98
4N33	1.30
4N35	98
MCT6	1.40
MCT2	95
FND357	1 60
FND500	1 40
FND507	1 60
FND800	3 50
TIL31A	2 50
TIL81	2 00
BPW50	2 00
COY89	90
MOC3020	2 10
MOC3021	2 50
MAN72A	1 25
MAN74A	1 25
FCD820C	90
FCD825C	.90
FCD850C	1 20
FPT1008	1 30
MSM3914	8 50
MSM3916	8 50
LEDS	
3mm GREEN	16
3mm RED	10
3mm YELLOW	16
5mm GREEN	16
5mm RED	10
5mm YELLOW	16
Z0162	
RECT GREEN	.25
Z0164	
RECT YELLOW	.25
FLS010	
5mm LED CLIP	08
DIODES	
IN4148	03
IN914	03
IN4001	.05
IN4002	05
IN4004	.05
IN4007	05
IN5404	.16
IN5408	.18
OA47	44
OA90	.18
OA202	88
OA636	90
P6006	
6A400V	.36
BAW62	.30
BA102	.70
IN3492	
25A100V	1.50
IN3492R	
25A100V	1 50
INS060	.30
BRIDGES	
10A400V	1.80
25A400V	3.10
BR254	
25A400V	3.95
BR354	
35A400V	4.50
W04	
I5A400V	.40
ZENERS	
IN4733A	
5 IV 1 WATT	.18
IN4734A	
5 6V 1 WATT	.18
IN4736A	
6 8V 1 WATT	18
IN4740A	
IOV 1 WATT	.18
IN4742A	
129 1 WATT	.18
IN53498	
12V 5 WATT	.70
BZX61/C75	
75V 1 WATT	.80
TRANSISTORS	
AC126	70
AC127	60
AC128	86
AC187	58
AC188	1.10
AC149	1 90
AC161	1 70
AC162	1.70
AF127	98
BC107	30
BC1078	35
BC108	30
BC108C	35
BC109	30
BC109C	35
BC177	35
BC178	35
BC179	35
BC212	20
BC318	15
BC327	20
BC328	20
BC546	15
BC547	15
BC548	15
BC549	15
BC549	16
BC550	15
BC556	.15
BC557	15
BC557B	16
BC558	15
BC559	15
BC637	35
BC639	30
BC640	.30
BCY70	60
BCY71	60
BD135	60
BD136	60
BD137	40
BD138	40
BD139	40
BD140	40
BD233	40
BD235	42
BD236	42
BD237	44
BD238	44
BD262	75
BD263	75
BD437	46
BD647	1 98
BD677	62
BD681	80
BD682	80
BDV64B	3 10
BDV65B	3 10
BDY96 BVX 80	3 50
BDY97 BVX 80	3 50
BF115	57
BF167	60
BF173	60
BF180	80
BF184	70
BF198	22
BF199	22
BF337	50
BF458	51
BF459	.51
BF469	.80
BF470	.80
BF494	27
BFY50	.53
BFY90	.72
BU126	1 87
BU208	1.50
BU326A	1 92
BUX80	2 50
BUMFE121	1 40
MFE1311.40	
MJ413	3.40
MJ802	3 95
MJ1001	2 50
MJ15003	3 95
MJ15004	3.95
MJ2955	1 70
MJ4032	8.00
MJ4035	7 50
MJ4502	4 10
MJE340	75
MJE350	85
MJE251	1 25
MJE70C	.51
MJE800	.51
MJE2955	1.92
MJE3055	1 76
MPSA05	19
MPSA06	.19
MPSA12	19
MPSA14	19
MPSA42	19
MPSA56	.19
MPSA92	19
MPF102	.56
MPF103	.79
MPF105	.79
MRF237	3.90
MRF454	29 00
MRF475	4 50
MRF901	2 80
TIP31	40
TIP31A	45
TIP31B	54
TIP31C	62
TIP32	44
TIP32A	56
TIP32B	58
TIP32C	.64
TIP41	66
TIP41A	.70
TIP41B	.74
TIP41C	76
TIP42	60
TIP42A	76
TIP42B	80
TIP42C	.82
TIP111	68
TIP112	.75
TIP116	.77
TIP117	83
TIP120	.66
TIP122	72
TIP125	.77
TIP127	96
TIP2955	1 50
TIP3055	1.50
2N301	3 90
2N697	.42
2N918	.42
2N2219	42
2N2219A	48
2N2222	42
2N2222A	48
2N2369	42
2N2484	42
2N2646	96
2N2647	1 60
2N2894	36
2N2904	45
2N2905	45
2N2905A	49
2N2906	40
2N2907	42
2N2907A	49
2N3019	46
2N3053	46
2N3054	1.74
2N3055	80
2N3302	39
2N3440	80
2N3441	2 50
2N3442	2 30
2N3563	18
2N3564	18
2N3565	18
2N3566	18
2N3567	18
2N3568	18
2N3569	18
2N3638	18
2N3640	18
2N3641	18
2N3642	18
2N3643	18
2N3644	18
2N3646	18
2N3702	27
2N3704	25
2N3771	3 20
2N3772	3 60
2N3773	4 30
2N3819	60
2N3866	86
2N3904	20
2N3906	.20
2N4032	46
2N4033	.70
2N4036	.49
2N4121	20
2N4236	1 30
2N4237	1 10
2N4250	19
2N4258	22
2N4355	.19
2N4356	19
2N4360	50
2N4401	18
2N4402	18
2N4403	.18
2N4416	1 40
2N4427	80
2N5088	18
2N5089	.20
2N5179	1.20
2N5190	.72
2N5191	74
2N5192	.61
2N5193	61
2N5195	65
2N5210	19
2N5245	.70
2N5303	3 65
2N5401	.20
2N5457	55
2N5458	.55
2N5659	60
2N5461	66
2N5485	55
2N5486	.55
2N5590	15 00
2N5591	16 00
2N5770	.19
2N5777	96
2N5873	1 35
2N5944	14 50
2N5946	19 50
2N5961	.19
2N6027	55
2N6084	22 00
2N6121	.60
2N6122	60
2N6123	.52
2N6124	60
2N6125	66
2N6126	58
2N6129	1.20
2N6130	1 40
2N6131	1 50
2N6133	1 60
2N696	.90
2N918	45
25A683	.70
2SC1017	2 60
2SC1061	70
2SC1096	72
2SC1106	4 80
2SC1226	95
2SC1306	1 50
2SC945A	.25
2SD350A	2 25
2SJ49	6 00
2SK134	6 00
3N201	1 80
SCR & TRIACS	
C1030	.65
C106D	80
C122D	1 60
C122E	2 00
C2300	5 90
Q4010L4	1 90
Q4015L5	2 70
Q6010L5	3 20
Q6015L5	3 50
Q6025H	9 80
S4015L5	2 20
S4025H	8.20
SC141D	1 30
SC146D	1 65
SC151D	2 20
ST2	55
ST4	65
TANTALUM	
IVF 35V	19
22UF/35V	19
33UF/35V	19
47UF/35V	19
1UF/35V	20
1 5UF/35V	20
2 2UF/35V	22
3 3UF/35V	23
4 7UF/35V	41
10UF/35V	55
ELECTRO PCB	
1UF/50V	15
2 2UF/25V	15
4 7UF/25V	15
10UF/25V	15
33UF/25V	15
47UF/25V	15
100UF/25V	16
220UF/25V	20
330UF/25V	25
470UF/25V	35
1000UF/16V	40
1000UF/25V	50
2200UF/25V	85
ELECTRO AXIAL	
47UF/63V	19
1UF/63V	19
2 2UF/63V	19
3.3UF/25V	19
4 7UF/25V	19
10UF/160V	.25
10UF/16V	19
10UF/25V	.19
10UF/63V	.20
22UF/25V	20
22UF/63V	20
47UF/16V	19
47UF/25V	19
47UF/63V	20
100UF/25V	20
100UF/63V	35
220UF/16V	20
220UF/25V	.25
220UF/63V	.50
470UF/16V	39
470UF/25V	42
470UF/63V	65
1000UF/16V	45
1000UF/25V	.52
1000UF/35V	.75
2500UF/16V	88
2500UF/25V	98
2500UF/35V	1 60
2500UF/50V	1 90
4700UF/35V	2 50
ELECTRO METAL CAN	
2500UF/80V	3.50
4000UF/75V	5 50
5600UF/40V	3 50
8000UF/75V	8 50
ELECTRO BIPOLAR	
2 2UF/50V	.35
4 7UF/50V	38
6 8UF/50V	39
10UF/50V	40
22UF/50V	42
GREENCAPS	
001UF/100V	.10
0015UF/100V	10
0022UF/100V	10
0033UF/100V	10
0039UF/100V	10
0047UF/100V	10
0056UF/100V	10
0068UF/100V	10
0082UF/100V	10
01UF/100V	10
015UF/100V	10
022UF/100V	10
033UF/100V	10
039UF/100V	10
047UF/100V	.14
056UF/100V	.14
068UF/100V	18
082UF/100V	18
UF/100V	.18
15UF/100V	18
22UF/100V	18
27UF/100V	22
33UF/100V	30
47UF/100V	34
85IUF/250V	
2 2IUF/250V	1 25
3 3IUF/250V	2.30
4 7IUF/250V	2.80
6 8IUF/250V	4.90
10IUF/250V	5 90
GREENCAPS HIGH VOLTAGE	
01UF/630V	22
022UF/630V	24
033UF/630V	.26
047UF/630V	30
1UF/630V	38
22UF/630V	45
33UF/630V	46
47UF/630V	50
CERAMIC	
1PF	.08
1 5PF	.08
2 2PF	08
2 7PF	08
3 3PF	08
3 9PF	08
4 7PF	08
5 6PF	08
6 8PF	08
8.2PF	08
10PF	08
12PF	08
15PF	08
18PF	08
22PF	08
27PF	08
33PF	08
39PF	08
47PF	08
56PF	08
68PF	08
82PF	08
STYROSEAL	
56PF/630V	25
68PF/630V	25
82PF/630V	25
100PF/630V	25
120PF/630V	25
150PF/630V	.25
180PF/630V	25

ROD IRVING ELECTRONICS

425 High St., Northcote, Vic. 48-50 A'Beckett St., Melb., Vic.
Phone (03) 489 8866, (03) 489 8131, Mail Order Hotline (03) 481 1436
Mail orders to P.O. Box 235 Northcote 3070 Vic.
Minimum P & P $3.00. Errors & omissions excepted.

Please address tax exempt, school, wholesale and dealer enquiries

RITRONICS WHOLESALE

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

MAIL ORDER MAIL ORDER MAIL ORDER

MAIL ORDER

MAIL ORDER

MAIL ORDER

MAIL ORDER

MAIL ORDER

MAIL ORDER

OFFER EXPIRES JULY 15, 1984

coincident with the changeover to solid-state. They had become more practical with the elimination of valve sockets and more appropriate as a means of supporting the ever-growing number of small components involved. And, of course, they lent themselves to mass production.

PC boards brought their own problems with shorts, dry joints and hairline cracks in the copper but, essentially, they were only a variation of the problems which had always bugged traditional wiring methods and hand soldering. With the density of components in modern electronic equipment, and the number of individual soldered joints, it is doubtful whether the industry could even manage without modern PC board technology.

Not surprisingly, however, the use of PC boards in hifi equipment has been questioned by the golden ear set, not because of shorts and dry joints, but presumably because they involve thin copper strip conductors bonded intimately to bulky insulation. It stands to reason (?) that it can't be as good as stranded wires, encased (if necessary) in PVC insulation and kept more out in the open!

I agree that some of the early boards left much to be desired but it didn't take engineers long to put their finger on problems such as crosstalk and common-mode noise, instability and/or distortion produced when the input signal happens to share a common return path with the output signal and/or the supply. Nowadays, with any design worthy of the description, problems such as these would not get beyond the drawing board.

In any case, they are not unique to PC boards and can as easily occur (and did occur) with hand wiring. So don't rush for your soldering iron on the strength of somebody's advice, and I quote:

> **"... printed circuits are another super-audio no-no".**

In the act of "improving" your system by re-building this section or that, you may inadvertently build back in the very faults that the original designer was careful to exclude.

This, in addition to invalidating any warranty or even the option of normal distributor service.

On the subject of valves and transistors, arguments about the relative merits of the two have been going on ever since transistors made it into consumer radio and audio equipment. Users were startled by their economy in battery-powered situations and impressed by the increased power available in domestic amplifiers.

But there were reservations about the tonal quality of solid-state amplifiers — and with good reason. Most used class-B output stages which, in valve equipment, were regarded as acceptable only for public address purposes. Too much reliance was placed on copious negative feedback, without allowing for the transient overload effects which could occur inside the feedback loop. And so on.

Solid-state audio equipment has been improved enormously since those days, to the point where it is accepted without question by most hifi enthusiasts and by most engineers involved in handling audio at a professional level. More than that, virtually all modern high technology test equipment is also based on solid-state circuitry.

> ***'There are people who cling tenaciously to the doctrine that there is something uniquely satisfying about an amplifier using valves'***

But some of the mud has stuck — as to a politician — and there are writers, readers and a few professionals who cling tenaciously to the doctrine that there is something uniquely good and sweet and satisfying about an amplifier using thermionic valves, referred to affectionately as "glass".

Now don't mistake me. With modern components and our extended knowledge of audio design, it is possible, these days, to produce a "glass" power amplifier or an "all glass" system capable of superb, even if not transcending, quality. For most people if may be unacceptably costly, or cumbersome, or hungry in terms of power consumption but, if those considerations don't bother you, go right ahead.

I would expect you to be keen about your unusual purchase, to show it off, to rave on a bit, as most of us do at times. You might be described as a "bit keen" but that's where it would end.

But how does one react to an observation by Ken Kessler in his "Classical Glass" article in the March '84 issue of "Hi-Fi News & Record Review"? Discussing the relative merits of valve and solid-state amplifiers, he discounts historic criticism of valve-type output transformers and observes:

> **"I've never paid too much attention to that argument, never having heard a solid-state amplifier which challenges even the humblest of valve units ..."**

Does he really mean that? If he does, what credence can you attach to any further assertions? If he doesn't mean it, why does he say it?

Does it not read like one of those gross exaggerations that I complained about, right at the beginning?

Having spent many years in the Production and Applications lab of the Amalgamated Wireless Valve Company, and many years since then in our own lab designing valve amplifiers, I am not without some background in the subject. Nor am I so detached as not to experience some nostalgia in respect to the valve "Playmaster" series, which were built by tens of thousands in Australia and New Zealand.

But I also remember the struggle we had up front to keep noise, hum and microphony within bounds and, at the back end, to offer reasonable power, frequency response, stability and distortion minima, without having costs going through the roof. What was true of the Playmasters was also true of the equivalent commercial amplifiers in that last-of-the-valves era.

It seems ludicrous to me to suggest that those amplifiers ("even the humblest" of them) with their comparatively high noise and distortion, and their comparatively lower power and dynamic range, could withstand a challenge from a modern high-performance solid-state amplifier. If Ken Kessler insists that such is the case, then I must insist on my right to reject him as a reliable witness.

If, on the other hand, he is talking about "even the humblest" of the current audiophile "glass" models then, for Heaven's sake, he should say so!

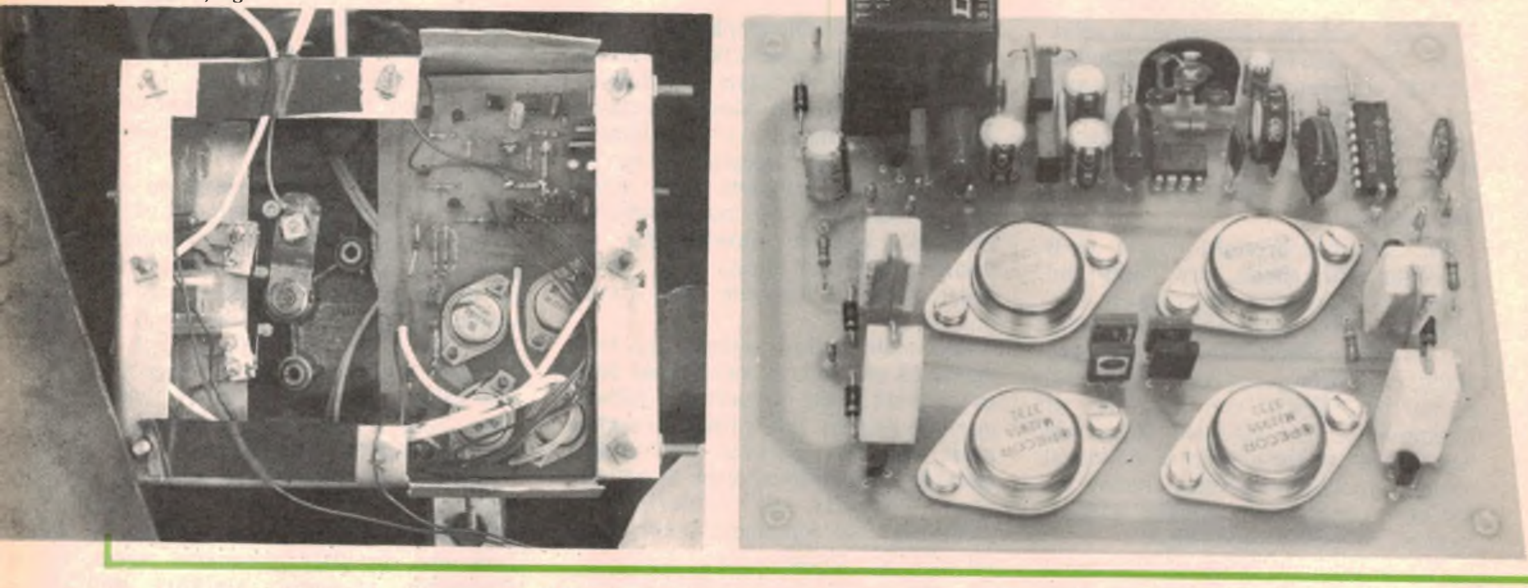
He goes on, in the article, to talk about a valve preamplifier from a small British company, Croft Acoustics. Apart from a toroidal power transformer, the underside picture is strongly reminiscent of the construction we used back in the days of the aforesaid "Playmasters": valves and sockets on an angle bracket, components on a tagboard nearby, with loosely anchored hand wiring to connectors on the rear, controls on the front and the power supply, concentrated around a second tagboard.

The preamplifier is provided with a moving-magnet rather than a moving-coil phono input — praised by Ken Kessler as one who, like the designers, prefers the Decca cartridge to moving coil types. Unfairly, perhaps, the "devil's advocate" in me sees this as a very convenient preference for glass people!

As for noise level with MM input, the

Continued on page 145

Below is an early prototype throttle actuator as installed in the author's Mazda Capella. The final version of this board is shown below, right.



Cruise control

Commercial cruise controls are available on some new cars and on the aftermarket, but usually cost around $200. This versatile design can be built for less than half that figure.

Have you ever driven long distances in the country, your foot getting cramped and wishing you had something that would automatically control the speed of the car? This cruise control will do the job. It is easy to build and install, uses readily available parts, and will maintain the speed of your car to within about 2% of the set speed.

To operate the unit, it is only necessary to bring the vehicle up to the desired speed and press the engage button. Press another button or the brake pedal and the cruise control is disengaged. Press the resume button and the car will resume the previous speed setting.

Passing another car is no problem since pressing the accelerator pedal further simply overrides the cruise control. When your foot is removed from the accelerator, the cruise control takes over as before and the car resumes the set speed. A new cruising speed can be set at any time simply by pressing the engage button at the desired speed.

In operation, the cruise control keeps the acceleration proportional to the difference between the set speed and the actual speed. A windscreen wiper motor is used to control the throttle setting and this can be obtained cheaply from a wrecker's yard.

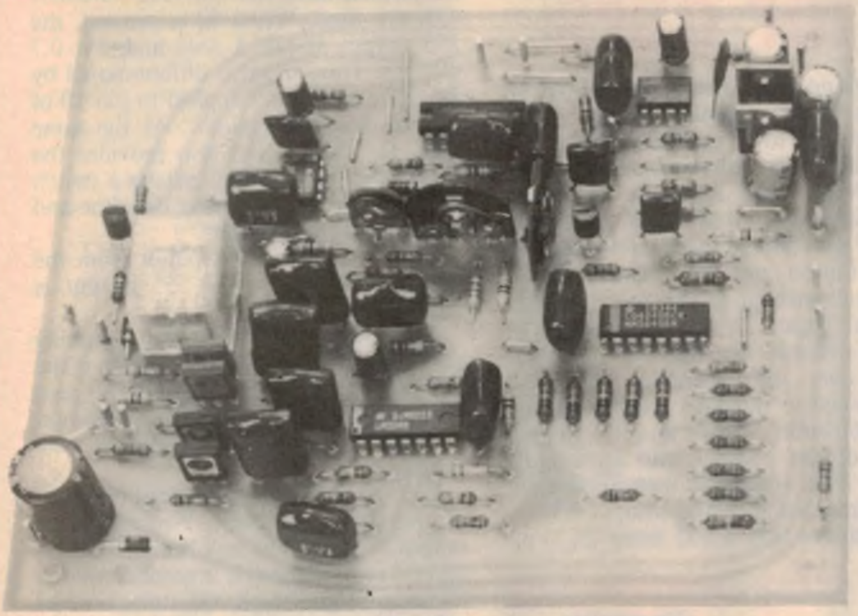
How it works

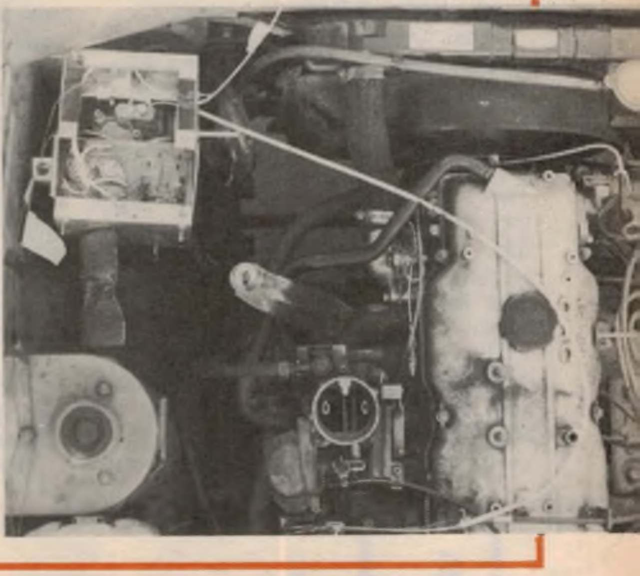
The cruise control circuitry has been split into two sections. One part, called the *signal processor,* sits under the dashboard and tells the other part, called the *throttle actuator*, what to do. The throttle actuator sits in the engine compartment and controls the throttle setting.

The signal processor sends a control voltage to the throttle actuator. This is called the *error signal*. If the error signal is above 5V, the throttle is opened further. Conversely, if the error signal is below 5V, the throttle is backed off. The rate at which the throttle is opened up or backed off is proportional to the difference between the error signal and the 5V rail.

The error signal is actually a voltage that is dependent upon the set speed, the actual speed, and five times the derivative of the actual speed. Note that the derivative of the speed is acceleration.

Zero, +5V, +10V and +12V supply rails are required for the circuits of both parts. This is achieved by using two 7805 voltage regulators in each section. Both 7805 inputs are connected to the car battery. One has its ground connection to earth (negative terminal of the car battery) and its output is +5V. The other 7805 uses this output as its ground, so its output is +10V. A 1kΩ resistor is connected between the output of the first 7805 and earth to ensure that no current flows back into the output of the first 7805. The +12V rail is simply the car battery voltage.





The signal processor (left) controls the throttle actuator. Below is another view of the throttle actuator installation.

for cars

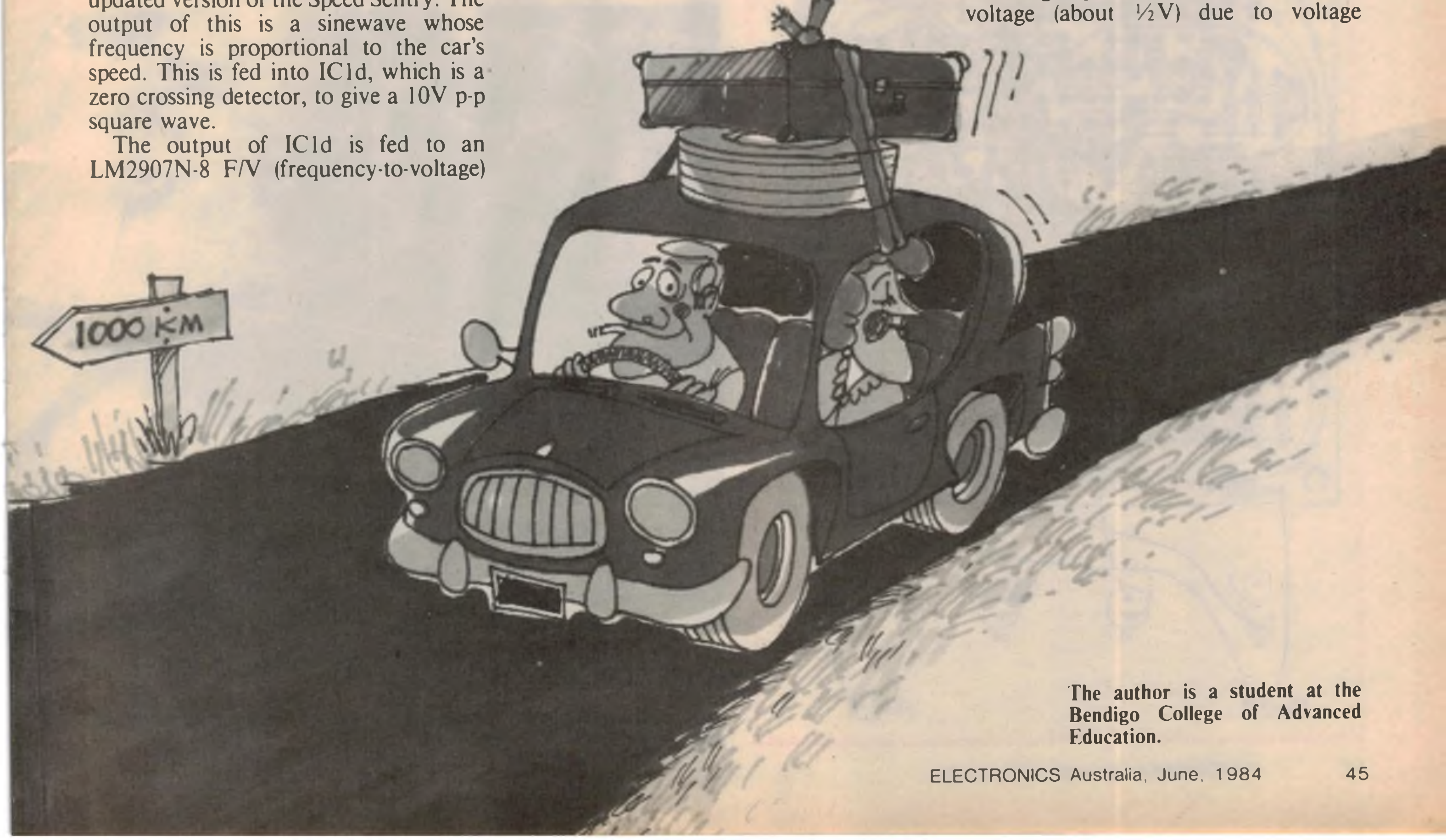
by JOHN KONING

Signal processor

The speed sensor consists of a coil and four magnets attached to the driveshaft as used in EA's Car Computer and the updated version of the Speed Sentry. The output of this is a sinewave whose frequency is proportional to the car's speed. This is fed into IC1d, which is a zero crossing detector, to give a 10V p-p square wave.

The output of IC1d is fed to an LM2907N-8 F/V (frequency-to-voltage) converter (IC5) which gives a voltage that is proportional to the car's speed. This voltage is then fed to a multi-stage RC filter network and thence to buffer amplifier IC2a. From there, the signal passes via C18 to differentiator stage IC2d and also via R42 to unity gain inverter IC2c. The outputs of the differentiator and the inverter are then fed into a summing amplifier involving IC1b.

The output of IC2c is also fed into comparator IC1a which has its output connected to the summer via a diode (D2) and a 1kΩ resistor (R51). The non-inverting input of IC1a is at a preset voltage (about ½V) due to voltage



The author is a student at the Bendigo College of Advanced Education.

Cruise control for cars

divider R47 and R48.

What happens is that when the speed drops below a certain level, the inverter output voltage falls below the voltage at IC1a's non-inverting terminal and the comparator's output goes high, driving the summer's output (pin 7 of IC1b) low. This tells the throttle actuator to close the throttle. When the speed is above this critical level, the comparator's output goes low but is blocked by D2 and thus has no effect on the summer's output.

This is a built-in safety measure designed to stop the cruise control being used below a certain speed, which is about 20km/h depending on the car.

To register the speed that you want the car to go at, a CD4040 counter (IC4) and an R-2R digital-to-analog (D/A) converter (R9 to 27 and IC2b) are used. Note that 1% tolerance metal film resistors are used here for accuracy. What happens is that when you have reached your desired speed, you press the engage button and the counter's clock input is connected to the zero crossing detector output for 0.7 seconds. The counter records the number of input pulses over this period, which is proportional to the car's speed, and the D/A converter converts the digital output of the counter into an analog voltage. This voltage is then applied to the summer via R28 and trimpot R29.

To achieve this, a 555 timer (IC3) in monostable mode and a BC548 transistor (Q1) are used. When S2 is pressed, the 555 output at pin 3 goes high for 0.7 seconds. This output is differentiated by R6, R7 and C8 and applied to pin 10 of IC4 to clear the counter. At the same time, the 555 output also provides the supply rail for Q1 which acts as a switch between the zero crossing detector and the input of the counter.

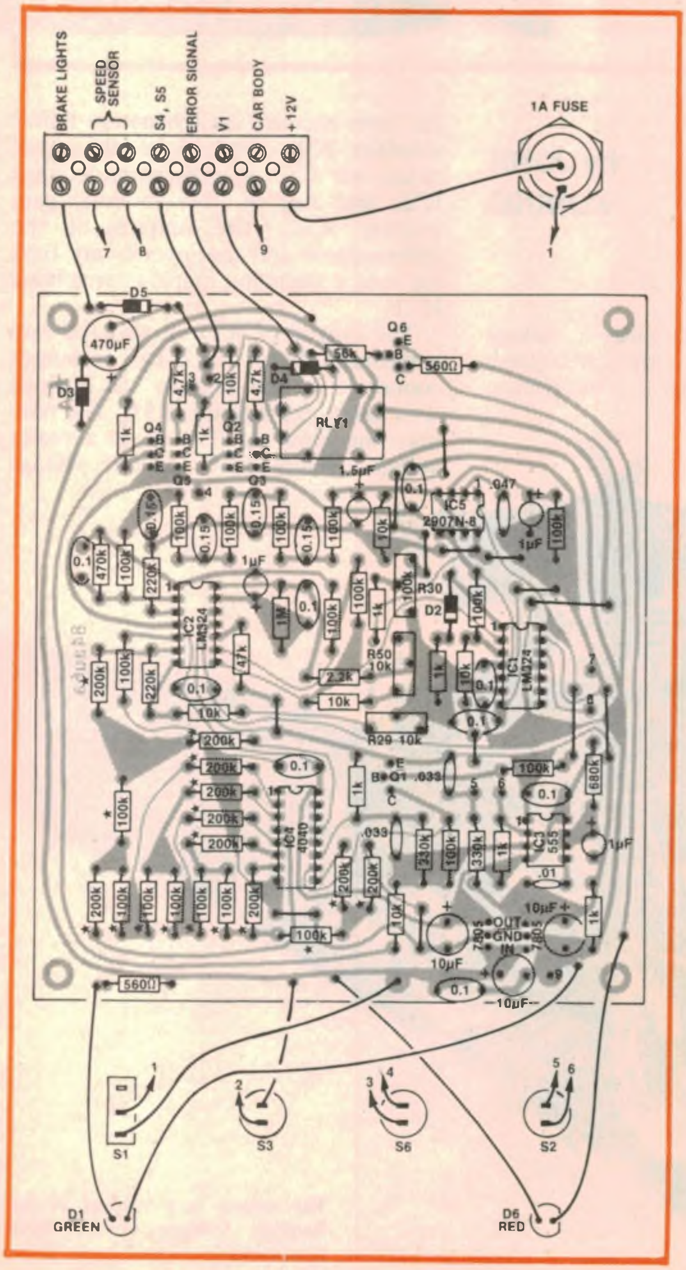
So IC4 only receives pulses from the speed sensor when the 555 output is high.

The output of IC1b (the summing amplifier) is the error signal, which is the set speed voltage minus the actual speed voltage minus five times the acceleration voltage. R31 is a pullup resistor for the summer.

We now come to the output circuitry of the signal processor. Normally, the output of IC3 is low and hence Q4 is on and Q5 is off. When S2 is pressed and the 555 output goes high, Q5 turns on (Q4 off) and triggers relay 1 which latches on via its second set of contacts. Note that Q3 also turns on since base current flows via Q5, R53 and R54.

Transistor Q2 is normally off. If, however, the brake lights turn on, or switches S3, S4 or S5 are closed, Q2 will turn on and Q3 and the relay will turn off. When the relay is off, the error signal output of the signal processor circuit is tied to earth. When the relay is latched on, the signal processor output is tied to the output of the summer (IC1b).

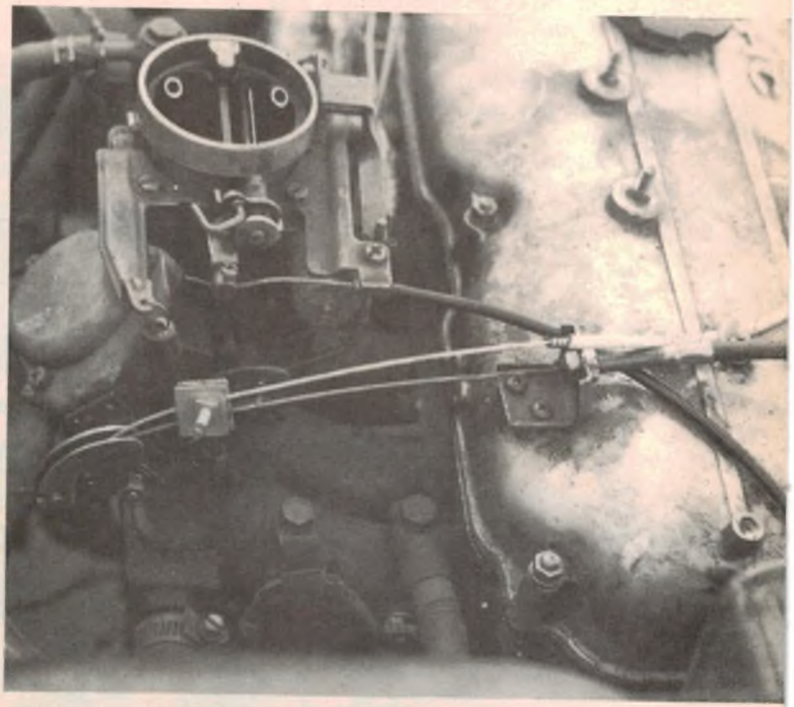
This arrangement ensures that the



We estimate that the current cost of parts for this project is approximately

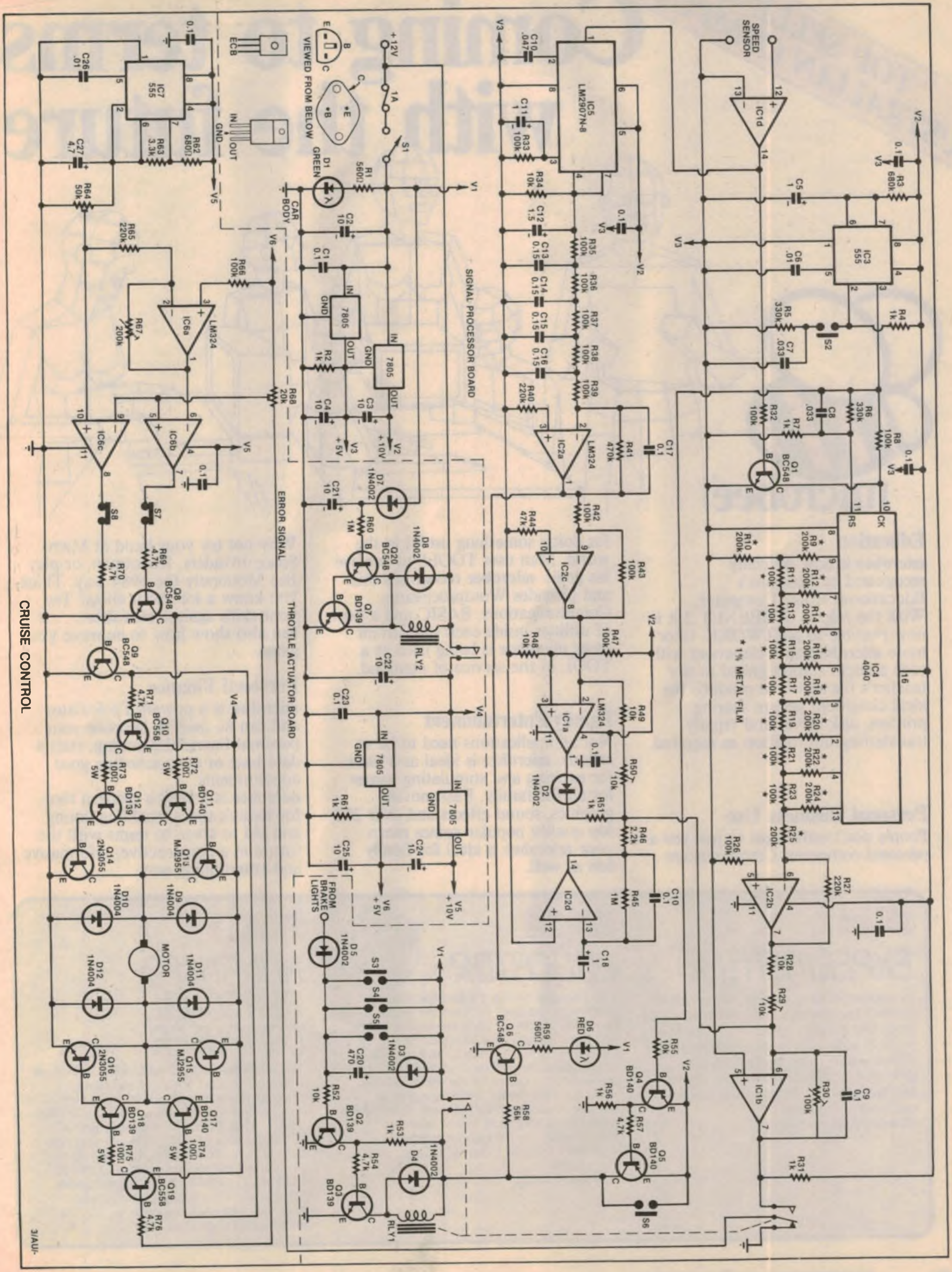
$70

This does not include the windscreen wiper motor, brake cable or metal cases.



Above: view showing how the throttle actuator cable is paralleled with the existing throttle cable.

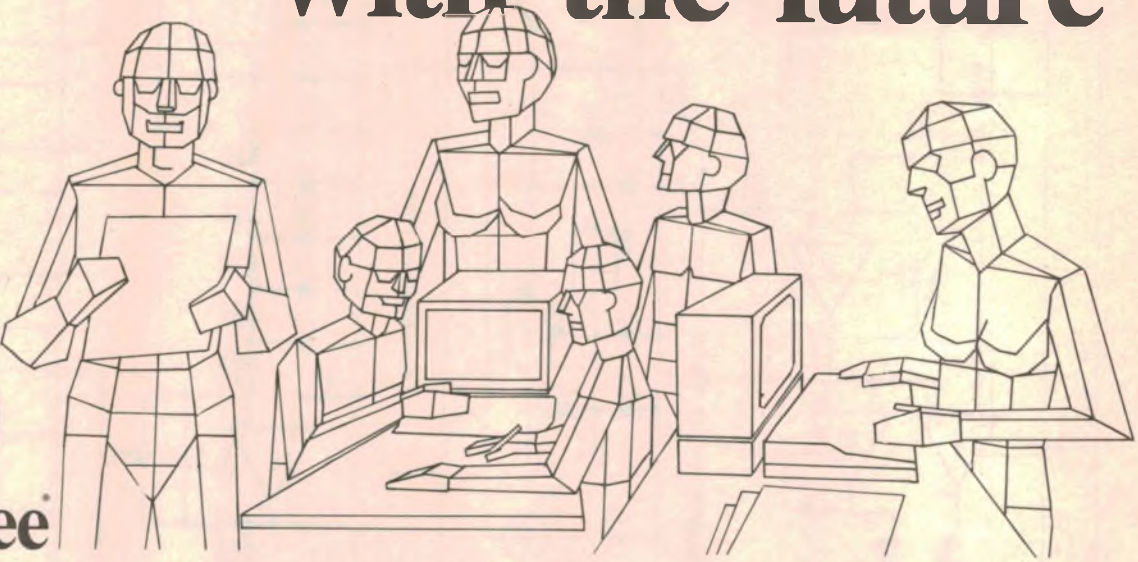
Left: parts layout for the signal processor PCB. The resistors marked with asterisks must be 1% types.



CRUISE CONTROL

TOP SELLING AUSTRALIAN COMPUTER

Coming to terms with the future



microbee

Education

microbee is now officially recognized as Australia's Educational Home Computer. With the release of BEENET 2 it is now possible to NETWORK 16 or more **microbees** in a classroom with each student station linked to the teacher's file server to produce the ideal classroom system sharing printers, disk drives and rapidly transferring information as required.

Personal Business Use

People don't only want to just *use* a personal computer. Computers are for doing something useful in the world. Man uses TOOLS to achieve his goals. **microbee** recognises this and provides Wordprocessing, Communications, BASIC and a host of utilities inside each unit. In all cases **microbee** is being used as a TOOL in the service of mankind.

Family Entertainment

Not all applications need to be so serious. **microbee** is ideal as a basis for exciting and stimulating games for all the family. Fast moving graphics, sound effects and over 200 top quality popular games mean your **microbee** is ideal for family fun as well.

Why not try your hand at Micro Space Invaders, Robotman, or play Bee Monopoly the 1984 way. Think you know a lot about chess? Try your skills against **microbee** . . . it can also show how to improve your game . . .

Personal Finance

microbee is a powerful calculator and can be used to improve your personal financial planning, start a data base or even schedule your appointments.

microbee is indeed a modern tool for today's times, enabling young and old to come to terms with the future in a constructive, informative and entertaining way.

SERIES 2

EXPERIMENTER

By popular request, the low cost **microbee Series 2 Experimenter** has been designed for those who are starting out in the fascinating world of computers or those who want to share the fascination of exploring the exciting developments in the fast moving MICROWORLD. All **microbees** can be expanded at any time.

microbee Experimenter $399

SERIES 2

EDUCATOR

APPROVED BY AUSTRALIAN EDUCATORS
FOR USE IN AUSTRALIAN SCHOOLS

The **microbee Series 2 Educator** was specifically designed to serve the needs of the education market. This is recognised by the fact that the **microbee** has been chosen by the NSW, WA, Queensland and the Australian Schools Commission as a recommended computer for use in schools. With the exceptional performance at a realistic price, powerful software designed for Australian curriculum needs, **microbee** is now in wide use throughout primary, secondary schools, technical colleges and universities.

microbee Educator $449

SERIES 2

ADVANCED PERSONAL COMPUTER

The **microbee** Series 2 APC with 500K Disk Drive is the most powerful and best priced/performance computer in its class. The APC is now supplied 'bundled' with WORDSTAR, MULTIPLAN, **microbee** BASIC, CP/M 2.2 plus MICROWORLD packages such as disk WORDBEE, EDASM, BASIC as well as vital utilities such as CONFIG, FORMAT, COMPARE. Comprehensive Microworld User Manual also supplied.

microbee APC (Single Disk Drive) $1495
microbee APC (Dual Disk Drive) $1795

The Solution: microbee Personal Communicator

Our top selling portable **microbee**, the Personal Communicator now features Telcom1 firmware, WORDBEE, Microworld BASIC, machine code MONITOR, ADM-3A terminal emulation, self-test in 28K of ROM with 32K of CMOS battery backed user memory, high resolution PCG GRAPHICS, SERIAL AND PARALLEL I/O ports, programmable cassette interface, and direct monochrome video output.

Add the low cost BEEMODEM and your Personal Communicator uses the home telephone line to become a complete home terminal ready, willing and able to communicate with other computers worldwide.

Microworld BASIC has long been a powerful feature of the **microbee**. A vast library of educational, entertainment and utility software is now widely available on the market. Microworld BASIC supports full high resolution graphics, colour if required, music, I/O data can be directed at will and, best of all, MW BASIC is a breeze to learn to program yourself.

microbee
Personal Communicator . . . $499

microbee computer centres

1 Pattison Ave,
Waitara 2077.
Phone (02) 487 2711

729 Glenferrie Rd,
Hawthorn 3122.
Phone (03) 819 5288

141 Stirling Highway,
Nedlands, Perth.
Phone (09) 386 8250

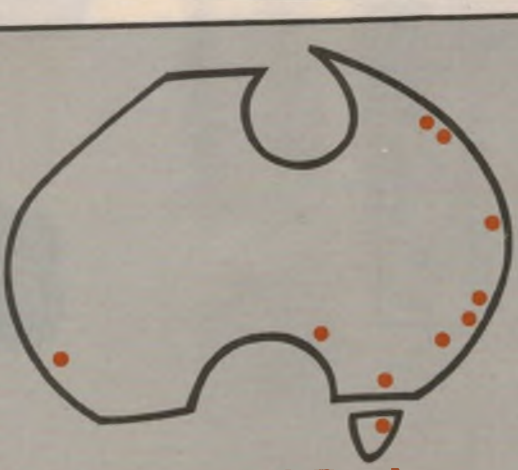
Cooleman Court,
Weston A.C.T. 2611.
Phone (062) 88 6384

151 Unley Road, Unley.
S.A. 5061. (08) 272 1384

455 Logan Road,
Stones Corner,
Qld 4120

Koala Crescent,
West Gosford 2250.
(043) 24 2711

Authorised Dealers in:—
NSW: Carlingford, Coffs Harbour, Concord, Hurstville, Lismore, Sydney, Waterloo, Wauchope
VICTORIA: Glen Waverley, Melbourne.
QUEENSLAND: Aitkenvale, Cairns, Milton.
SOUTH AUSTRALIA: Adelaide, Edwardstown, Port Lincoln.
WESTERN AUSTRALIA: Mount Tom Price.
TASMANIA: Launceston
ACT: Belconnen, Weston.



Shops and Dealers Australia wide

bankcard
welcome here

DIRECT ORDERS
PHONE (02) 487 2711
TELEX AA72767

APPLIED
TECHNOLOGY
RETAIL PTY LTD

microbee

Cruise control for cars

throttle is released when the Cruise Control is disengaged.

Note that when S1 is initially closed, current flows via D3, C20, R52 and the base of Q2 until C20 is charged up. This holds the Cruise Control disengaged for about five seconds after switch on and is necessary because the 555 triggers when S1 is closed.

S6 is the resume switch and allows the Cruise Control to be re-engaged at its previous speed setting. It is simply wired in parallel with Q5 and, when pressed, latches on the relay. Alternatively, the Cruise Control can be re-engaged by bringing the car back to the desired speed and pressing S2.

The status of the Cruise Control is indicated by LEDs D1 and D6. D1 is a green or orange LED that indicates when the Cruise Control has been turned on (S1 closed), while D6 is driven by Q6 and turns on when the Cruise Control is engaged (ie, when relay 1 is latched on).

Throttle actuator

So much for the signal processing circuitry. Let's now turn our attention to the throttle actuator. This comprises ICs 6 and 7, transistors Q7 to Q20, and the windscreen wiper motor.

The windscreen wiper motor is driven by a dual totem pole transistor arrangement so that the full battery voltage is applied in both forward and reverse directions. The four diodes D9 to D12 are flywheel diodes and protect transistors Q13 to Q16 by quenching back EMF from the motor.

Pulse width modulation of the windscreen wiper motor driving voltage is used to ensure maximum mechanical torque at various speeds, a measure which also ensures maximum electrical efficiency since the transistors operate in switchmode.

The pulse width modulation is achieved by using a 555 (IC7) in astable mode and an LM324 quad op-amp (IC6). The 555 oscillates at 42Hz. The output is taken from pin 6 of the 555 and consists of a triangular waveform that peaks at 6.7V (⅔Vcc) and bottoms at 3.3V (⅓Vcc). This is reduced to peak at 5V and bottom at 2.5V by R64, which is a trimpot connected as a voltage divider.

When the signal processor output falls below 5V (indicating that the car is over the set speed or is over-accelerating), comparator IC6c drives Q9. Q9, in turn, drives Darlington pair Q17 and Q15, as well as Q10, Q12 and Q14. Thus, when the signal processor output falls below 5V, Q14 and Q15 are pulsed on and the windscreen wiper motor is driven in one direction to close the throttle.

Similarly, when the signal processor output rises above 5V, Q8 is driven by IC6a and IC6b. This turns on Q13 and Q16, and so the windscreen wiper motor is driven in the opposite direction to open the throttle. S7 and S8 are limit switches which open at the throttle extremities to prevent the motor from being overdriven. S7 opens when the throttle is fully open, while S8 opens when the throttle is fully closed.

The duty cycle of the driving pulses increases the further that the throttle actuator output is away from 5V. Note that R67 is adjustable so that the duty cycle of the throttle opening driving pulses can be made longer relative to the throttle closing driving pulses, for a given error. The reason for this will be explained later.

Transistors Q7 and Q20, in association with C21 and R60, ensure that power to the throttle actuator is maintained for about 10 seconds after S1 is opened. This is to ensure that the throttle is fully released when the Cruise Control is switched off. When S1 is closed, C21 charges up via D7 and Q20 and Q7 are turned on. Relay R2 is thus also on and supplies power to the throttle actuator.

When S1 is opened, C21 discharges via

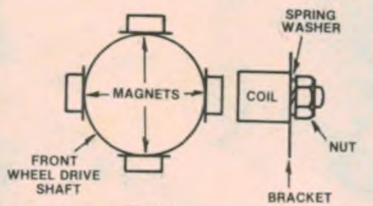


Fig. 2

Fig. 2: coil and magnet arrangement for front-wheel drive cars.

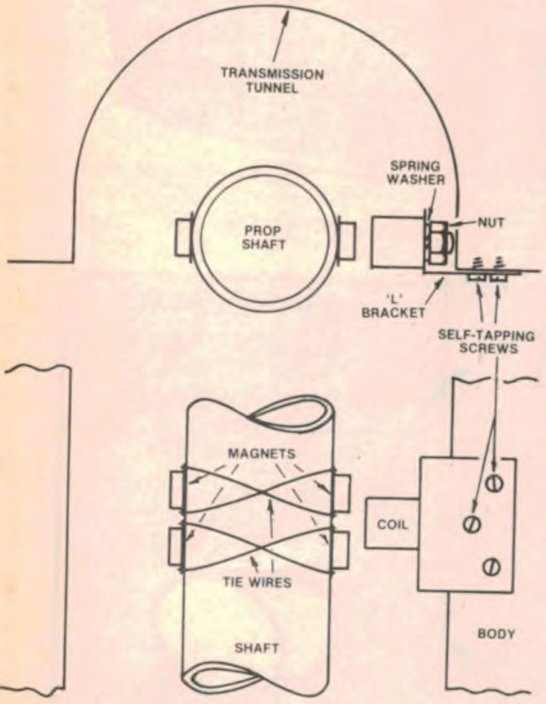
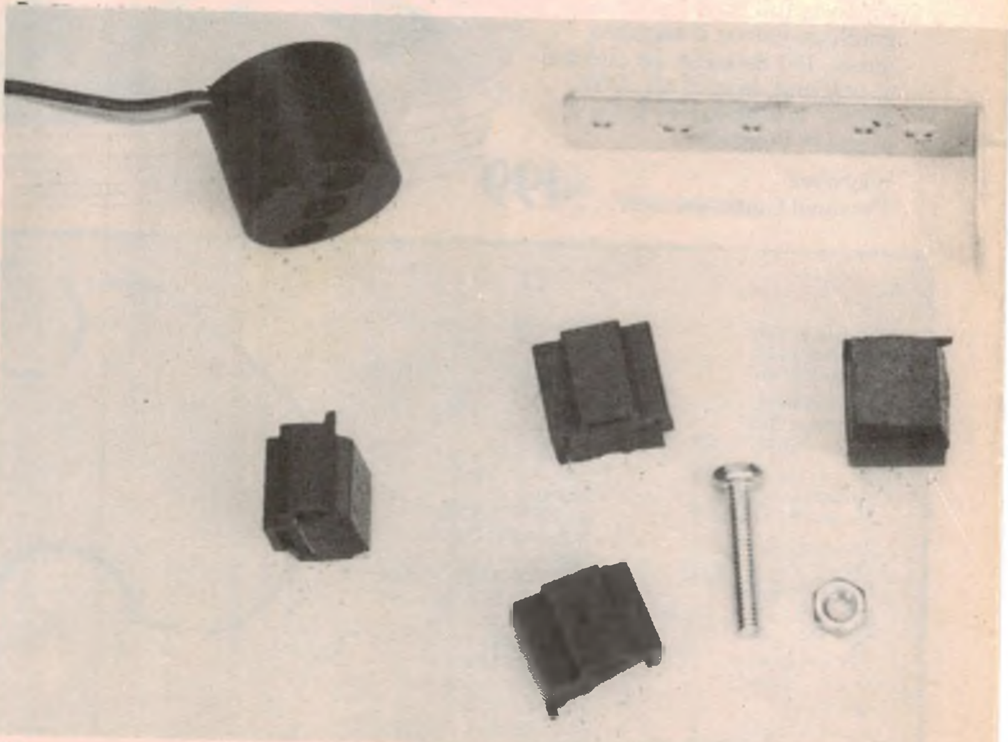


Fig. 1

Fig. 1: speed sensor arrangement for rear-wheel drive cars. Note the twin magnet arrangement (see text).



The speed sensor consists of a pick-up coil, four magnets and a mounting bracket.

R60, keeping Q20, Q7 and relay 2 on for about 10 seconds. Relay 1 is off during this time and so the throttle actuator quickly closes the throttle.

The microswitches on the clutch (manual cars only) and gear lever are there to prevent the engine from revving if the clutch is pushed in or the car is knocked out of gear. The clutch microswitch should be closed when the clutch is depressed, while the gear lever microswitch should be open when the car is in top gear (manual) or drive (automatic) and closed otherwise.

Construction

Construction of the Cruise Control is straightforward. The signal processor circuit is built on a printed circuit board (PCB) coded 84au6a (140 x 120mm), while the throttle actuator is built on a PCB coded 84au6b (131 x 110mm). These boards are housed in separate metal cases.

Begin construction by installing the parts on the signal processor PCB (84au6a). Install the resistors and wire links first, then the capacitors, relay and semiconductors in that order. Note that the resistors used in the R:2R ladder network are close-tolerance 1% types. These are marked with asterisks on the wiring diagram.

Take care to ensure that all polarised components are installed correctly. The CD4040 (IC4) is a CMOS device so the usual precautions apply. Earth the barrel of your soldering iron to the earth track on the PCB and solder the supply pins (8 and 16) first.

Note that the LM2907 is available in both 8-pin and 14-pin versions. The PCB is designed to accept the 8-pin version (ie, the LM2907N-8).

Once assembly of the PCB has been completed, it can be installed in its metal case. The front panel of the case carries the on/off, disengage, engage and resume switches and the two LEDs, while the rear panel carries an 8-way terminal block and an in-line fuseholder. Install the PCB on 12mm spacers, then complete the wiring to the front and rear panel hardware.

The case used for the prototype was homemade, but there's no reason why you can't use a standard metal case if you so wish. Because requirements will differ from vehicle to vehicle, the details are left to the individual. Some constructors, for example, may wish to mount the control switches and LED indicators on a separate panel which can be mounted in a more convenient location.

If ignition interference subsequently proves a problem, try using shielded audio cable for the switch leads.

Do not install the signal processor in the car at this stage. Before doing this, it is necessary to make a few adjustments and these will be described later on.

Attention can now be turned to the throttle actuator PCB (84au6b). Take particular care when installing the transistors and note that Q11 and Q12 face in the opposite direction to Q17 and Q18. The four power transistors are bolted directly to the PCB using machine screws and nuts.

It is a good idea to solder the nuts on the copper side of the PCB in order to ensure a reliable electrical connection.

The four 100Ω 5W resistors are mounted vertically on the PCB. Once mounted, these should be glued to the board with epoxy adhesive in order to prevent undue strain on the leads due to vibration.

There are two ways of installing the throttle actuator: either you can mount the PCB, windscreen wiper motor and microswitch assembly in a single metal case, or you can install the PCB in a smaller case and mount the windscreen wiper motor and microswitch assembly externally. The second option is recommended since it provides greater flexibility when installing the parts under the bonnet.

A bicycle brake cable is used as a throttle linkage between the throttle and the windscreen wiper motor. Details of the limit switch assemblies are left to individual constructors as the arrangement used will depend upon the windscreen wiper motor. Most constructors will probably use conventional microswitches, but magnet and reed switch assemblies may be more suitable for some installations.

The windscreen wiper motor should preferably be a permanent magnet type, although a wound field type can be used provided that the field windings and armature windings are normally connected in parallel. In the latter case, the field windings should be connected between the output of relay 2 and the car body while the armature should be connected across the output of the power transistors.

Windscreen wiper motors in which the field and armature windings are connected in series are not suitable since the direction of this type of motor cannot be reversed.

At this stage, the throttle actuator can be installed in the vehicle but note that it will be necessary to retain access to the

PARTS LIST

1 PCB, code 84au6a, 140 x 120mm
1 PCB, code 84au6b, 131 x 110mm
1 mini PCB relay, 12V DPDT (Cat No. S4061, Jaycar, Altronics, Rod Irving)
1 DPDT relay, 10A contacts (DSE Cat No. S7200)
1 SPST toggle switch
3 momentary contact pushbutton switches
4 microswitches (S4, S5, S7 and S8 — see text)
1 panel-mounting 3AG fuseholder
1 1A 3AG fuse
2 LED mounting bezels
8 12mm spacers
1 8-way terminal block
2 metal cases to suit (see text)
1 windscreen wiper motor
1 bicycle brake cable
1 speed sensor (coil plus magnets, Jaycar)

Semiconductors

3 LM324 quad op amps
2 555 timers
1 CD4040 12-stage ripple counter
1 LM2907N-8 F/V converter (Geoff Wood Electronics)
4 7805 5V voltage regulators
5 BD139 NPN transistors
4 BD140 PNP transistors
5 BC548 NPN transistors
2 BC558 PNP transistors
2 2N3055 NPN transistors
2 MJ2955 PNP transistors
6 1N4002 diodes
4 1N4004 diodes
1 red LED (5mm)
1 green LED (5mm)

Capacitors

1 470μF/16VW PC electrolytic
7 10μF/16VW PC electrolytics
1 4.7μF/16VW PC electrolytic
1 1.5μF PC electrolytic
3 1μF PC electrolytics
4 0.15μF metallised polyester (greencap)
12 0.1μF metallised polyester
1 .047μF metallised polyester
2 .033μF metallised polyester
2 .01μF metallised polyester

Resistors (¼W, 5% unless stated)

2 x 1MΩ, 1 x 680kΩ, 1 x 470kΩ, 2 x 330kΩ, 3 x 220kΩ, 10 x 200kΩ 1%, 13 x 100kΩ, 7 x 100kΩ 1%, 1 x 56kΩ, 1 x 47kΩ, 6 x 10kΩ, 6 x 4.7kΩ, 1 x 3.3kΩ, 1 x 2.2kΩ, 8 x 1kΩ, 1 x 680Ω, 2 x 560Ω, 4 x 100Ω 5W

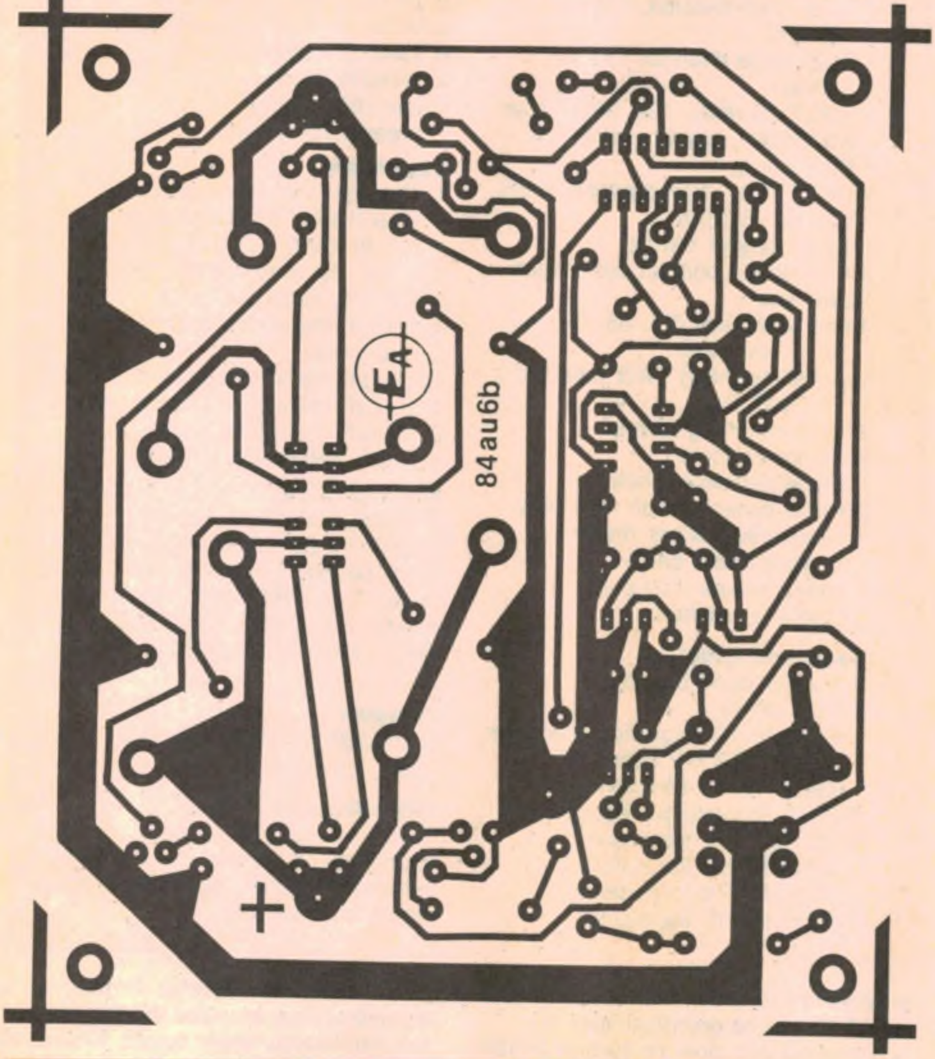
Trimpots

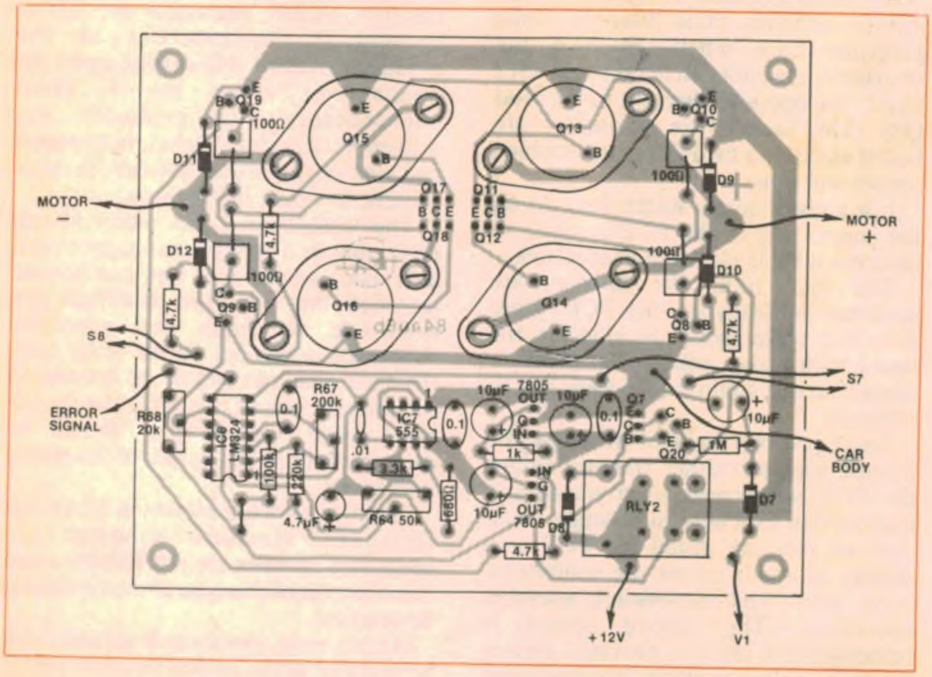
1 x 200kΩ, 1 x 100kΩ, 1 x 50kΩ, 1 x 20kΩ, 2 x 10kΩ

Miscellaneous

Machine screws and nuts, lockwashers, scrap aluminium, automotive cable, automotive wiring connectors, etc.

Cruise control for cars





Parts layout for the throttle actuator PCB. Take care with component orientation.

trimpots for adjustments. The PCB has a "+" sign marked on it to indicate the output that goes positive when the throttle is being opened. The corresponding "positive" terminal of the windscreen wiper motor can be determined during installation by momentarily connecting it across the car battery and noting the polarity required to open the throttle.

Final adjustments

For proper operation of the cruise control, several trimpot adjustments have to be made. To do this, a signal source, a 12V power supply and an oscilloscope are necessary. If you don't have an oscilloscope, then an AC voltmeter will do.

After installing the throttle actuator and connecting it to the car battery, turn trimput R68 fully towards pin 14 of the LM324. Turn R64 fully towards the LM324 and R67 towards the power transistors. Now connect the anode of D7 to the positive battery terminal.

If you have a dual-trace oscilloscope, set the traces to "dc" and connect the earth leads of the probes to the car body. Make sure both traces are centred on the screen when the inputs of the probes are earthed. Connect one probe to the 5V rail and the other (set to 10:1) to the wiper of R64. Adjust R64 until the triangle waveform just touches the 5V rail trace.

Alternatively, if you don't have a CRO, connect an AC voltmeter across the output of the throttle actuator and adjust R64 until the voltmeter gives a reading. R64 should then be backed off to the point where the voltage just disappears.

For the rest of the throttle actuator adjustments, disconnect the fuel line from the carburettor to avoid flooding the engine. Now connect the error signal input to the 10V rail. Turn R68 until the windscreen wiper motor slowly pulls the throttle open. Allow the windscreen wiper motor to fully open the throttle and trip limit switch S7. Now connect the error signal input to the 0V rail. The windscreen wiper motor should close the throttle, but at a faster rate than when it was opened. This is due to the throttle return spring.

You now have to alternatively open and close the throttle, each time turning R68 a bit further until the windscreen wiper motor travels at the maximum speed without ploughing through the microswitches. Now adjust R67 so that the windscreen wiper motor opens and closes the throttle at an equal rate.

On the signal processor board, turn trimpot R29 fully away from C9, turn R50 fully towards R29 and turn R30 fully away from R50. Connect the signal processor to a 12V power supply or a car

MOST PEOPLE IN AUSTRALIA DON'T KNOW THEIR OWN STRENGTH

Just because you don't see supersonic jets blazing across our skies everyday, doesn't mean that we don't have one of the most powerful Air Forces in our region.

A force of over 22,000 highly trained professionals operating a network of bases and facilities across the nation.

Our Air Force flies some of the finest aircraft, uses the most sophisticated technology and is ready to meet any situation.

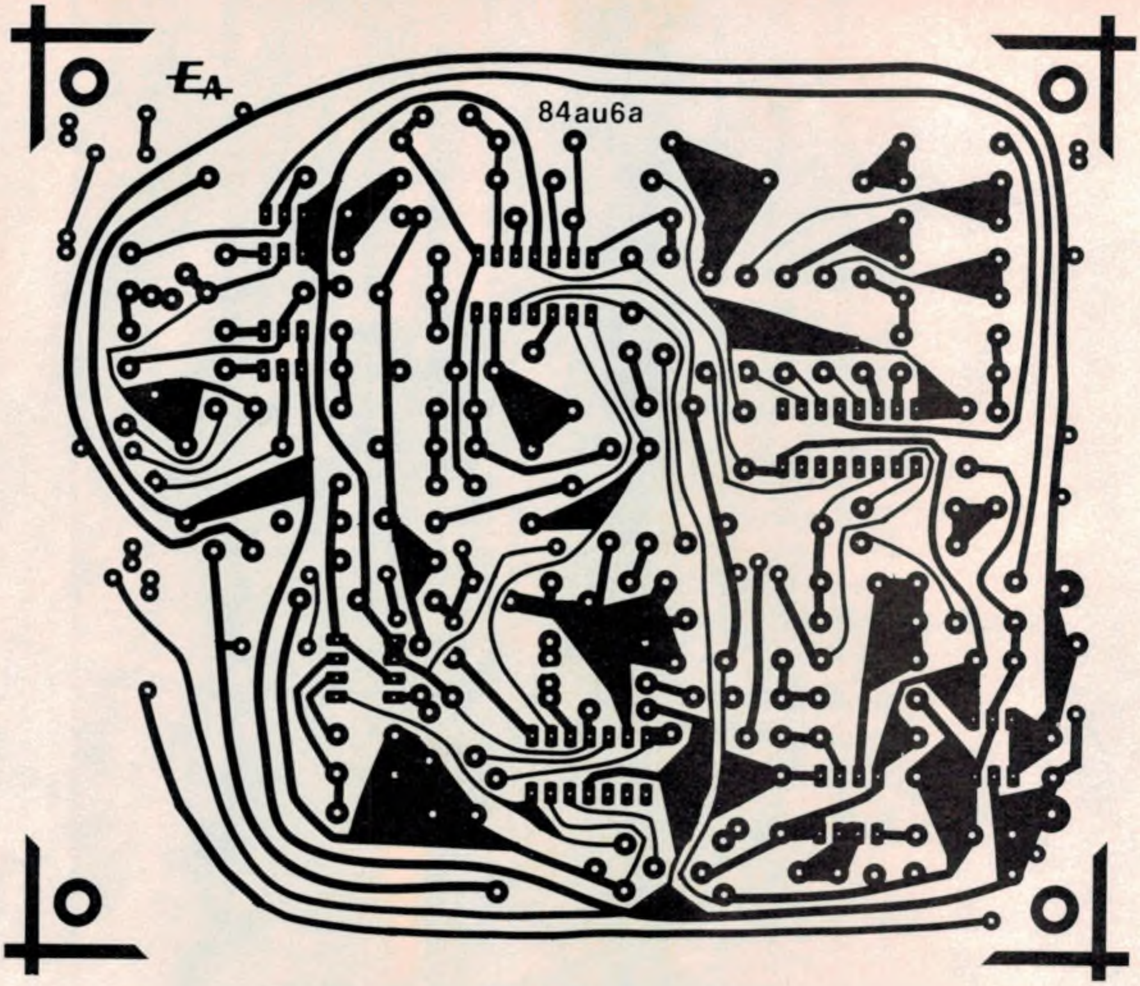
Today, the Air Force is a strong force in Australia's Defence.

JOIN AUSTRALIA'S AIR FORCE.

Authorized by Dir. Gen. Recruiting Dept. Defence

HG 12 FPC 13A

Cruise control for cars



Actual size artwork for the signal processor PCB. The throttle actuator PCB is on page 52.

battery. Connect the speed sensor inputs to a signal source of about 100Hz. Connect an oscilloscope or voltmeter between the 5V rail and the error signal output.

Now press the engage button. If the error signal output is above the 5V rail, turn R29 until the error signal is equal to the 5V rail. If the error signal is below the 5V rail, turn R50 until the error signal is equal to the 5V rail.

The signal processor can now be installed in the vehicle and the wiring run to the speed sensor, brake lights, throttle actuator, and clutch and gear lever microswitches. A normally closed spring loaded automotive switch will probably be the best way to go for the clutch microswitch, while the gear lever microswitch can take any form that's convenient. The main point to ensure is that the switch is open when the car is in top gear, and is closed otherwise.

Do not leave any of these switches out. The cruise control will not operate correctly if you do, and could even prove dangerous.

Figs. 1 and 2 show how the speed sensor is installed in rear-wheel drive and front-wheel drive cars respectively.

On rear-wheel drive cars, the sensor should be mounted as close to the gearbox as possible, where vertical movements of the tailshaft are minimal. The magnets are secured using tie wire and epoxy adhesive. Two magnets are shown at each position to compensate for longitudinal movements of the driveshaft.

The coil is mounted on an L-shaped bracket and secured to the car using self-tapping screws. Position the bracket so that there is a 25mm air gap between the coil and the magnets when they are directly opposite each other. Finally, carefully route the two-core cable from the coil to the speed sensor inputs on the signal processor.

On front wheel drive cars, the magnets are mounted at four locations, 90° apart. This is because the driveshaft on a front-wheel drive vehicle rotates much more slowly than the tail shaft on a rear-wheel drive vehicle. The magnets should be positioned either on the driveshaft coupling flange or, if this is not possible, as close to the inboard end of the driveshaft as possible.

Check to ensure that there is little relative movement between the pickup and the magnets as the suspension moves. Check also that the installation does not foul any other part of the vehicle over the full extent of the suspension travel.

Now we come to the road test. Drive to a quiet, preferably hilly, road, bring the car up to normal cruising speed, and engage the cruise control. Now ease your foot off the accelerator pedal — the cruise control should take over.

It is now a matter of adjusting R30, which is the error signal gain control, so that the cruise control gives a smooth response when going up and down hills, but keeps the speed to within reasonable limits. You should be able to adjust the gain to give a smooth response while keeping the speed to within 3km/h of the set speed.

Once the gain has been set, install the signal processor permanently under the dashboard.

Other speed setting methods

There are other ways of setting the speed besides bringing your car up to cruising speed and pressing a button, as in this design. You can in fact substitute a potentiometer for half the circuit of the signal processor and use this to set the speed.

If you wish to set the speed by adjusting a pot, then delete: IC3 and 4; Q4 and Q5; R3 to R24; R55, R56 and R57; and C5 to C8. Connect a 1kΩ pot between the 5V rail and the 10V rail and connect its wiper to R25. Replace R27 with a 100kΩ resistor and trimpots R29 and R50 with links.

The cruise control is now engaged by pressing the resume switch S6, while the speed is set by the 1kΩ pot.

The dawn of a new era in microcomputer technology

NEW TANDY TRS-80® MODEL 2000

High Performance MS™-DOS Computer That Operates at Twice the Speed of the IBM® PC

Our Tandy® 2000 delivers much more than other 16-bit MS-DOS based computers. More speed. More disk storage. More expansion. Higher resolution graphics. And a modular design that advances the science of ergonomics.

Use the Hottest Names In Software

Like dBase II, a powerful relational data base management program. Microsoft-Multiplan, the "second-generation" electronic worksheet. PFS:File, a simple way to organize information. MultiMate, the highly-acclaimed word processing program. And many more already acclaimed by the entire microcomputer industry. Still more programs are coming, including Microsoft's state-of-the-art MS-Windows operating environment. You can view several "windows" at once—files, letters, graphs and more—and exchange information between them.

More Speed, Storage and Expansion

A "next-generation" 16-bit CPU makes the Tandy 2000 dramatically faster than the IBM PC and other MS-DOS systems. The vast storage capacity lets you set up massive data bases. You can add more memory, high-resolution color and monochrome graphics, our new Digi™-Mouse and much more. And you can install most of these options yourself.

Complete Service and Support

The Tandy 2000 is backed with the quality and support that have kept Tandy Corporation in the forefront of the microcomputer industry. See the Tandy 2000 at Tandy Computer Centres and participating Tandy stores and dealers nationwide.

Compare the Tandy 2000 to the IBM Personal Computer

Price Comparison†	Tandy Model 2000	IBM Personal Computer
Base Unit	$4450	$3429
2nd Drive	Included (720K)	$821 (320K)
Monochrome Monitor	$349	$644
Display/Printer Adapter	Included	$516
128K RAM (Total)	Included	$251
RS-232	Included	$188
MS-DOS 2.0	Included	$115
Total Cost*	$4799	$5964
Feature Description	**Tandy Model 2000**	**IBM Personal Computer**
Internal Memory	128K Standard	64K Standard
Disk Capacity per Drive	720K	160K or 320K (Optional)
Microprocessor Clock Speed	8 MHz	4.7 MHz
True 16-Bit Microprocessor	Yes (80186) 16-bit/16-bit data path	No (8088) 16-bit/8-bit data path
User-Available Expansion Slots*	4	2
Graphics Options		
Color Resolution	640 x 400	320 x 200
Number of Colors	8	4
Monochrome Resolution	640 x 400	640 x 200

*Comparable IBM configuration with monochrome adapter and display, communications adapter, two 320K disk drives and 128K RAM. †Manufacturer's pricing as of 1/9/83.

Tandy 2000 With Two Disk Drives	Tandy 2000 HD With Built-In 10-Megabyte Hard Disk
4450^{00} 26-5103	6950^{00} 26-5104

Non-interlaced monitor, graphics and Digi-Mouse not included

Enquire Now at Your Nearest

Tandy COMPUTER CENTRE

The biggest name in little computers®
TANDY AUSTRALIA LIMITED INC. IN N.S.W.

Prices apply at participating Tandy stores and dealers. IBM is a registered trademark of International Business Machines Corp. PFS is a registered trademark of Software Publishing. MS and Multiplan are trademarks of Microsoft Corp. MultiMate is a trademark of Softword Systems Inc. dBase II is a trademark of Ashton-Tate.

Straight sail

If you wish to attend a university to obtain a degree, why not have the Navy to pay your way. And offer you a career at the same time.

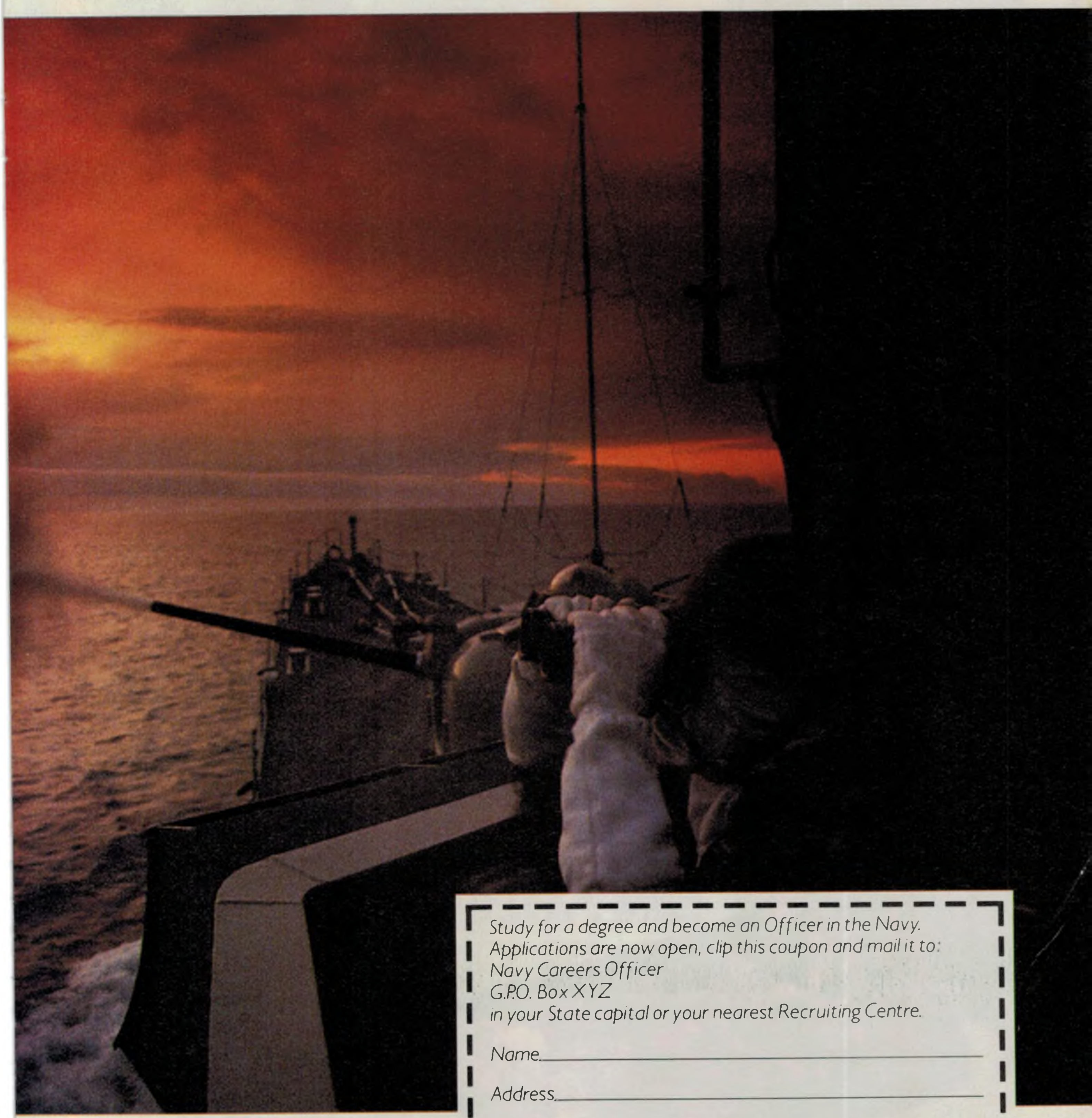
The Navy is seeking university entrants in the fields of Science, Arts, Mechanical or Electrical Engineering to attend the Royal Australian Naval College and the new Australian Defence Force Academy.

If you have matriculated or are currently undertaking your matriculation, are an Australian citizen or eligible to apply for Australian citizenship, are under 20 on the 1st January of your intended year of entry and are able to meet our selection requirements you will be offered excellent pay to obtain the degree of your choice and qualify as an Officer in the Navy. Taking up positions such as Combat Systems Officers, Marine Engineers, Seaman Officers and Supply Officers. Commanding men and playing a key role in the defence of Australia.

So, if you want more than a degree maybe the Navy can offer you straight sailing into a career.

Are you good

ing through a degree course.



enough?

Study for a degree and become an Officer in the Navy.
Applications are now open, clip this coupon and mail it to:
Navy Careers Officer
G.P.O. Box XYZ
in your State capital or your nearest Recruiting Centre.

Name____________________

Address____________________

____________________Postcode________

Birthdate____________________

Authorised by the Director General of Recruiting, Department of Defence NCM 68. DPS. 123

BUILD THIS:
VHF amateur transceiver

by LEO SIMPSON

Are you an amateur wanting to upgrade your two-metre gear? Then here's your chance to do it by putting together this up-to-the-minute transceiver which has all the most wanted features. The price? Just $199.

By any standard, the UHF transceiver described in the September, October and November 1983 issues of EA has been an outstanding success. Many hundreds have been successfully built and the kit supplier responsible, Dick Smith Electronics, has not been able to keep up with the demand.

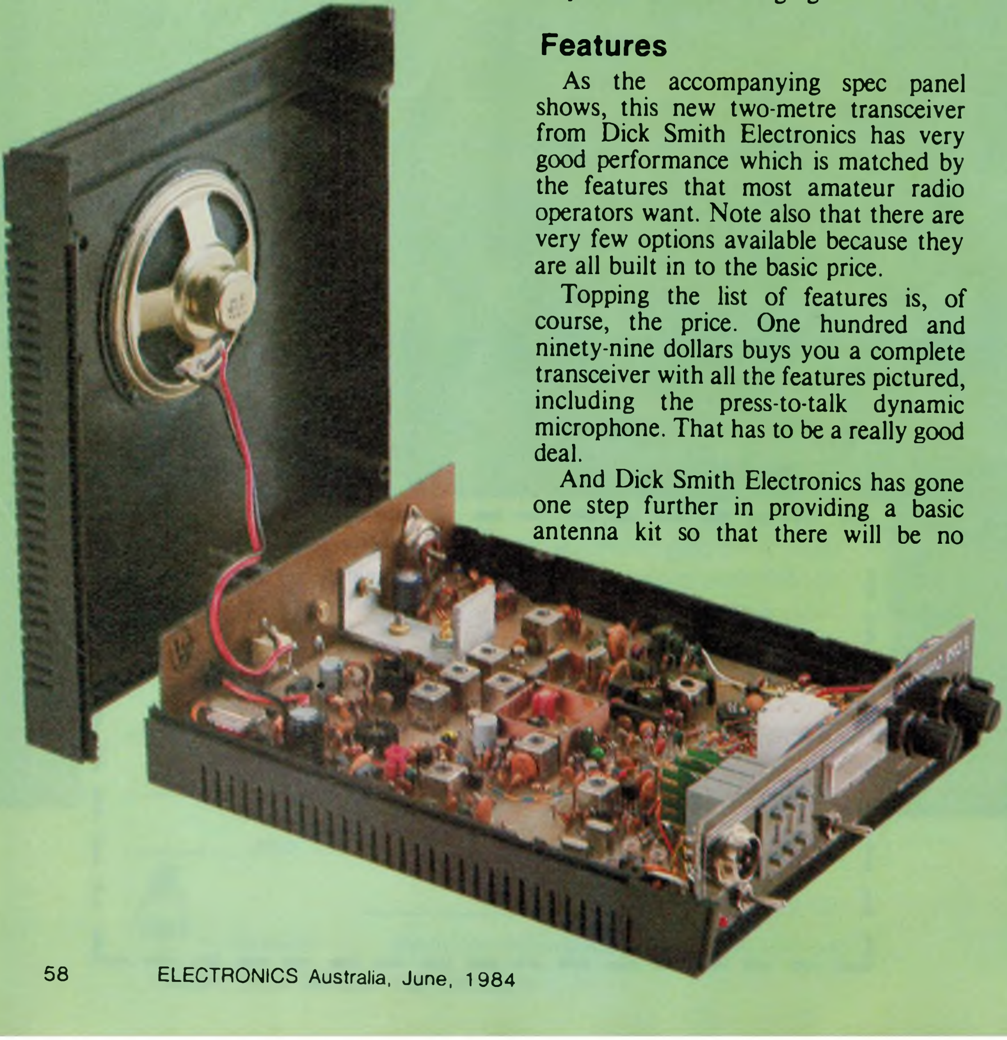
As the reputation of the UHF transceiver has grown, more and more amateurs have decided to have a go at building a really worthwhile piece of gear for themselves. At the same time, they can save a substantial amount of money over the price of an equivalent commercial unit.

We're very glad to be able to report this development because it signals a resurgence in the construction of gear amongst amateurs who, for a long time, have been content to buy rather than build.

In fact, the UHF transceiver kit has been hailed both here and overseas as being perhaps the most significant amateur radio construction project to be published anywhere for a long time!

Just as night follows day, there was bound to be a call for a two-metre version of the transceiver. We ourselves remarked that the VHF version was just crying out to be produced.

Well now it has happened. The same team that produced the UHF kit, Garry Crapp VK2YBX/T, and Gill McPherson, VK2ZGE, have put their thinking caps on and produced a two-metre transceiver that will certainly set any keen amateur longing.



Features

As the accompanying spec panel shows, this new two-metre transceiver from Dick Smith Electronics has very good performance which is matched by the features that most amateur radio operators want. Note also that there are very few options available because they are all built in to the basic price.

Topping the list of features is, of course, the price. One hundred and ninety-nine dollars buys you a complete transceiver with all the features pictured, including the press-to-talk dynamic microphone. That has to be a really good deal.

And Dick Smith Electronics has gone one step further in providing a basic antenna kit so that there will be no temptation to switch on the transmitter with no load as soon as it is completed. The antenna kit comprises a quarter-wave vertical radiator, gutter-grip mounting base and feed, a PL-259 connector and three metres of good quality coax cable, all for $24.95.

For those amateurs not in a club and not sure of their ability to complete the transceiver successfully, DSE have their "Sorry Dick, it doesn't work" service coupon. This costs an additional $50 and may take up to three weeks service time if the constructor decides to take advantage of the offer but at least it is a sure way of getting an operational unit, if all else fails.

Operating facilities on the new transceiver are all that most amateurs would want without all the "bells and whistles" of some of the fancy imported models. There are none of those hard-to-remember-how-to-use memories and the frequency readout and selection is via no-nonsense push-button type "thumbwheel" switches.

As is usual practice with two-metre amateur transceivers, the two most significant digits of the frequency section are omitted which means that there is an assumed decimal point between the first and second digits of the three-digit readout (ie, 14- --MHz). In the photos, this means that the transceiver is set for a frequency of 147.02MHz.

Standard controls for volume and squelch require little comment as does the signal strength-cum-power meter. The microphone socket is a standard configuration allowing press-to-talk operation.

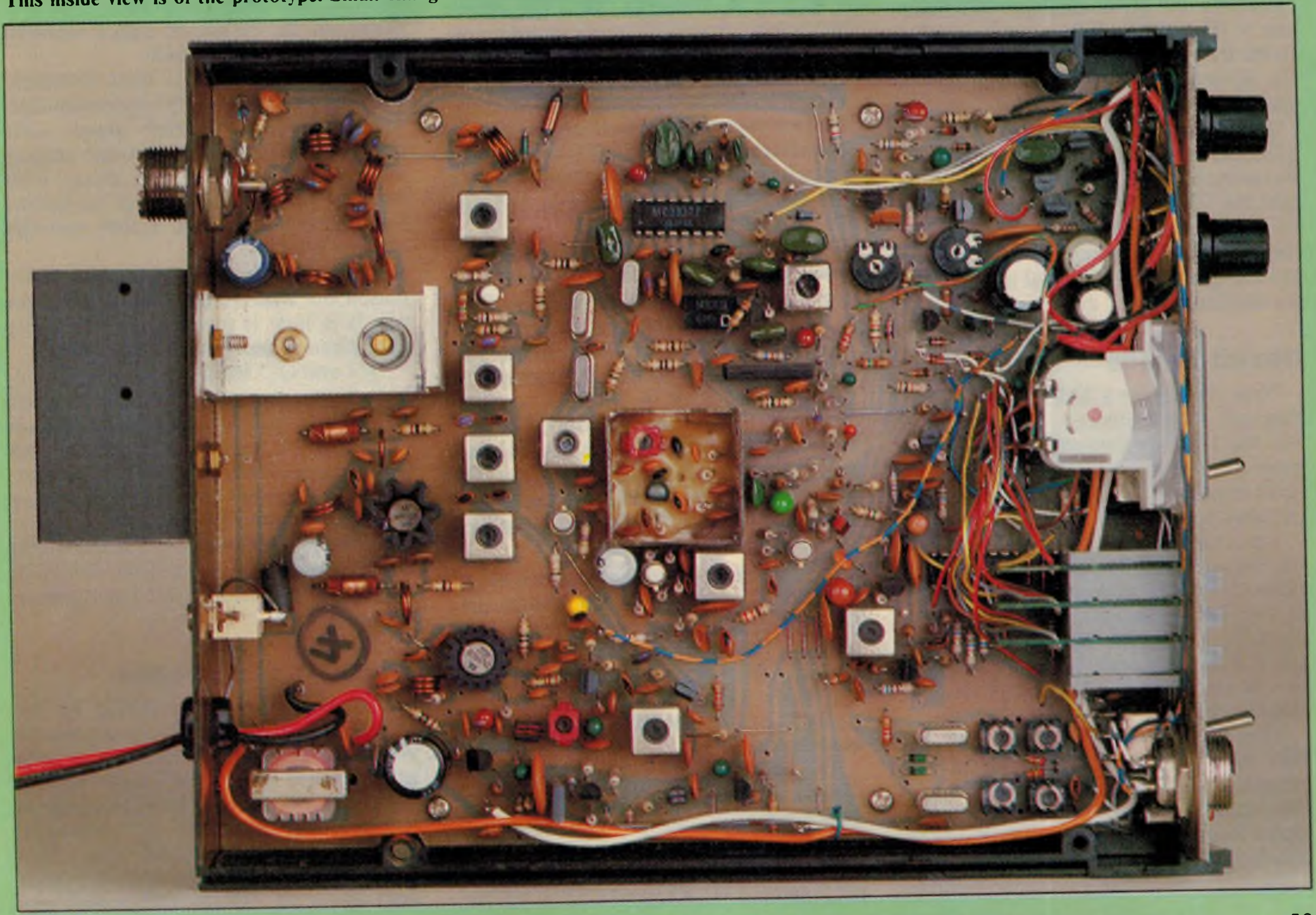
In addition, there is a three-position switch for simplex and plus or minus 600kHz transmitter offset for working into repeaters and there is also an anti-repeater button so that the transceiver can be used to listen in on the repeater receiving frequency.

Finally, there is the 5kHz offset switch which effectively doubles the number of channels from 400 to 800, albeit with 5kHz channel spacing.

How it works

Readers who have already taken a look at the circuit and block diagrams will have noted the similarities to the circuit of the abovementioned UHF transceiver described last year. Some sections of the circuit, notably the microphone preamplifier and audio power amplifier, are identical while other

This inside view is of the prototype. Small changes will be evident in the production models.



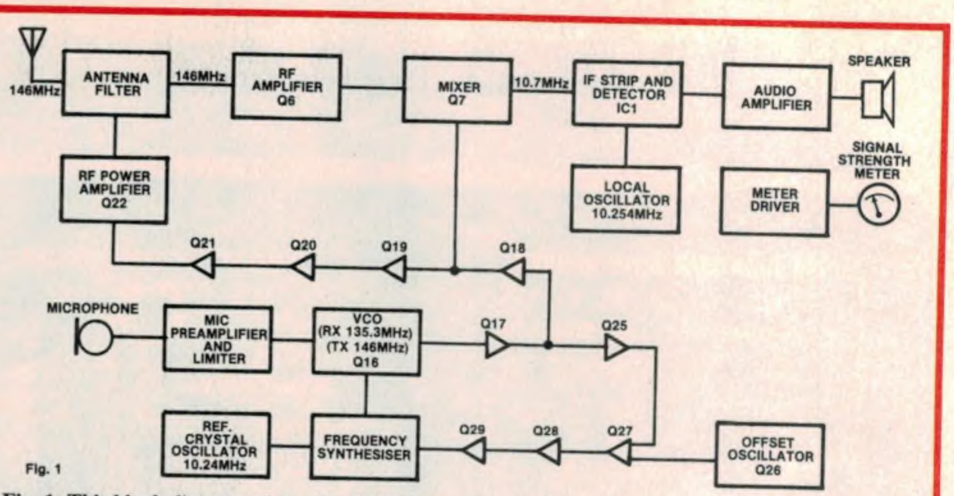


Fig. 1

Fig. 1: This block diagram of the new VHF transceiver highlights the conventional nature of the circuit.

sections, such as the antenna filter, IF strip and power supply, are also very similar.

For those not familiar with the series of articles on the UHF transceiver, let's now go through the block diagram, before attacking the main circuit diagram. Refer now to Fig. 1.

The block diagram shows that the transceiver is split into two sections, receiver and transmitter, which come together in the antenna filter. Both these sections employ a common frequency synthesiser and voltage controlled oscillator.

The receiver is a conventional double conversion superheterodyne with intermediate frequencies at 10.7MHz and 455kHZ. The second conversion from 10.7MHz to 455kHz is achieved in an integrated circuit which also includes limiting amplifiers and an FM quadrature detector. From there the signal is passed to an audio amplifier.

The VCO (voltage controlled oscillator) has two modes and, as you might have guessed, these are transmit and receive. In the transmit mode, the VCO is set to an exact frequency within the range of 144 to 148MHz by the frequency synthesiser which, in turn, is controlled by the offset oscillator. The output of the VCO is fed via Q17 and Q18 to the RF power amplifier and thence via the antenna filter circuit to the output socket.

In the receive mode, the VCO is set at a frequency exactly 10.7MHz below the incoming frequency. This is necessary to give the 10.7MHz intermediate frequency at the output of the mixer, Q7. The lower VCO frequency is obtained by switching a different crystal into the offset oscillator.

Circuit details

Now let's have a look at the circuit diagram. Don't shudder. If you figured out the UHF transceiver described last year, this one is more straightforward in most respects. We'll consider the receiver circuitry first.

Input signals from the antenna are fed via the antenna filter and RF switching network on the extreme righthand side of the circuit diagram. The signals pass via L30, L29, L27, L26 and L28 and C123. From there they go to the input of Q6 via transformer L2 and C11 (on the extreme lefthand side of the circuit).

The RF switching is performed by D13 (near L28, on the RH side of circuitry). In the transmit mode, D13 is forward biased and thus shorts out any RF signal from the transmitter which would otherwise be fed into the receiver input.

Q6 is a conventional common emitter amplifier with L3 as its collector load. L3 is part of the three-stage bandpass filter which only accepts signals in the 144 to 148MHz range.

Mosfet Q7 is the mixer. Gate 1 of Q7 is the incoming RF signal while gate 2 is the VCO (local oscillator) signal. L6 is the drain load of Q7 and the mixer output is the difference frequency, 10.7MHz. This is passed via FL1, a two-pole filter, to IC1.

IC1 is a Motorola MC3357 device specifically designed for use in a narrowband FM dual conversion communications receiver which is exactly what this circuit is. We have already talked about the first conversion which is from 144 (to 148MHz) down to 10.7MHz which takes place in mixer Q7. The MC3357 handles the second conversion using an internal 10.245MHz local oscillator.

This gives a second intermediate frequency signal of 455kHz which is amplified, limited and detected by IC1. IC1 also provides the squelch function.

In greater detail, crystal X1 at pin 1 of IC1 sets the local oscillator frequency to 10.245MHz. This is internally mixed with the 10.7MHz signal from Q7 to produce a 455kHz IF which is then fed to an external filter at pin 3. Transistor Q8 amplifies the filtered 455kHz signal and feeds it back into the limiting amplifier input at pin 5.

The limiting amplifier is a five-stage differential amplifier which boosts the 455kHz signal well into clipping, at its output. That is, we say the signal is limited. This effectively removes any amplitude variations (AM) so that the signal only contains frequency modulation.

The limited signal is then fed to the internal FM quadrature detector associated with coil L7 and capacitor C37 at pins 7 and 8.

The detected audio is extracted from pin 9 and fed via R33 and C35 to VR40, the volume control. At the same time, a sample of the signal is coupled via R32 and C33 to an internal amplifier between pins 10 and 11.

This amplifies any noise signal (hiss) above the expected audio passband which is then rectified by D7 and used to "squelch" the audio output via control pin 12. VR39 is the squelch control.

Transistor Q8 feeds a portion of the 455kHz signal (before limiting is applied) to IC7, the meter amplifier. This produces an indication of signal strength when in the receive mode.

Transistors Q9 to Q12 form a conventional audio amplifier. Q9 is a straightforward common emitter stage with negative feedback applied to the emitter via R44. Q10 is a class-A driver with bootstrapping via the output capacitor, C47. Its collector load is R49 and the speaker itself.

If the speaker is disconnected for any reason the whole amplifier will latch up which is how it manages to withstand open-circuits continuously (see specs).

Q11 and Q12 form a fully complementary output pair with quiescent current set by R46 and D8. R47 and R48 are rather high in value at 2.2Ω which gives good bias stability, limits the power output to some extent and gives momentary short circuit protection.

Resistors R44 and R43 set the audio amplifier gain to around 25 (ie, 5600/220 = 25) while C45 rolls off the response above 3kHz.

Transmitter operation

The transmitter is controlled by the press-to-talk switch on the microphone and this controls the various supply rails, as mentioned above. We'll come back to that. The signal from the microphone is fed to the preamplifier, Q13 and Q14, which provide substantial gain. The amplified signal is fed via C52 to a diode limiting circuit, D9 and D10, which pre-

SPECIFICATIONS

GENERAL

Frequency Coverage	144 to 148MHz (see text)
Channel Spacing	10kHz; with 5kHz offset
Number of Channels	400 @ 10kHz; 800 @ 5kHz (see text)
Frequency Stability	within ±10ppm from 0 to 60°C
Modulation	Frequency Modulation
Temperature Range	from 5 to 50°C
Duty Cycle	two minutes transmit, two minutes receive
Supply Voltage	12 to 15V DC; test voltage 13.8V DC
Polarity	negative chassis
Current Drain	Receive: muted, 110mA; unmuted, 300mA Transmit: 1.9A at 10W; 2.5A at 15W
Protection	(a) 3A in-line fuse (b) diode reverse polarity protection (D1) (c) RF power amplifier can withstand up to 5:1 VSWR and open or short-circuit conditions for at least two minutes (d) audio power amplifier can withstand open circuit continuously and momentary short circuits

TRANSMITTER

Power Output	10 watts nominal; 15 watts maximum
Maximum Deviation	limited to 5kHz under normal operation; up to 10kHz with overdrive
Distortion	less than 10% at 3kHz deviation
Spurious Emissions	less than 60dB with respect to carrier
Harmonics	less than 60dB
Microphone Sensitivity	5mV RMS

RECEIVER

Sensitivity	0.5μV into 50Ω for 12dB SINAD; typically 0.4μV
Selectivity	better than 60dB at ± 25kHz
Audio power	1W at 1% THD into 8Ω
Frequency response	6dB/octave rolloff above 1kHz

vent the following stages from being overloaded.

The signal from D10 is fed to Q15, a two pole active filter stage with a gain of unity. The output of this stage is the modulating signal which is applied from trimpot VR61 to varicap diode D11 via R62, C57 and R64. D11 is in the tank circuit of the VCO (Q16), and thus is able to frequency modulate the VCO according to the microphone signal voltage.

The VCO is a conventional grounded gate oscillator using an N-channel FET. It oscillates at a nominal 146MHz (centre of band) as set by L8 and C64. Varicap D12 sets the VCO to the exact frequency required, as controlled by the frequency synthesiser.

The main VCO output signal is taken from its source and fed to Q17 and Q18, which are transformer coupled, and thence to Q19 and Q20 which are more or less conventional common emitter amplifier stages. Q21 and Q22, on the other hand, are class-C power amplifier stages which operate without forward bias at their bases.

By way of explanation, in a class-C amplifier such as Q22, the collector current flows for substantially less than every alternate half cycle with the tuned circuit preventing the generation of harmonics. In effect, a class-C amplifier tank circuit can be considered as the analog of a flywheel which has a short burst of energy applied to it during every cycle. It is a highly efficient amplifier.

The output power from Q22 is coupled to the antenna filter circuit mentioned previously. The path is via L26, L27, L29 and L30 to the output socket. A measure of the transmitter output is provided as follows: Gimmick capacitor C169 (two wires twisted together) feeds a small portion of the transmitter output to D14 which rectifies the signal and applies the resultant DC to the signal meter via R109 and filter capacitor C134.

Frequency synthesis

The method of frequency synthesis is essentially a variation on the conventional phase lock loop (PLL) circuit. A PLL normally comprises a voltage controlled oscillator (VCO), a reference oscillator, a programmable frequency divider (fed by the VCO), and a phase comparator which compares the frequency divided output of the VCO with the reference oscillator.

For a VHF transceiver it is usual to have three oscillators: a VCO, a reference oscillator and an offset oscillator. In this case the VCO is Q16, the reference oscillator is associated with IC6 and the offset oscillator is Q26. IC5 is the phase comparator and IC4 is the programmable divider.

Let's start by looking at IC6. This IC is a combined oscillator and divider with a division ratio of 1024. It drives crystal X2 at a frequency of 10.24MHz which when divided by 1024 produces a reference frequency of 10kHz at pin 7.

IC5, the phase comparator, compares the 10kHz reference frequency from IC6 against the 10kHz output from the programmable frequency divider, IC4. The output at pin 3 of IC5 is the PLL error voltage which is a series of pulses. These are filtered to produce smooth DC by R91, C156, R87, R86 and C153. This DC error voltage is then applied to D12 in the VCO (Q16) to maintain control over the VCO output.

As shown on the circuit, when the PLL is in the lock condition and the VCO output is 144MHz, then the error voltage at TP3 is 2.7 volts DC (after setting up).

Where the frequency synthesiser circuit diverges from normal PLL practice is that the programmable divider does not merely "divide down" the output of the VCO. Instead, IC4 divides the difference between the VCO output and the third harmonic of the offset oscillator.

The reason for this indirect procedure is that it is not possible to easily provide for programmable division directly from 144MHz.

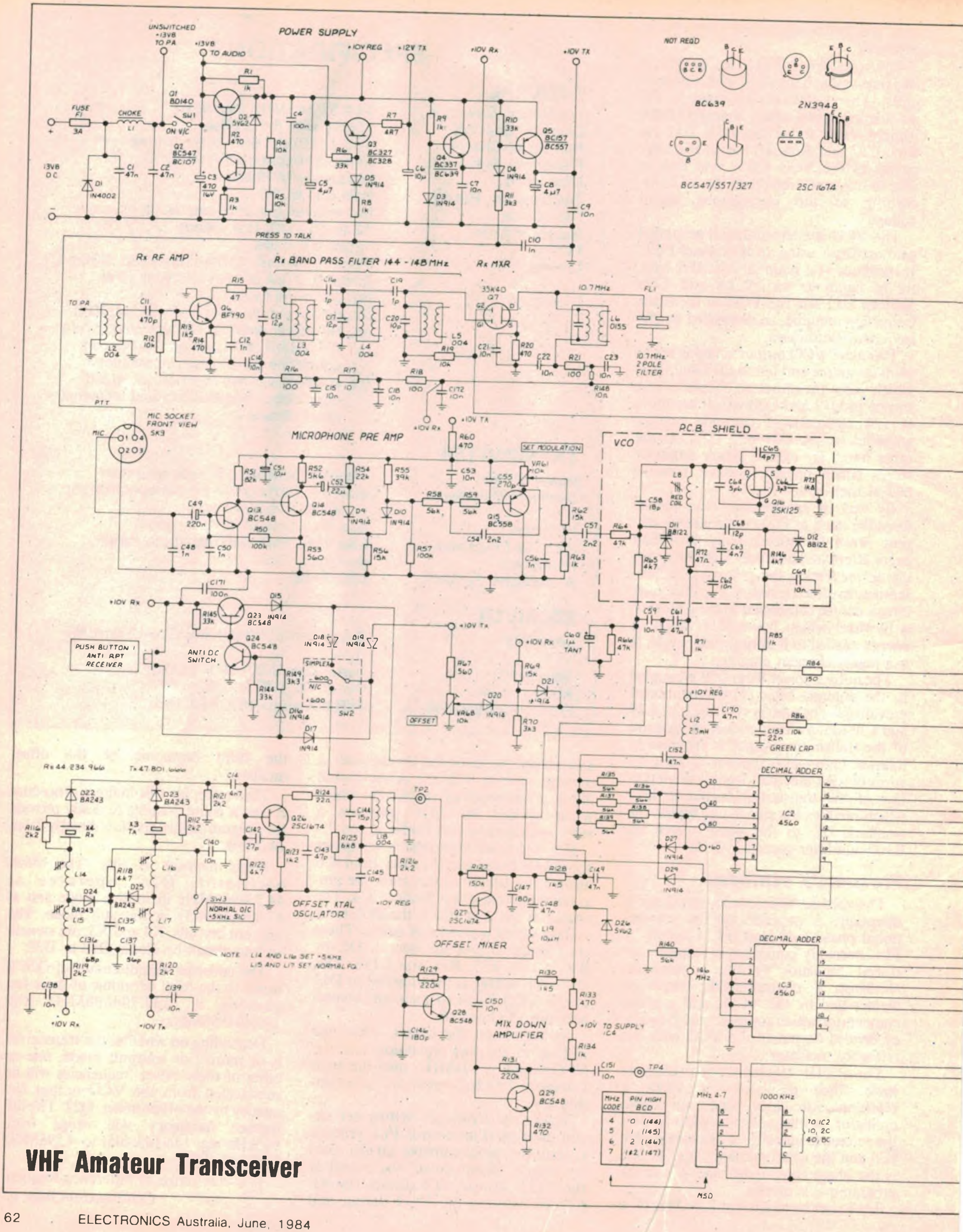
What happens is this. The offset oscillator, Q26, operates at 44.234966MHz in receive mode and at 47.801666MHz in transmit mode. The relevant crystals, X4 and X3, are switched into circuit by diodes D23 or D22.

The collector output circuit of Q26 is tuned to the third harmonic of these frequencies ie, 132.704898MHz and 143.404998MHz.

Depending on whether the transceiver is in receive or transmit mode, one or other of these offset frequencies will be substracted from the VCO output frequency by the offset mixer, Q27. The difference frequency will range from 595kHz (eg, 144-143.405) to 4.595MHz (148-143.405).

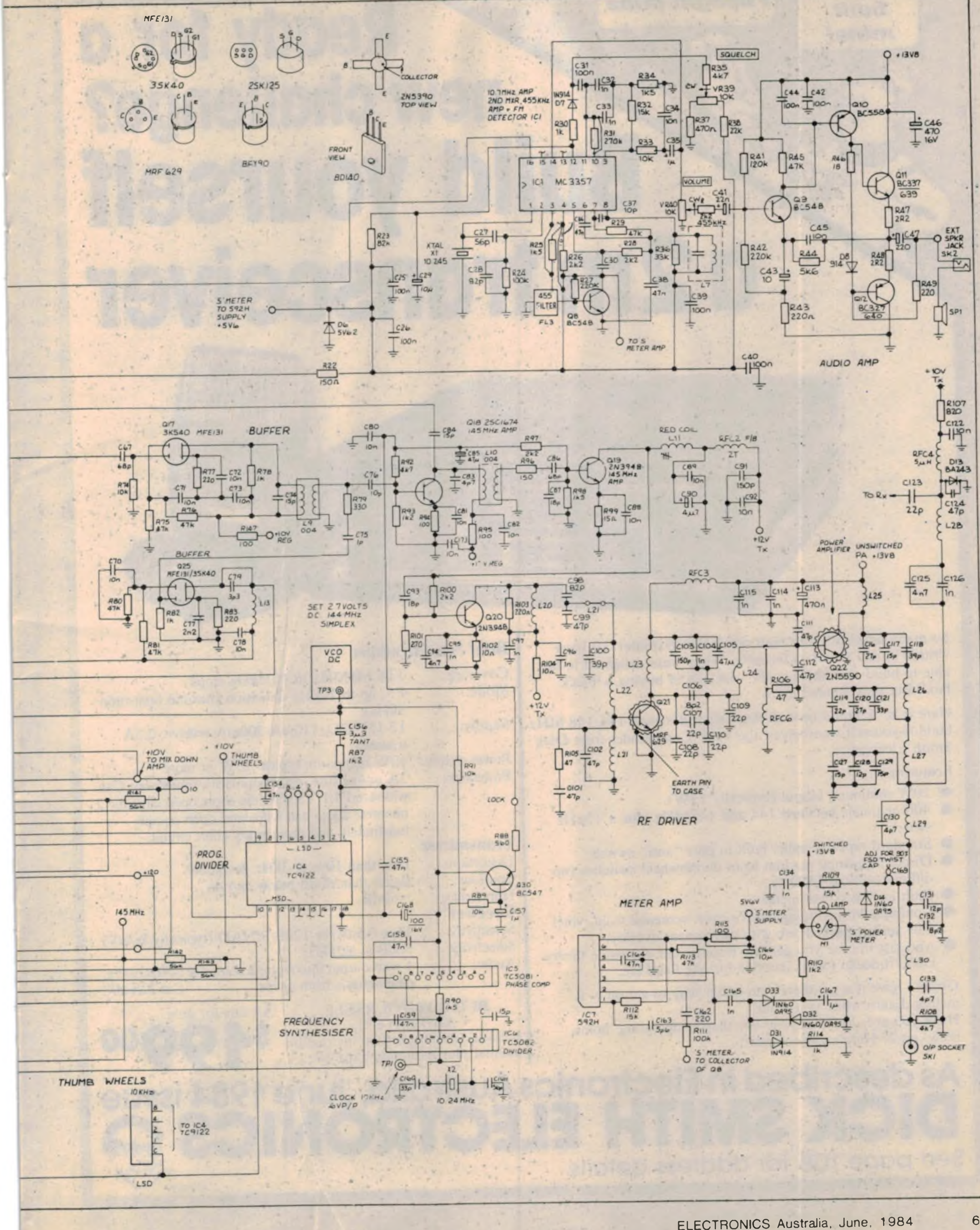
It is this range of difference frequen-

Continued on page 65



MHz CODE	PIN HIGH BCD
4	0 (144)
5	1 (145)
6	2 (146)
7	1+2 (147)

VHF Amateur Transceiver


MFE131
3SK40
2SK125
MRF629
BFY90
2N5390 TOP VIEW
COLLECTOR
FRONT VIEW
BD140
10.7MHz AMP 2ND MXR 455kHz AMP + FM DETECTOR IC1
IC1 MC3357
SQUELCH
VOLUME
455 FILTER
FL3
Q8 BC548
TO S METER AMP
S METER TO 592H SUPPLY +5V6
KTAL X1 10.245
455kHz
L7
AUDIO AMP
+13V8
Q9 BC548
Q10 BC558
Q11 BC337 639
Q12 BC327 640
EXT SPKR JACK SK2
SP1
Q17 3K540 MFE131
BUFFER
Q18 2SC1674 145MHz AMP
Q19 2N3948 145MHz AMP
RED COIL
L9 004
L10 004
+10V REG
+12V Tx
Q25 MFE131/3SK40
BUFFER
SET 2.7 VOLTS DC 144MHz SIMPLEX
Q20 2N3948
VCO DC
TP3
POWER AMPLIFIER
UNSWITCHED PA +13V8
Q21 MRF629
Q22 2N5590
EARTH PIN TO CASE
RF DRIVER
+10V Tx
TO Rx
D13 BA243
+10V TO MIX DOWN AMP
+10V THUMB WHEELS
PROG. DIVIDER
IC4 TC9122
LSD
MSD
LOCK
Q30 BC547
145MHz
IC5 TC5081 PHASE COMP
IC6 TC5082 DIVIDER
FREQUENCY SYNTHESISER
TP1
CLOCK 10KHz 6VP/P
10.24MHz
METER AMP
S METER SUPPLY
SWITCHED +13V8
ADJ FOR 90° FSD TWIST CAP
LAMP
S POWER METER
M1
IC7 592H
S METER TO COLLECTOR OF Q8
O/P SOCKET SK1
THUMB WHEELS
10KHz
TO IC4 TC9122
LSD

Ready for a new challenge?

Build yourself a 2m transceiver

So many amateurs who built our UHF 'Explorer' kit have written in and asked us for more. They were delighted to be able to build something again – instead of buying a 'black box'! But they wanted more . . .

Here it is: A brand new all-Australian designed 144-148 MHz build-it-yourself transceiver: the VHF Commander from Dick Smith Electronics.

Featuring . . .

- 10W minimum output (typically 15W)
- 400 channels between 144 and 148MHz plus a +5kHz switch
- Standard repeater splits built in plus "anti" switch
- Direct frequency readout from thumbwheel switches (no difficult-to-read LEDs!)
- Built-in S & power meter
- Complete kit including deluxe case, screened front panel plus solder masked pcb with component overlay.
- And just in case you get into trouble: our exclusive 'Sorry Dick, it doesn't work' service for one fixed fee.

Go on – give it a go: there's no better way to get on to 2 metres. Learn while you build!

Have you ever heard anyone say they're operating 'home brew' on 2? Here's your chance!

Brief Specifications

Coverage:	144-148MHz in 10/5kHz steps
Mode:	F3, up to 10kHz deviation (normal operation 5kHz)
Supply:	12-15V DC, 110mA-300mA receive, 2.5A transmit
Power output:	10W minimum, typical 15W or more
Protection:	3A in-line fuse, reverse polarity protection. Can withstand 5:1 VSWR (inc short/open circ) for 2 minutes; audio can withstand open circuit indefinitely and momentary short circuit.
Transmitter	
Distortion:	Less than 10% at 3kHz deviation
Spurious:	Better than 60dB below carrier.
Harmonics:	−60dB
Receiver	
Sensitivity:	Max 0.5uV for 12dB SINAD (typically 0.4uV)
Selectivity:	60dB at ±25kHz
Audio:	1 watt output into 8 ohms response 6dB/octave, de-emphasis from 1kHz

Cat K-6308

BUILD IT YOURSELF AND SAVE!!!

Includes comprehensive instruction manual plus mounting hardware.

All this for only . . .

$199.00

As described in Electronics Australia, June 1984 issue

DICK SMITH ELECTRONICS

See page 108 for address details

A764/KT

cies which is applied to the programmable frequency divider, IC4, via Q28 and Q29.

So IC4 is programmed by the thumbwheel switches to divide the relevant difference frequency from Q27 to provide a 10kHz output which is applied to the phase comparator, IC5.

Note, by the way, that the difference between the transmit and receive offset frequencies is 10.7MHz which is the required intermediate frequency.

So far so good. But now we have to backtrack a little. There is a problem in that IC4 cannot precisely divide frequencies that are not an exact multiple of 10kHz. Therefore that example of 595kHz (the lowest difference frequency) is not valid. And in fact, those offset oscillator frequencies given above are not quite correct.

Because of the provision for 5kHz channel spacing, the offset oscillator crystals are in fact 1666Hz too high. When the third harmonic of each crystal is considered it will be 5kHz high. So in normal operation, the crystals are pulled low by L14 and L15 for X4 and L16 and L17 and X3. So the normal offset transmit frequency is 47.8MHz (143.4MHz 3rd harmonic) and the offset receive frequency is 44.2333MHz (3rd harmonic is 132.7MHz).

When these offset frequencies are subtracted from the VCO the range of difference frequencies will be 600kHz to 4.6MHz. And note that 600kHz is an exact multiple of 10kHz.

When the +5kHz facility is switched on, L15 and L17 are switched out of circuit by diodes D24 and D25. so that now the crystals do run 1666Hz high and so the VCO frequency is shifted up by 5kHz.

Band protection

Note that when the 10kHz outputs of IC6 and IC4 (the programmable divider) are locked together IC5 turns on Q30. This turns on Q18 and Q19 and thus allows the transmitter to operate. Thus the transmitter is prevented from producing signals which are outside the 144 to 148MHz band.

But what about that +5kHz offset we have just discussed. When that is applied it would be possible for the VCO to operate at 148.005MHz and still produce a lock condition. The circuit design takes care of this possibility too since the thumbwheels are wired to only permit a maximum VCO frequency of 147.99MHz. When the 5kHz is added this gives a maximum VCO frequency of 147.995MHz which is still inside the band limits.

Strictly speaking then, this means that only 399 channels are available with 10kHz spacing and 798 channels with 5kHz spacing (144.005 to 147.995MHZ).

±600kHz offset

Yet another factor has to be taken care of by the frequency synthesiser circuitry. For repeater operation, the transmitter frequency usually has to be offset by minus 600kHz from the receive frequency. Less often, it may have to be changed by plus 600kHz. This condition could be met by adding more crystals to to the offset oscillator circuitry but in this circuit it has been achieved digitally.

As well as avoiding the expense of extra crystals, the digital method of offset does not require any alignment. IC2 and IC3 are digital adders. They add a code of 60 or 120 to the code applied by IC4. In the normal simplex mode, the addition of the 60 code is the standard. For −600kHz repeater operation, this code is removed (controlled by D18 and IC2).

For +600kHz operation, IC2 and IC3 are brought into play by D29 and D27 to add a code of 120 to IC4.

A neat advantage of this scheme is that it allows the "anti-repeater" operation whereby the receiver only can be shifted by ±600kHz. This is achieved by the pushbutton in conjunction with Q23, Q24 and associated diodes. The advantage of the anti-repeater function is that it allows the operator to listen directly to his contact instead of via the repeater.

Note that when the 600kHz offset facility is in use, the out-of-band protection circuitry does not prevent transmission outside the band limits. In this case it is up to the operator to make sure he or she does not transgress.

Power supply

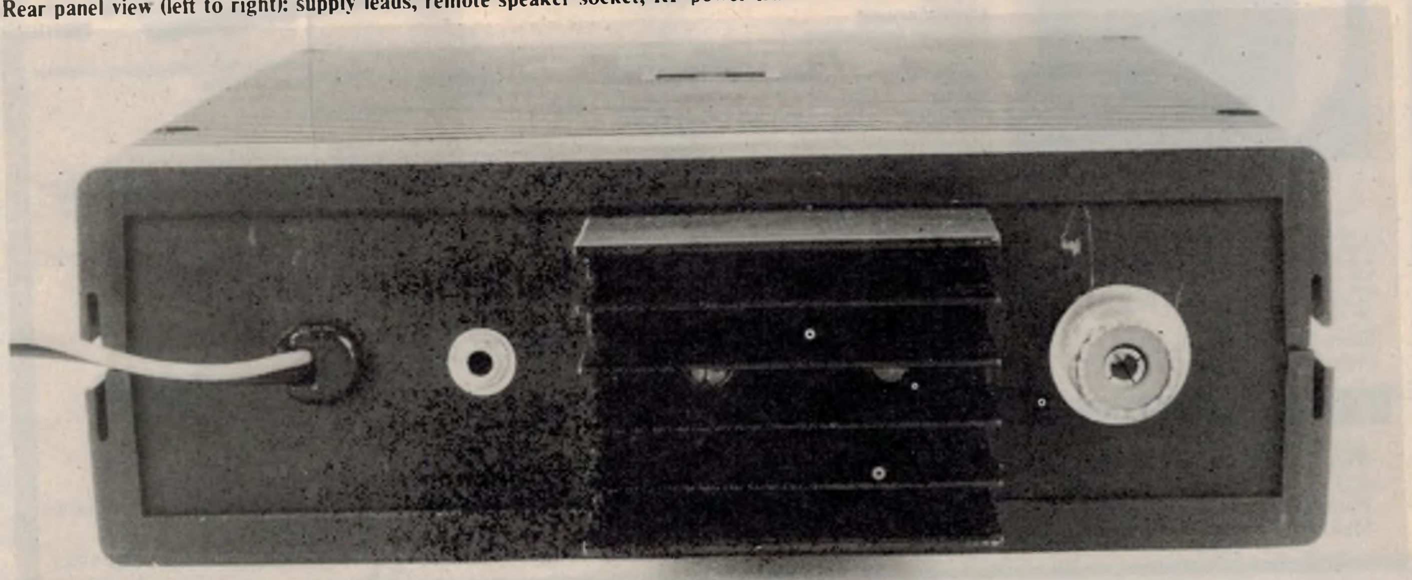
A +10V regulated supply derived from Q1, Q2 and D2 supplies power directly to the VCO, offset oscillator, frequency synthesiser circuitry and mix down amplifier (Q28 and Q29). The +10V regulated rail is also switched to various other sections of the circuit by Q4 and Q5, depending on whether the transceiver is in the receive or transmit mode.

When in the receive mode, the press-to-talk switch is open and D3, D4 and D5 cannot conduct. Therefore Q4 supplies the +10V Rx rail. When the PTT switch is closed for transmit mode, D3 and D4 conduct, turning off Q4 and turning on Q5 to supply the +10V Tx rail. D5 also conducts, turning on Q3 to supply the +12V Tx rail.

The final two stages of the RF power amplifier, Q21 and Q22, are powered directly from the 13.8V (battery) supply, as is the audio amplifier. This is OK since Q21 and Q22 are normally biased off and can only operate when Q19 and Q20 are turned on by the +12V Tx rail.

Continued next month

Rear panel view (left to right): supply leads, remote speaker socket, RF power transistor heatsink and antenna socket.



SWIVEL BASE MONITORS FROM $179 THIS MONTH

WHAT'S NEW AT ROD IRVING ELECTRONICS

Ritron 11 Monitors are now available to increase our range of Data Displays. They feature a unique adjustable swivel base that tilts forward or back 30 degrees and swivels right to left 60 degrees. Technical specifications are listed below:

SPECIFICATIONS — CRT SIZE: 12 inches non-glare 90 degree deflection. **INPUT SIGNAL:** 1.0-2.5V p-p composite video signal. **INPUT IMPEDANCE:** Normal 75ohm, high approx 50K ohm. **INPUT TERMINALS:** RCA phone jack. **RISE TIME AND FALL TIME:** Less than 25 us. **VIDEO BANDWIDTH:** 20 MHz ± 3dB. **SCANNING FREQUENCY:** Horizontal, 15.75KHz ±0.5KHz; Vertical, 50Hz/60Hz; Horizontal Retrace Time, Approx 8.5us; Vertical Retrace Time, Approx 800us. **PHOSPHORS AVAILABLE:** Amber, Green. **RESOLUTION:** Centre, 1000 Lines; Corner, 800 Lines; Geometric distortion. 2% or less; Linearity, less than 2%. **CONTROLS:** Front, POWER ON/OFF, brightness contrast; Rear, V-Hold, H-Hold, V-Line, V-Size.

AVAILABILITY: Green Phosphor in Stock **$179.00**
Amber Phosophor Early March **$199.00**

SCHOOL AND DEALER ENQUIRIES WELCOME

APPLE™ COMPATIBLE DISK DRIVE

SPECIFICATIONS

™ *Registered trade mark Apple Corpóration*

HIGH-SPEED ACCESS, HIGH ACCURACY POSITIONING instead of plastic CAM positioner or lead screws positioner, a high microprecision metal band positioner is adopted in the mechanism to position the head.

BRUSHLESS DC DIRECT-DRIVE MOTOR Direct drive means that there is no improper belt seating, so the variations in speed and friction-producing side loading can be eliminated, which allows motor running lifetime to be over 10,000 hours.

MOTOR CLOSED LOOP SERVO Hall effect devices are utilized as speed control sensor in DC motor system, so motor can run stably and accurately.

SLIM, HALF-HEIGHT DRIVE The disk drive is only 41mm high, it is only half the size of conventional models.

NO CONTACT WRITE-PROTECTED SENSOR Photo coupler is used as write-protected sensor. It means no damage, long lifetime and good reliability for disk media.

GENERAL SPECIFICATIONS

Capacity (formatted)	163K (20K bytes more than the original)
No. of tracks	40 tracks (5 tracks more)
No. of sectors track	13 to 16 sectors
Disk rotation speed	300 rpm
Track density	48TPI
Track to track time	Less than 6 msec

$349.00

INCLUDES CONTROLLER CARD

BARE DRIVE & CASE

$299.00

OTHER CARDS ALSO AVAILABLE. ASK AT OUR CITY STORE.

DO YOU NEED A CASE FOR A SINGLE BOARD COMPUTER

This stylistic low profile case will give your system the professional look it needs. This case comes complete with an encoded, parallel output keyboard. The keyboard is in its own case attached via a coiled connector, so it can be placed for maximum comfort. Sit one of our new swivel monitors on top and make your system look like it's worth thousands. Cut outs are for 2 x 5¼in Slimline disk drives.

GREAT FOR SINGLE BOARD COMPUTERS, TERMINAL CARDS, ETC.

CASE AND ENCODER KEYBOARD $249.00

Tax Ex $199.00

Dimensions:

	W	D	H
Box	450mm	295mm	110mm

Box Cat. No. X11080

Dimensions:

	W	D	H
Keyboard	450mm	195mm	40 (28mm)

K/B Cat. No. X11081

NEW VIDEO MONITORS

Get a clear honest image!

Computer data and graphic displays never looked better, brighter, sharper

High Resolution

- Recommended Display Characters: 1920 (80x24).

GUARANTEED for 12 months by Rod Irving

SCHOOL AND CLUB BULK BUYS — Please ring for pricing

- High quality non-glare CRT
- Compact and Lightweight with all Controls Inside Front Panel
- All units 100% Factory Burned in
- 800 lines centre resolution
- Suitable for Apple* — and other computers. (Apple is a registered trademark of Apple Computer Company Inc)
- Green or Orange Phosphor available
- 18MHz
- First shipment arriving middle of June, 1983
- Direct Import Price for June

Green Phosphor **$189** ($162 Exempt)
Orange Phosphor **$199** ($179 Exempt)

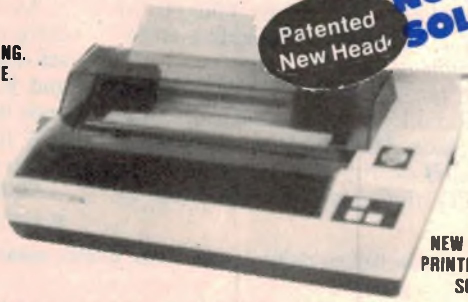
GREAT VALUE

'THE PRINTER PEOPLE' SPECIALS

AS REVIEWED BY EA NOVEMBER '83

500 NOW SOLD

THESE ARE THE REAL THING. NOT A CHEAP SUBSTITUTE.



NEW DELUXE PRINTER NOW SUPPLIED

A NEW PRINTER NOW!

CP-80/I, 80-COLUMN IMPACT PRINTER

SPECIFICATIONS

Functional Specifications

Printing method — Serial impact dot matrix. Printing format — Alpha-numeric — 7 x 8 in 8 x 9 dot matrix field. Semi-graphic (character graphic) — 7 x 8 dot matrix. Bit image graphic — Vertical 8 dots parallel horizontal 640 dots serial line.
Character size — 21mm (0.083")-W x 2.4mm (0.09")-H 7 x 8 dot matrix.
Character set — 228 ASCII characters. Normal and italic alpha-numeric fonts, symbols and semi-graphics.
Printing speed — 80 CPS 640 dots/lines per second.
Line feed time — approximately 200 msec at 4.23mm (1/6") line feed.
Printing direction — Normal — Bidirectional logic seeking. Superscript and bit image graphics — Unidirectional left to right.
Dot graphic intensity — Normal — 640 dots 190.5mm (7.5") line horizontal. Compressed characters — 1.280 dots/190.5mm (7.5in) line horizontal. Line spacing — Normal — 4.23mm (1/6"). Programmable in increments of 0.35mm (1/72") and 0.118mm (1/216").
Columns/line — Normal size — 80 columns. Double width — 40 columns. Compressed print — 142 columns. Compressed double width — 71 columns. The above can be mixed in a line.
Paper feed — Adjustable sprocket feed and friction feed.
Paper type — Fanfold Single sheet. Thickness — 0.05mm (0.002") to 0.25mm (0.01"). Paper width — 101.6mm (4") to 254mm (10").
Number of copies — Original plus 3 copies by normal thickness paper.

Mechanical Specifications

Ribbon — Cartridge ribbon (exclusive use), black.
MTBF — 5 million lines (exclusing print head life)
Print head life — Approximately 30 million characters (replaceable).
Dimensions — 377mm (14:8")—W x 295mm (11.6")-D 125mm (4.9")-H incl sprocket cover.

Parallel CP 80 **$379** *Serial CP80* **$559**

2000 Sheets "Keen Edge" Paper $39.50

ROD IRVING ELECTRONICS
425 High St., Northcote, Vic. 48-50 A'Beckett St., Melb., Vic.
Phone (03) 489 8866, (03) 489 8131, Mail Order Hotline (03) 481 1436
Mail orders to P.O. Box 235 Northcote 3070 Vic.

Minimum P & P $3.00. Errors & omissions excepted.
Please address tax exempt, school, wholesale and dealer enquiries

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

ERRORS AND OMISSIONS EXCEPTED

DEALER ENQUIRIES ESPECIALLY WELCOME ON ALL THESE PRODUCTS

ROD IRVING ELECTRONICS

425 HIGH ST, NORTHCOTE 3070 VIC   PHONE (03) 489 8866, (03) 489 8131

"BIG BOARD II"

Over 1,000 sold

Jim Ferguson, designer of the "Big Board" distributed by Digital Research Computers, has produced a stunning new Computer, "Big Board II". It has the following features:

4 MHz Z80-CPU AND PERIPHERAL CHIPS

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

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

"Big Board II" has the three memory banks: the first memory bank has eight 4164 RAMs that provide 60K of user space and 4K of monitor space. The second memory bank has two SKx8 SRAMs for the memory-mapped CRT display and space for six 2732 As, 2Kx8 static RAMS, or pin-compatible E(E)PROMs, the third memory bank is for RAM or ROM added to the board via the STD bus Whether bought as a bare board, a full kit, or assembled and tested, it comes with a 450nS2732A EPROM containing the monitor

MULTIPLE-DENSITY CONTROLLER FOR SS/DS FLOPPY DISKS

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

VASTLY IMPROVED CRT DISPLAY

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

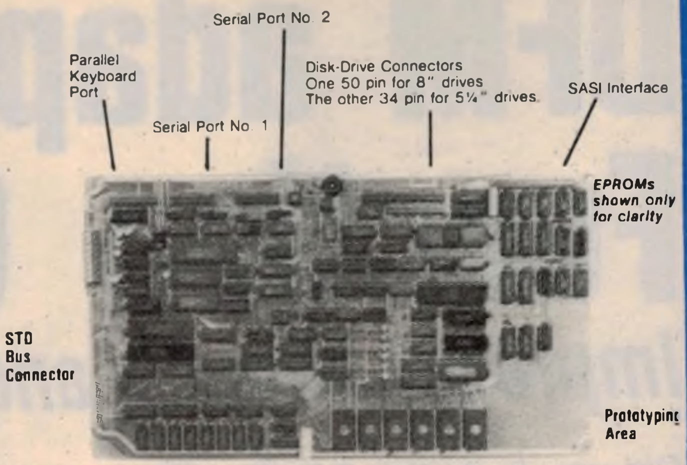
STD BUS CONNECTOR

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

A Z80-A S10/0 = TWO ASYNCHRONOUS/SYNCHRONOUS SERIAL PORTS

TWO Z80-A CTCs = EIGHT PROGRAMMABLE COUNTERS/TIMERS

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



PROM PROGRAMMING CIRCUITRY AND SOFTWARE

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

CP/M

CP/M with Russell Smith's CB10S for the new Ferguson computer is available for $230 + TAX
The CB10S is available separately for $65 + TAX
Actual board size: 39.6cm x 22 2cm 5 inch B10S being developed Approx price $95 + TAX

Kit Price

$695 inc tax Less 10% for 3+

$895 Assembled and Tested

KIT PRICE FOR THIS MONTH

$649.00

NEW SINGLE BOARD PRODUCTS AND PRICING

THE 6809 "UNIBOARD"™

SINGLE BOARD COMPUTER KIT

PERFECT FOR COLLEGES, OEM'S, INDUSTRIAL AND SCIENTIFIC USES!

64K RAM! DOUBLE DENSITY FLOPPY DISK CONTROLLER!

FEATURES THE POWERFUL, THIRD GENERATION, MOTOROLA 6809 PROCESSOR!

Many software professionals feel that the 6809 features probably the most powerful instruction set available today on ANY 8 bit micro. Now, at last, all of that immense computing power is available at a truly unbelievably low price.

FEATURES:

★ 64K RAM using 4116 RAMS.
★ 6809E Motorola CPU.
★ Double Density Floppy Disk Controller for either 5-1/4 or 8 inch drives. Uses WD 1793.
★ On board 80 x 24 video for a low cost console. Uses 2716 Char Gen Programmable Formats. Uses 6845 CRT Controller.
★ ASCII keyboard parallel input interface. (6522)
★ Serial I/O (6551) for RS232C or 20 MA loop.
★ Centronics compatible parallel printer interface. (6522)
★ Buss expansion interface with DMA channel. (6844)
★ Dual timer for real time clock application.
★ Powerful on board system monitor (2732). Features commands such as Go To, Alter, Fill, Move, Display, or Test Memory. Also Read and Write Sectors. Boot Normal, Unknown, and General Flex™.

PC BOARD IS
DOUBLE SIDED, PLATED THRU
SOLDER MASKED, 11 x 11-½ IN.

BLANK PC BOARD
$199.95 + tax
WITH PAL'S, AND
TWO EPROMS.

FOR 5-¼ OR 8 INCH
SOURCE DISKETTE
ADD $25 + tax

$599.00 incl tax
COMPLETE KIT!
FULLY SOCKETED.

ALL OPTIONS ARE
STANDARD. NO
EXTRAS TO BUY!

PLEASE ALLOW 4 WEEKS FOR DELIVERY

YOUR CHOICE OF POPULAR
DISK OPERATING SYSTEMS:

FLEX™ from TSC	$209
OS9™ from Microwave	$289

Specify 5-¼ or 8 Inch

48-50 A'BECKETT ST, MELBOURNE 3000 VIC   PHONE (03) 347 9251

Mail Order Delivery Instructions: Minimum Pack and Post $3.00 for Australia Post. Please allow extra for bigger orders and Certified, Airmail or Registered Post. Minimum order is $5.00. Please address orders to Mail Order Department, PO Box 235, NORTHCOTE, 3070 VICTORIA. PHONE (03) 481 1436.

DFM adaptor for the Function Generator

Improves linearity and measures to 300kHz

Did you build the Function Generator described in April 1982? Now you can add this enhancement which lets it operate as a frequency meter and improves the linearity of the coarse frequency control.

by JEFF SKEEN & LEO SIMPSON

The Function Generator was and still is a very popular project. Now, in response to a number of requests, we have produced a small printed circuit board which enhances the capabilities of the project.

For those not familiar with the Function Generator and who do not have access to the original April 1982 article, the circuit itself was republished in last month's issue in an article entitled, "What to do if your project doesn't work". Reference to that circuit will show that there are two major sections: the oscillator, involving the XR2206, and the frequency meter, involving the 74C926.

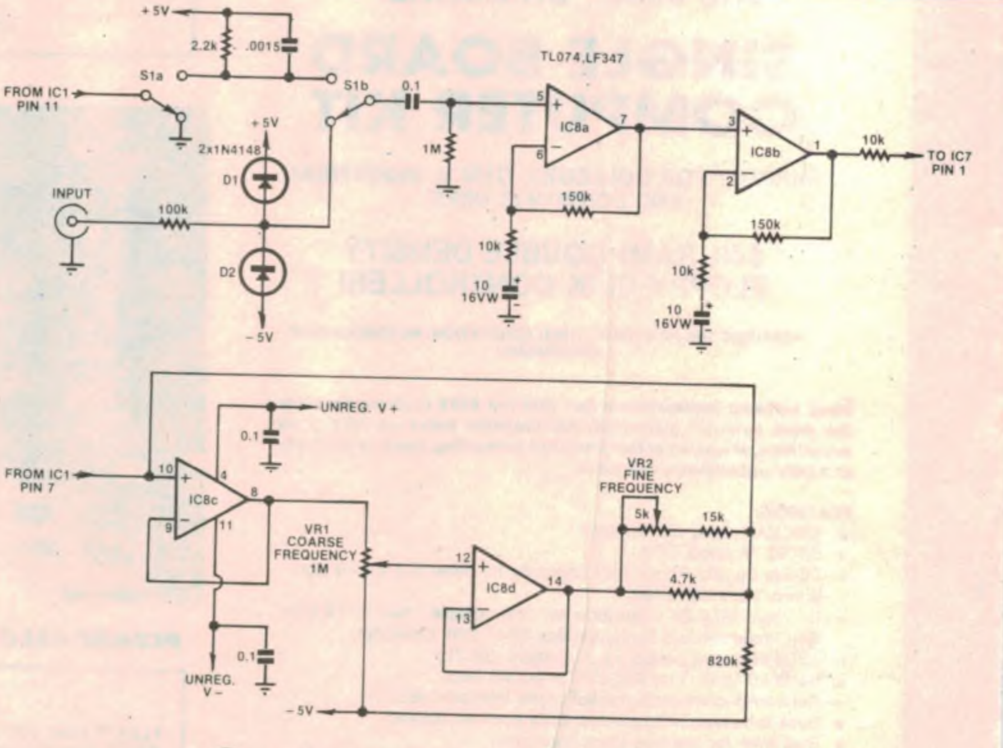
In the original design the frequency meter section of the circuit was permanently connected to the output of the XR2206 oscillator; it could not measure the frequency of external signals. The rationale for this approach was that we did not want to unduly complicate the design. That the project has proved so popular indicates that this was a good decision. Now we are providing an option to those who wish to make use of that frequency meter.

The modification gives the Function Generator the ability to measure frequencies up to 300kHz and above, depending on the signal level. The accompanying graph shows a plot of input sensitivity versus frequency. For most of the range the sensitivity is around 20 millivolts peak-to-peak or better which is more than adequate for most applications.

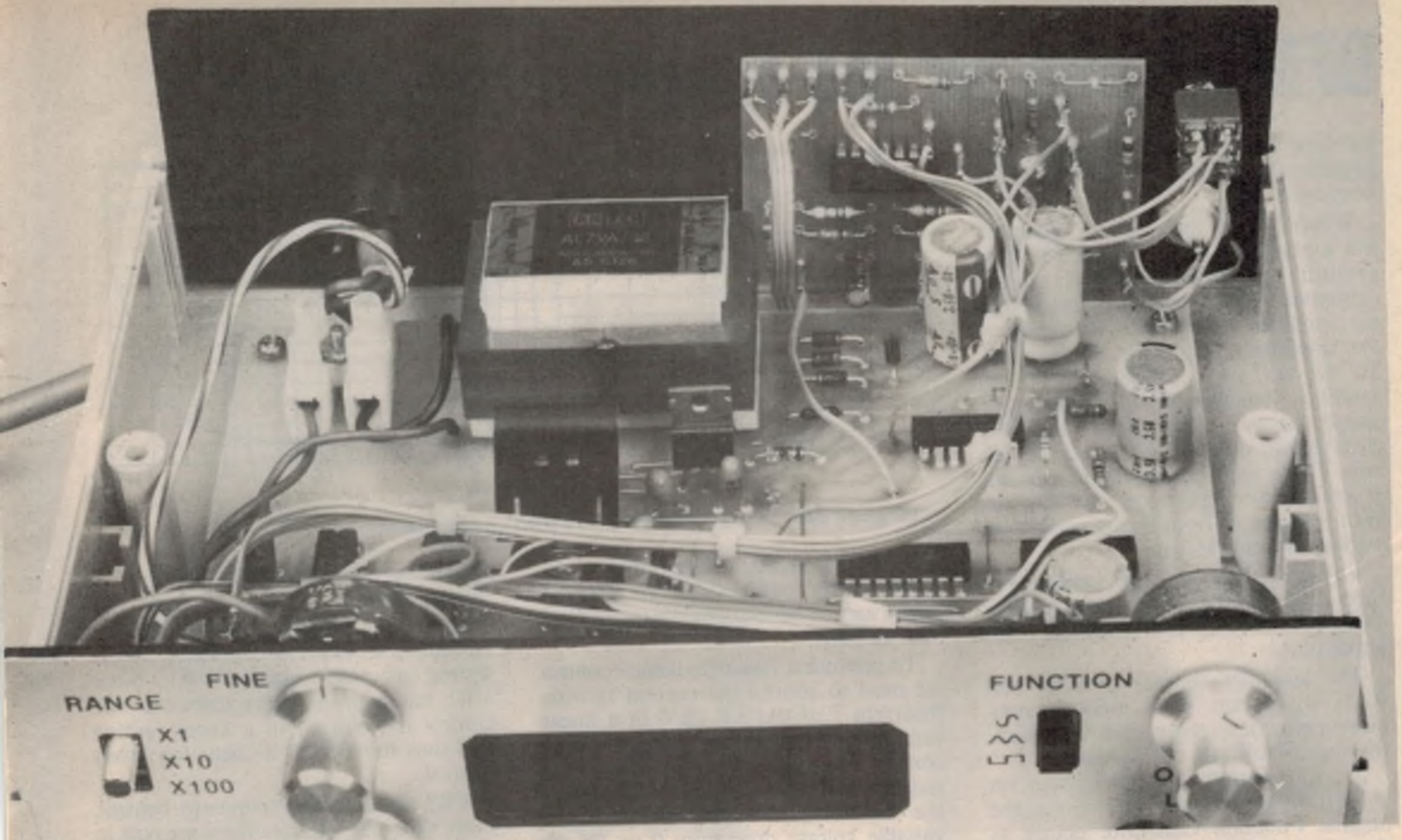
The other feature of this option is an improvement to the coarse frequency control, making it more linear and much easier to use to select a given output frequency. In the original design, the frequency control is essentially a potentiometer wired as a variable resistor; the lower the resistance, the higher the output frequency. Hence, the control has a very non-linear 1/x or hyperbolic law.

Again, we were aware of this drawback when we produced the original design but it does have the virtue of simplicity. The add-on circuit is a big improvement though and makes it very easy to set the frequency output.

Mechanically, the modifications entail the addition of a BNC socket and a toggle switch on the rear panel plus a small printed circuit board. Quite a lot of rewiring is involved too, which is the hardest part of the whole job. The cost is quite minor though, so it is quite a worthwhile addition to an already useful piece of test equipment.



FUNCTION GENERATOR ENHANCEMENT



Above: interior of the function generator with the new board on the rear panel. Below: close-up of the new board.

Circuit description

Relatively few components are needed for this modification. There is just one quad op amp IC package and a few other passive components.

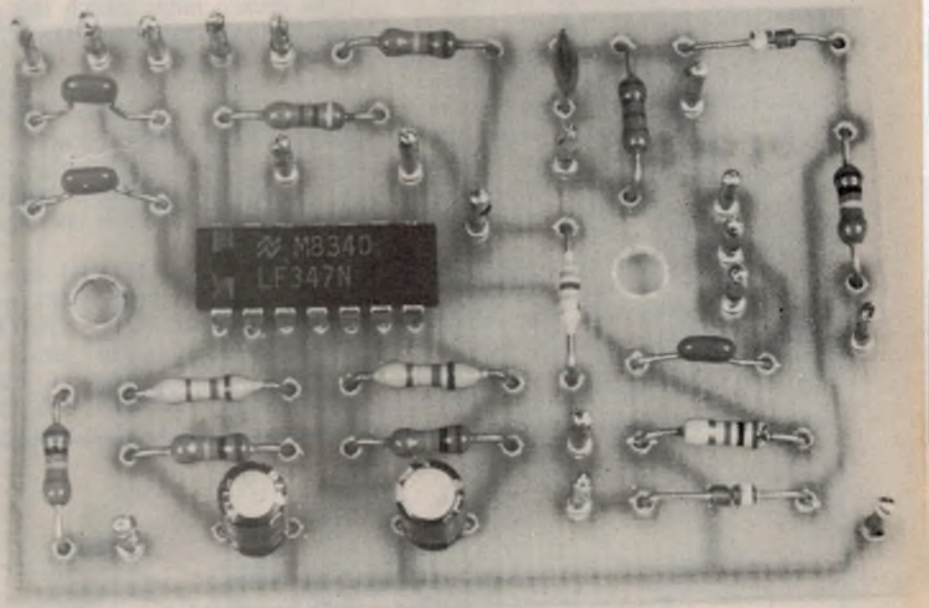
Let's have a look at the frequency meter side of the circuit first. Incidentally, the quad op amp on the add-on PCB is referred to as IC8, which continues the numbering used in the Function Generator to avoid confusion.

At first sight, adding the external frequency meter facility to the Function Generator is quite straightforward. All that is necessary is to break into the signal measuring chain involving the hex Schmitt trigger IC7 and install an amplifier with sufficient gain to give an adequate sensitivity.

In practice, it is not so easy. What you need is an amplifier which can provide gain and sufficient output signal to exceed the positive and negative thresholds of the Schmitt trigger.

The problem is that typical CMOS Schmitt trigger ICs have positive and negative thresholds which are within a volt or so of the supply rails. For example, if the supply rails are ±5V, as in this case, the input signal to the Schmitt trigger will need to be in excess of 8V peak-to-peak for reliable operation.

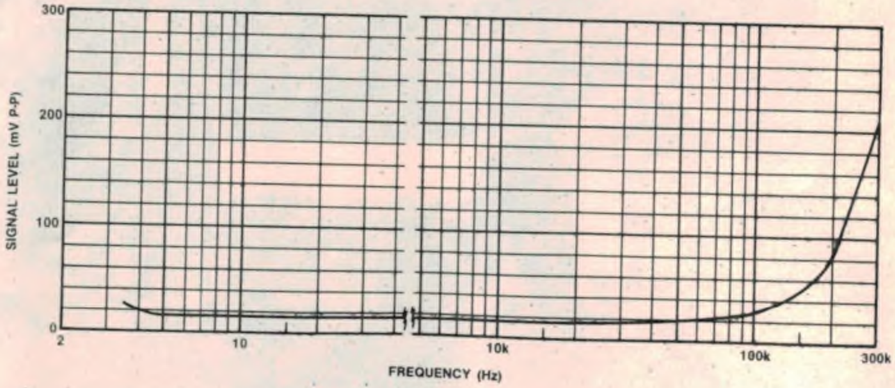
Typical op amps running from the same ±5V rails cannot satisfy this requirement. They just don't have enough output voltage swing. To overcome this problem, the quad op amp package is powered from the unregulated supply rails of the Function Generator, which are around ±13 volts DC.



The unregulated supply rails do not present any problems to the op amps in this circuit since they have a very high supply voltage rejection ratio of 80dB or more. This is another way of saying that fluctuations of the supply voltage rails do not affect the output of the op amps.

The input source to the amplifier is controlled by S1. When this switch is in the "generator" position, the squarewave output from pin 11 of the XR2206 IC passes via S1a and S1b to the input of the amplifier. The 2.2kΩ resistor is a pull-up resistor necessary for correct operation of the XR2206 output while the .0015μF capacitor was a circuit modification

DFM adaptor for the Function Generator



This graph plots the input sensitivity as a function of frequency.

(published in June, 1982) to prevent false triggering of the counter circuit at low frequencies.

When S1 is in the "counter" position, S1a shorts the output of the XR2206 to ground to prevent stray circuit capacitance from coupling spikes into the amplifier input while S1b connects the amplifier input to the BNC socket. To prevent gross overloading of the amplifier, voltage limiting diodes are placed between the input and the positive and negative 5V power supply rails. These limit the maximum voltage at the amplifier input to ±5.6V and are in turn protected from excess current by a 100kΩ limiting resistor.

Following S1b, a 0.1μF capacitor is used to couple the input signals while a 1MΩ resistor sets the amplifier input impedance.

The amplifier consists of IC8a and IC8b which are both used in non-inverting mode to give a gain of 16 each, thus an overall gain of 256 times.

The output of the amplifier passes via a 10kΩ limiting resistor and rejoins the original Function Generator circuit as the input to Schmitt trigger IC7a. This Schmitt trigger squares up the output of the amplifier and provides the drive to the following counter section.

Because the amplifier output voltage can swing higher than the Schmitt trigger supply voltage, voltage protection is required on the Schmitt trigger input. This is achieved by the internal protection diodes in the Schmitt trigger in conjunction with the 10kΩ limiting resistor just mentioned.

Now let's have a look at the second part of the circuit which involves the frequency control on the XR2206 oscillator chip. As previously mentioned, this originally used a pot wired as a variable resistor. The actual frequency produced is directly proportional to the current drain from pin 7 of the XR2206 which can be varied over the range from 1μA to 3mA.

To produce a linear frequency control we need to control the current flowing from pin 7 of the XR-2206 in a linear fashion. Our method for doing this is to control the voltage drop across the resistance in series with pin 7. By fixing the resistance at 4.7kΩ and using a variable voltage drop from 0 to 3V we can alter the frequency by a factor of around 200 to 1. When coupled with the three decade range switch this gave a total frequency range of 12Hz to 220kHz on the prototype.

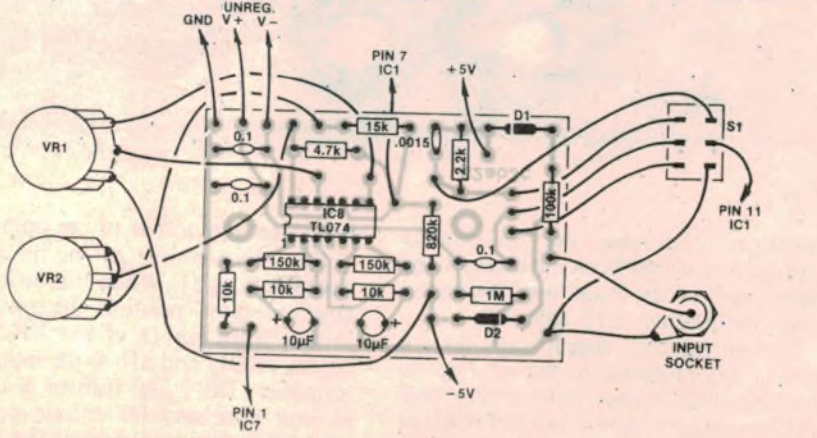
The remaining op amps, IC8c and IC8d, provide this function. IC8c is connected as a voltage follower to buffer the fixed −2V at pin 7 of the XR2206, IC1. The output of IC8c is connected to VR1 which has its other end connected to −5V.

Thus the wiper of VR1 can swing linearly over the range from −2V to −5V and drives IC8c which is also connected as a unity gain voltage follower. IC8d drives a network consisting of VR2 and two resistors which are also connected to the −2V output of IC1.

So IC8d functions as a variable current sink which is controlled by the setting of potentiometer VR1. Since VR1 has a linear characteristic it will control the current in a linear fashion and thus function as a linear frequency control.

VR2 acts as a fine frequency control. Both VR1 and VR2 are the same pots as used in the original Function Generator design. In fact, in a simplified design, the coarse frequency control is so effective that VR2 could be dispensed with.

The 820kΩ resistor at the output of IC8d is used to set the minimum frequency of oscillation of the XR2206. The 820kΩ resistor is permanently connected between pin 7 of the XR2206



Take care with the orientation of polarised components.

PARTS LIST

1 PCB, code 82ao3c, 70 x 48mm
18 PC stakes
1 DPDT toggle switch
1 panel-mounting BNC socket
2 6mm PCB spacers
2 sets 12mm x ⅛-inch nuts and bolts
½ metre 10-way ribbon cable

Semiconductors
1 LF347 or TL047 quad op amp IC
2 1N4148 diodes

Capacitors
2 10μF 16VW PC mount electrolytics
3 0.1μF metallised polyester

Resistors (¼W, 5%)
1 x 1MΩ, 1 x 820kΩ, 2 x 150kΩ, 1 x 100kΩ, 1 x 15kΩ, 3 x 10kΩ

NOTE: As discussed in the text, the two potentiometers, two resistors and one capacitor on the PCB are from the Function Generator and do not need to be purchased.

and the negative supply rail. This means that there will always be a 3V drop across it and so it will always draw about 3.7μA from pin 7 regardless of the settings of the fine and coarse frequency controls. This minimum current corresponds to a frequency of around 12Hz.

Construction

The circuit is constructed on a small printed circuit board (PCB) coded 82ao3c and measuring 70 x 48mm. Use the overlay diagram as a guide to the component locations and double check the orientation of the polarised components — the two diodes, the op amp and the two electrolytics.

PC stakes are used to terminate all wires leading to and from the PCB. This allows connections to be made easily to the PCB when it is mounted in position. There are 18 PC stakes to be placed on the board in all.

Separate the two halves of the Function Generator case from the PCB and front and rear panels. Several components must be removed from the function generator PCB and installed on the new PCB. These components are: the 2.2kΩ resistor adjacent (and connected to) pin 1 of IC7, the .0015μF capacitor in parallel with the 2.2kΩ resistor, and the 4.7kΩ resistor in series with the fine and coarse frequency controls.

In addition, the connection between pin 11 of the XR2206 and pin 1 of IC7 must be broken. This is most easily done by removing the wire link by which the connection is made.

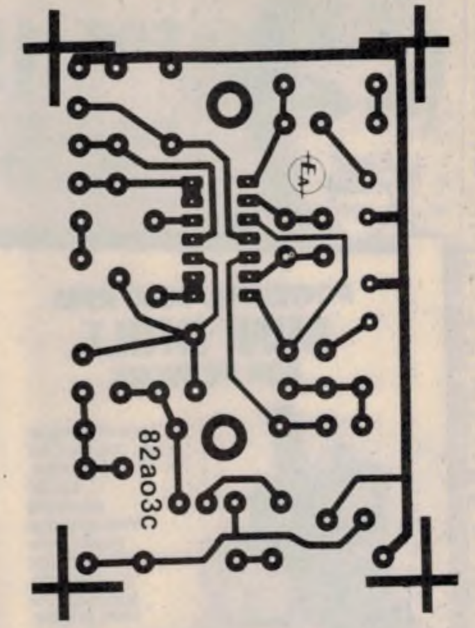
Once all components are mounted on the PCB, the rear panel should be removed from the Function Generator and the mounting hole positions for the PCB, BNC socket and toggle switch laid out. The positions shown in our photograph give the best clearance between the existing PCB and the new components. Drill the mounting holes, fit standoffs to the PCB mounting screws, then attach the PCB, BNC socket and toggle switch to the rear panel.

The existing wiring leading to the frequency controls should be removed now and the wiring leading to the new PCB commenced. Follow our wiring diagram carefully and use colour coded ribbon cable so that identification of the individual wires is made easier. Most connections to the original PCB can be made from the component side via vacant component mounting holes. The exceptions are the connections to the unregulated power supply rails and ground which are made to the underside of the PCB.

When the wiring is completed, reassemble the Function Generator into its case and switch on. Set the rear panel toggle switch to the frequency generator position and check that the display changes frequency as the coarse frequency control is rotated. Rotating the fine frequency control will give only a slight change at the lowest frequencies but should have more effect at higher frequencies where it is most likely to be used. There should be a big difference apparent in the operation of the coarse frequency control now, with the frequency range not being bunched towards one end of the potentiometer.

With the Frequency Generator position tested, the toggle switch is set to the counter position and a test signal with an amplitude greater than 20mV and a frequency between 20Hz and 100kHz applied to the BNC input. The digital display should indicate the frequency of the applied signal. When acting as a frequency counter, the Function Generator will still deliver sine and triangular waves but the square wave output will be a squared up version of the frequency counter input. This signal may be used as an external trigger signal for oscilloscopes if required.

If you wish to still have the Function Generator square wave output available when in the counter mode it will be necessary to isolate pin 3 of IC7 from pins 2 and 5 by cutting tracks. The amplifier output should then be connected to pin 3 of IC7 rather than pin 1. The 2.2kΩ resistor. .0015μF capacitor and wire link should be left in position if this is done.

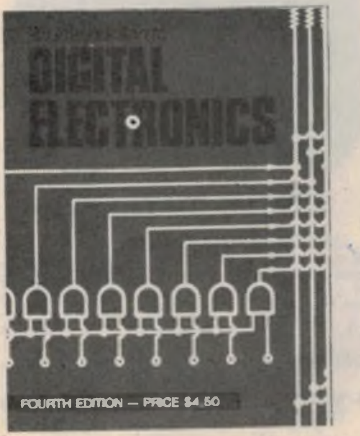


Full size PCB artwork.

We estimate the cost of parts for this project to be approximately

$12

This includes sales tax.



AN INTRODUCTION TO DIGITAL ELECTRONICS

Electronic equipment now plays an important role in almost every field of human endeavour. And every day, more and more electronic equipment is "going digital". Even professional engineers and technicians find it hard to keep pace. In order to understand new developments, you need a good grounding in basic digital concepts, and An Introduction to Digital Electronics can give you that grounding. Tens of thousands of people — engineers, technicians, students and hobbyists — have used the previous editions of this book to find out what the digital revolution is all about. The fourth edition has been updated and expanded, to make it of even greater value.

Available from "Electronics Australia", 57 Regent St, Chippendale, Sydney, 2008. **PRICE $4.50** OR by mail order: Send Money Order or Cheque to "Electronics Australia", PO Box 163, Chippendale 2008. **PRICE $5.40.**

PHONE YOUR ORDER — ALTRONICS TOLL FREE 008·999·007

FOR 15c PHONE YOUR ORDER TOLL FREE ON 008·999·007

We will immediately confirm stock availability. We will also confirm the very hour your order will be dispatched (over 95% of orders leave the same day). **With Jet Service Delivery we deliver next day to capital cities and suburbs** — Country areas please add 24 to 48 hours. **Available bankcard holders only** — sorry non-bankcard holders must post a cheque or money order — even so, we promise to deliver quicker than any other supplier in Australia.

POWERFUL 6000 RPM MINI DRILL FOR PC WORK

Tons of Torque.
Just the shot for PCB work.
12V DC operated from external Power Pack
1.2mm chuck capacity.
Supplied c/w 1mm drill bit.

INCREDIBLE VALUE

T2302 now only	$10.00
Drill Bits:	
T2320 (0.8mm)	$1.25
T2326 (1.0mm)	$1.25

HALF PRICE Z80 A

FULL SPEC

FAMOUS SGS BRAND

Z9001 CPU	WAS $8.95	NOW	$4.50
Z9005 PIO	WAS $8.95	NOW	$4.50

OOPS WE MADE A BOO BOO!

Right now we have around ½ million Premium Quality Genuine Philips IN914/IN4148 Signal Diodes — Out they go at never to be repeated prices.

BE QUICK

STOCKS ARE DWINDLING

	1's	100's	1000's
Z0101	4c	3c	2c

SAVE ON BULK QUANTITIES

VIDEO ENHANCER

Here's a **simple** but **effective** Video Enhancer that is super **easy to build** at a fraction of the cost of commercial models.
Unit sharpens picture detail, and can actually improve the quality of a copy by amplifying the top end of the video signal.

AT LAST A VIDEO ENHANCER KIT

K5825 .... **$35.00**

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

STEREO SYNTHESIZER FOR VCR'S AND TUNERS

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

- Quality Phillips MN3001 (not second source dropout)
- Provision for 2 different signal sources.
- Selection of either source via front panel switch
- Normal or stereo sound selection
- Complete kit includes all hardwear, cables etc., even solar.

Important ★ beware of Kitset suppliers who sell this kit for **less** ★ you get **less!**

K5810 .... **$55.00**

ELECTRET MIC INSERT

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

C 0170	$1.95
10 Up	$1.50

GO ANYWHERE 12-240V POWER

MASSIVE 300 WATTS

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

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

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

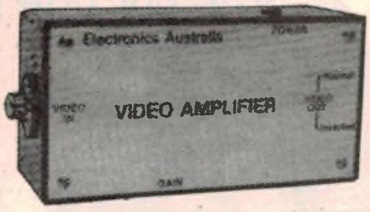
($10 DELIVERY AUSTRALIA WIDE)

40 WATT MODEL

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

K6700 .... **$55.00**

VIDEO AMPLIFIER



SINGLE OUTPUT

INVERSE AND NORMAL OUTPUT

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

NO MORE SMEARY COLOURS, SIGNAL BEATS OR RF INTERFERENCE

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

K5850 .... **$14.95**

BANKCARD HOLDERS — PHONE ALTRONICS TOLL FREE 008·999·007 FOR NEXT DAY JETSERVICE DELIVERY

BANKCARD HOLDERS — PHONE ALTRONICS TOLL FREE 008·999·007 FOR NEXT DAY JETSERVICE DELIVERY

FOR DESPATCH P&P CHARGES AND ADDRESS DETAILS PLEASE REFER TO OUR AD ON PAGE 131

PHONE YOUR ORDER — ALTRONICS TOLL FREE 008·999·007

BANKCARD HOLDERS — PHONE ALTRONICS TOLL FREE 008·999·007 FOR NEXT DAY JETSERVICE DELIVERY

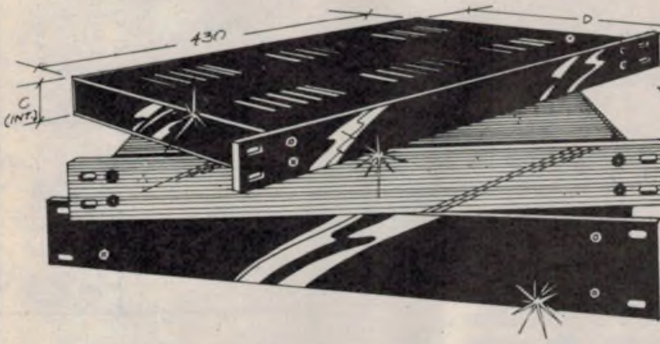
OR FOR 30c POST AN ORDER TO ONE OF ALTRONICS COMPETITIORS

— naturally you won't have a clue as to whether they've got the items you need available. And of course, be prepared to wait, wait, patiently wait sometimes for weeks!

Why waste your valuable cash? Altronics staff are waiting for your call now (up to 6pm eastern standard time).

YOUR BUDGET PROBABLY WILL ~~WON'T~~ STRETCH TO AFFORD OUR PROFESSIONAL SERIES ALL ALUMINIUM RACK CABINETS

NOW YOUR PREAMPS, AMPS, CONTROL MODULES MONITOR PANELS ETC. CAN LOOK EVERY BIT AS GOOD AS TECHNICS, NAKAMICHI AND OTHER TOP MANUFACTURERS



LAST MONTH AT THESE PRICES

* These beautifully crafted rack cabinet boxes will give your equipment a real 1st class appearance. * All aluminium construction. * REMOVABLE TOP AND BOTTOM PANELS. * All dimensioning conforms to the International Standard. * Natural or Black finish. * Ventilated lid. * Deluxe brushed finish anodised front panel. * Individually cartoned. * Supplied in Flat Pack Form — Easily assembled in minutes.

Side Elevation:
D = 254mm C (Internal Chassis Height)
B (Mounting Bolt Centres)

Cat. No.	Finish	A	B	C	ea.	5 +
H 0401	Natural	44	34	38	$45.00	$42.50
H 0402	Natural	88	57	82	55.00	52.50
H 0403	Natural	132	89	126	59.95	55.00
H 0411	Black	44	34	38	45.00	42.50
H 0412	Black	88	57	82	55.00	52.50
H 0413	Black	132	89	126	59.95	55.00

Beware of other rack boxes that do not conform to International Rack Sizing.

FUSE HOLDER 3AG

32 x 6.3mm Fuse

S6000...... **95c**
10 Up...... **85c** each

PRICE SLAUGHTER ON GENUINE HITACHI MOSFETS (PRIME SPEC)

Z1510 2SK 134
Z1512 2SJ 49

$5.90EA
$5.5010up.

DALO PEN

Etch resistant ink.

Makes PC artwork a breeze.

T 0033 .. **$2.50**

CHECK THIS!

WATERCLEAR LEDS

(ILLUMINATE RED)
HIGH INTENTISY

Z0157 ....1 - 9................**10c**
10 - 99...............**.9c** 100 + ...**8c**

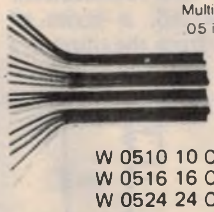
FUSE HOLDER M205

20 x 5mm Fuse

S5990...... **90c**
10 UP...... **80c** each

CHECK OUR PRICE ON RAINBOW CABLE

Multicoloured Flat Ribbon Cable
.05 inch/1.27mm centres.



	Price Per M ea.	Price Per M 10 +
W 0510 10 Core	1.10	.95
W 0516 16 Core	1.75	1.60
W 0524 24 Core	2.50	2.25

PROFESSIONAL AUTOMATIC WIRE STRIPPER

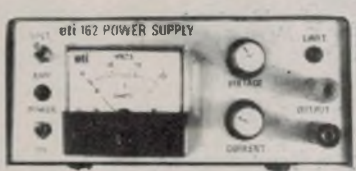
Automatically adjusts to insulation/wire diameter. This absolutely brilliant stripper is the finest we've ever used.

T 1520

$9.50

SUPERB KIT POWER SUPPLIES

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



BENCH STANDARD

- ★ 3-30v Output @ 1 Amp
- ★ Fully Regulated, Fully Protected from Thermal Overload and Short Circuits.
- ★ ETI Design.

K3205..... (PICTURED)..... **$49.50**

HIGH CURRENT

MICROCOMPUTER PS

★ + 5 Volts @ 3 Amps. ★ + 12 Volts @ 2 Amps. − 12 Volts @ 200 milliamps.

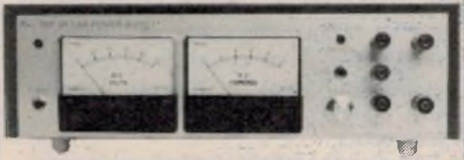
This universal design has enough grunt to power most disk drives.

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

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

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

HIGH CURRENT — DUAL METERING



EA SWITCH MODE DESIGN

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

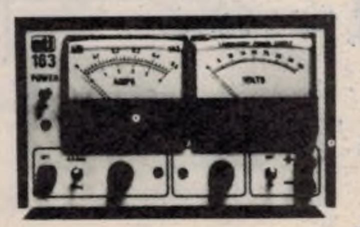
K3300. . (EA MAY, JUNE '83). . **$139.00**
K3301... (10 TURN VOLTAGE CONTROL OPTION)... **$10.00**
K3302..... (± 12V OPTION) EA JULY '83..... **$12.50**

ETI SERIES REGULATOR DESIGN

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

A PROFESSIONAL SUPPLY

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



FEATURING: VARIABLE CURRENT LIMIT-DUAL METERING

BANKCARD HOLDERS — PHONE ALTRONICS TOLL FREE 008·999·007 FOR NEXT DAY JETSERVICE DELIVERY

FOR DESPATCH P&P CHARGES AND ADDRESS DETAILS PLEASE REFER TO OUR AD ON PAGE 131

Circuit & Design Ideas

Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. As a consequence, we cannot accept responsibility, enter into correspondence or provide constructional details.

Audible indicators for panel lamps

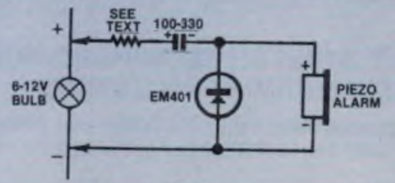


Fig. 1

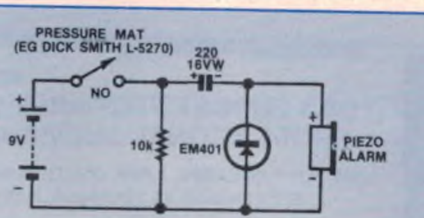


Fig. 2

The low current requirements and wide operating voltage range of continuous-tone piezoelectric alarms enable the production of transient sounds using passive RC networks.

The circuit of Fig. 1 produces a "ding" whenever the associated panel lamp turns on. The sound decays exponentially in volume as the capacitor charges to the full applied voltage.

When the lamp is turned off, the capacitor discharges via the diode and the lamp filament. If a low power diode is used, a small series resistor (10 to 1000Ω) may be used to limit the diode current if the lamp normally draws more than one amp. This circuit has been used as an automotive oil warning indicator and on custom built switchboards.

An interesting variation is shown in Fig. 2. Here the piezo alarm is used as a shop entry annunciator. It rings once each time the pressure mat is stepped on. A 9V transistor radio battery should power this circuit for at least six months.

Finally, the circuit of Fig. 3 uses a small bridge rectifier or four low cost diodes to produce a sound whenever the associated lamp goes on or off. Using a smaller capacitance gives a "dik-dik" sound which makes the circuit ideal as an audible blinker indicator for cars with "quiet" flasher units.

By using a non-polarised electrolytic or plastic dielectric capacitor, the circuit may be connected directly across the associated lamp without any need to check the polarity.

These circuits use so few components that construction can consist of gluing the diode(s) and capacitor(s) to the back of the piezo alarm. After wiring and testing the whole assembly can be potted in Araldite.

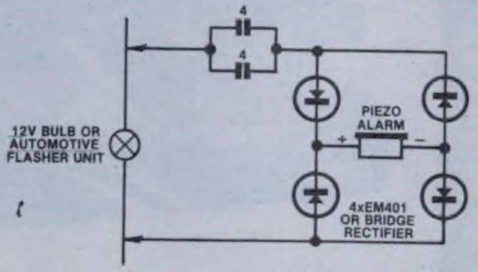


Fig. 3

S. Payor,
Kogarah Bay, NSW.

$25

Extended response sound switch

Most sound switches respond immediately a sound is detected. This can be a problem in some applications. For example, if the circuit is to respond to a doorbell it may be triggered when a door is slammed or any other short loud noise occurs.

This circuit can be set to respond only to sounds of a specific duration, or longer. Short sounds will cause no response.

Part of the circuit of Cudlipp (featured in EA, February 1982) is used here (IC1). This functions as a microphone preamplifier and source of pulses which are delivered while ever a sound is present. IC2a is connected as a retriggerable monostable which provides a pulse of half to one-second duration when triggered by the output of IC1b.

IC3 is a comparator with a normally low output which goes high when the voltage at pin 2 exceeds ½Vcc. IC2b is connected as a non-retriggerable monostable which operates the relay via a BC548 when it is triggered by IC3's output.

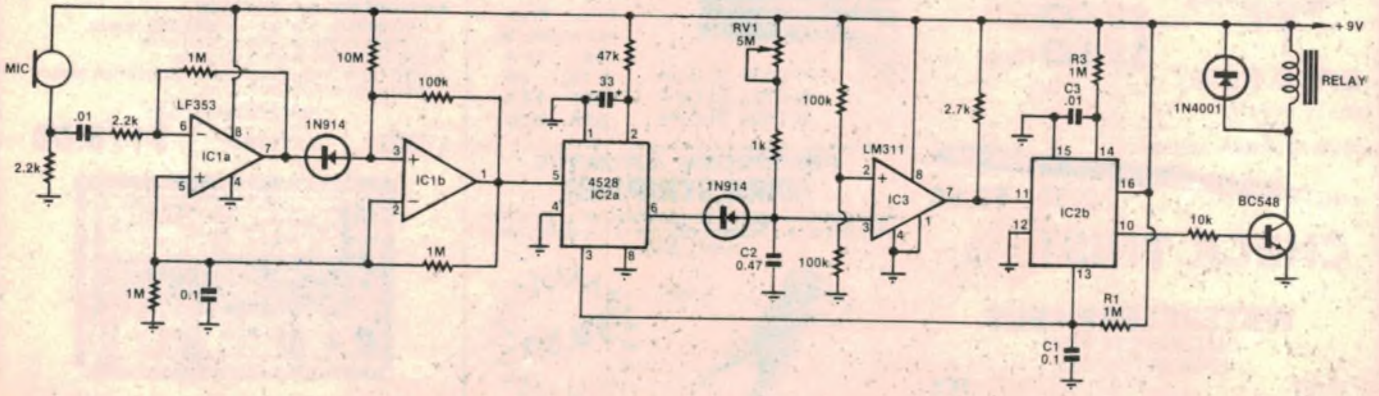
When the circuit is first switched on, R1 and C1 will reset the monostables. When sound is detected, a series of negative-going pulses from the output of IC1b will trigger IC2a. Since IC2a is retriggerable, its output (pin 6) will remain high until the sound has ceased.

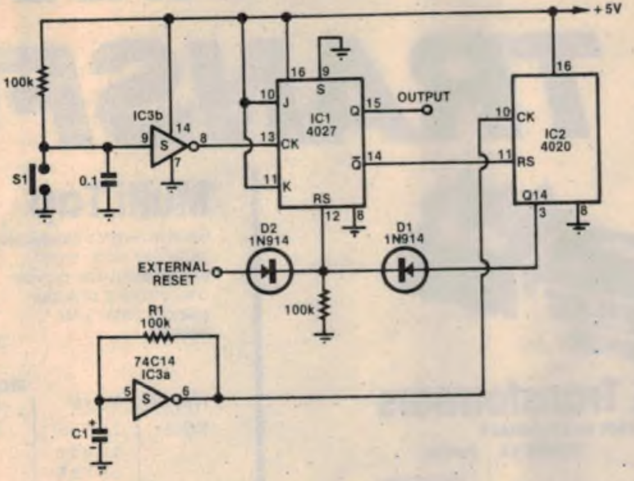
While the output of IC2a is high capacitor C2 will charge at a rate set by RV1. If the output of IC2a remains high for sufficient time, the voltage across C2 will exceed ½Vcc and so flip the comparator and thus trigger IC2b which will operate the relay for a time set by R3 and C3.

If C2 is not able to charge for long enough, it will merely discharge via the diode when the output of IC2a goes low and thus the relay cannot be turned on.

P. Vandermost,
East Brighton, Vic.

$25





Single pushbutton long-period timer

With this circuit, only a single pushbutton switch is required to initiate or terminate a long-period timing cycle. IC1 is a 4027 JK flipflop and changes state on a rising clock edge. This occurs every time switch S1 is pressed, the output appearing at pin 15 (Q).

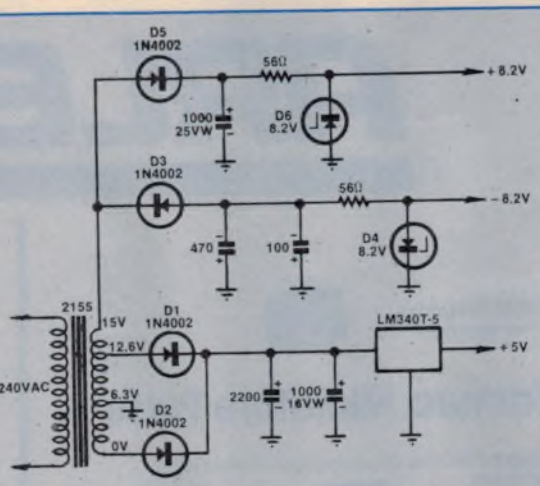
If Q is initially low, Q is high and binary counter IC2 is held reset with its Q14 output low. Closing S1 will cause Q to go high and Q to go low, thus releasing the reset on IC2 which is now clocked by Schmitt trigger oscillator IC3a. IC2 is subsquently reset (ie, Q low and Q high) either by a further switch operation or when Q14 of IC2 goes high.

In addition, the circuit may be reset during the timing cycle by applying an external reset signal to D2.

The maximum timing period (P) is nominally $P = 1.4(R1)(C1) \times 2_{n-1}$ seconds where Qn is the 4020 output (for the circuit shown, n = 14). Possible applications include use as a verandah light or exhaust fan controller.

G. Cutter,
Bentleigh, Vic.

$20



Modified supply for storage CRO Adapter

Some imported 2155-type transformers exhibit poor regulation characteristics and this can sometimes lead to problems in areas of low mains voltage. In the case of the Digital/Analog Storage CRO Adapter (EA, November 1980 and March 1981), it can lead to a very high ripple content on the ±8.2V supply rails.

This problem can be overcome by altering the transformer tappings and adding a few extra components as shown. The 5V regulator now derives its supply from the 0, 6.3 and 12.6V tappings instead of the 0, 7.5 and 15V tappings previously used. An extra 1000μF capacitor has also been added at the input, in parallel with the existing 2200μF capacitor, and this ensures that the regular input remains above its dropout voltage while reducing its dissipation.

The ±8.2V supplies are derived from the 15V tappings. Diodes D3 and D5 provide half-wave rectification of the AC supply, while zener diodes D4 and D6 regulate the supply rails to −8.2V and +8.2V respectively. Note that an extra 100μF capacitor has been added across the 470μF capacitor used in the negative supply.

I. Stevenson,
Bracken Ridge, Qld.

$15

Automatic volume control

Here is a simple circuit that will automatically adjust the volume of a car radio or cassette deck according to the ambient road of engine noise.

A microphone is placed under the bonnet of the car, either adjacent to the engine or one of the wheels, which ever causes the greatest noise problem. Its output is rectified by D1, filtered to provide a steady DC voltage, and fed to op amp IC1. The gain of IC1 is variable between one and 30 by means of a 100kΩ trimpot, while the non-inverting input is biased to half supply by two 100kΩ resistors.

The output of IC1 drives transistor Q1 which varies the current through a green LED. The output of the LED is then coupled to an LDR which, in turn, varies the resistance between the active and wiper terminals of the volume control. Thus, when the engine noise rises, the LED brightness increases, the value of the LDR decreases, and the volume increases.

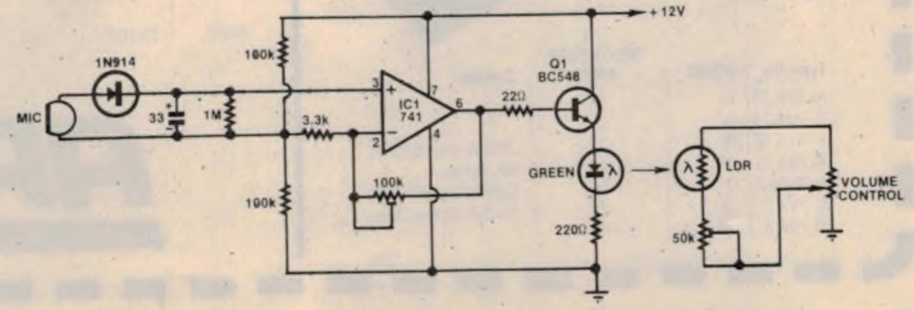
In practice, the 100kΩ trimpot should be adjusted so that the LED just lights with the engine at idle. The LED and the LDR should then be mounted inside a light-proof tube. The 50kΩ trimpot in series with the LDR functions as a sensitivity control.

B. Paterson,
Glen Iris, Vic.

$15

Wanted: your brain-waves

Come on now. You must have had some bright circuit and design ideas which are worth publishing. Why not send them in and make a little extra brass for more electronic components? We pay between $5 and $40 per item published, depending on the merit and the amount of work we have to do to publish it. Why not jot your idea down now and send it in?



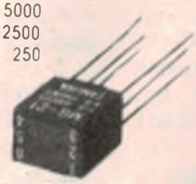
ARLEC TRANSF

O.E.M. Enquiries
welcomed

Tamura Miniature Pulse

Designed principally for computers and measuring instruments

Type No.	Primary Inductance (uH)	Details
G 52 J12C	800	Centre tap
G 53 E21C	2500	Centre tap
G 50 J111	8	3 windings
G 51 H111	50	
G 52 E111	250	
G 52 H111	500	
G 52 J111	800	
G 73 H111	5000	
G 74 B111	12500	
G 52 E211	250	



O.E.M. Enquiries
welcomed

Tamura
Green Chip Series

Miniature transformers designed for transistor circuitry

Type No	Impedance (!) PRI	SEC	Details
MG 24	500	50	AUDIO
MG 22	500CT	600	
MG 25	600CT	12	
MG 21	600CT	600CT	
MG 23	1K	50	
MG 17	10K CT	1 5K CT	
MG 16	10K CT	2K CT	
MG 15	10K CT	10K CT	
MG 14	20K CT	1K CT	
	Inductance		
MG 106	O I H		Inductor

Low Profile

AL 7 VA Series Insulated to AS 3126 P C B mounting pins compatible with other current models and provision for additional anchorage to PCB's 240V 50HZ PRIMARY

Type No	VOLTS	SECONDARY AMPS	Details
AL 7VA 30	30	23	
AL 7VA 24	24	29	
AL 7VA 18	18	39	2 equal secondaries for - Series - Centre Tap or Parallel Connection
AL 7VA 15	15	47	
AL 7VA 12	12	58	
AL 7VA 9	9	78	
AL 7VA 6	6	117	

P.C.B. Transformers

250V 50 HZ PRIMARY

Type No.	VOLTS	POWER VA	Details
75000 Series	2-12V	1, 2, 5, 7 10, 12	2 Secondaries May be used separately or connected in Series or Parallel

Low and Extra Low Voltage

240V, 50 HZ PRIMARY

Type No.	VOLTS	SECONDARY AMPS	Details
2150	12 6CT	1 25	
2155 A	8 5, 9 5 12 6CT, 15CT	1	
5502	44CT	1 25	
5504	15	2	
5508	12 6CT	2	
5579	6 3	1	
5755	40CT	1 25	
6474	12 6CT	0 15	
6625	25	0 5	
6672 A	17 5, 20, 24CT, 27 5CT 30CT	1	
6978 A	9, 10 5 12 6CT, 15CT	2	
7309	12	2 5	
7310	24	1 25	
60817	24	1 25	
5503	11 5, 17	4	
7243	19, 33, 40, 50CT	2	
7311	24	4 2	
9583	10 9, 18 5 - 2	4 7, 0 87 - 2	
60202	17 5, 20, 24CT, 27 5, 30CT	3	
60203	30CT 40CT 50CT, 60CT	2	Two secondaries can be series or parallel connected
60291	25 2CT	3 5	

Multi Tap

General purpose transformers for special projects and experimental work provide a wide choice of output voltages 240V, 50HZ PRIMARY

Type No.	VOLTS	SECO AM
60202	2 5, 3, 3 5 4 5, 5 5, 6 6 5, 7 5, 8 9, 10, 12, 12 5 15, 17 5, 18 20, 24, 27 5, 30	3
60203	5, 10, 15, 20, 25, 30 45, 50, 55 60	2 A Ser 4 A pa
2155 A	1 1, 2 2, 2 2 2 4, 3 1, 3 2, 4 1, 5 1, 5 5 6 3, 6 5, 7 5 8 5, 8 7, 9 5 12 6, 15	1
6978 A	1 2, 1 5, 2 1 2 4, 2 7, 3 3 6, 4 2, 4 5, 5 1, 6, 6 3 7 5, 8 7, 9 10 5, 12 6 15	2
5672	2 5, 3, 3 5, 4 5, 5 5, 6, 6 5, 7 5, 8 9, 10, 12, 12 5, 15, 17 5, 18, 20 24, 27 5, 30	1

Thyristor (SCR) Trigge Transforme

For power supplies, lamp dimmers, motor speed controls

Type No.	VOLTS	SECON Max AM
XT1185	415 (Max voltage between windings)	70

HEAD OFFICE VICTORIA
30 32 Lexton Road, Box Hill Vic

NEW SOUTH WALES
47 Drummond St Belmore N S

WAGGA
K J Warden (Agencies) Pty Ltd
Norton Street Wagga N S W

A C T
K J Warden (Agencies) Pty Ltd
24 Geelong St Fyshwick A C T 2

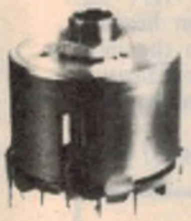
SOUTH AUSTRALIA
30 Beulah Rd Norwood S A 50

ARLEC

ORMER GUIDE

DARY PS	Details
	Centre tapped 5V 24V 30V
mp es mp allel	Centre tapped 10 20 30 40 50 and 60V
	Centre tapped 2 12 6 and 15V
	Centre tapped 3 12 6 and 15V
	Centre tapped 5 24 and 30V

er



DARY
SCR
PS

3128 Ph (03) 840 1222 Telex 32286
2192 Ph (02) 789 6733 Telex 22871
550 Ph (069) 21 2735 Telex 69960
609 Ph (062) 80 5519 Telex 62475
67 Ph (08) 42 8918 Telex 89234

Enclosed Stepdown Transformers

240V, 50 HZ PRIMARY

Ideal for garden lamps, pond lights and water pumps, automatic trouble lamps, safety lights, pool lighting etc

Type No.	VOLTS	SECONDARY AMPS	Details
60269	32	2 25	Type No 60280, 60426 and 60480 have two fuses in the secondary output for pool lighting applications
60279	32	7 8	
60280	32	5 9	
60425	24	3	
60426	24	7 9	
60453	12	6	
60480	12	15	

Portable Stepdown Transformers

Type No	VOLTS	SECONDARY AMPS	Details
PT 5578	115	0 35	For shavers radios tape recorders heating blankets TV receivers appliances and instruments 2 Pin socket
PT 2164	115	0 87	
PT 2166	115	2 17	
PT 2168	115	4 35	
PT 2170	115	8 7	
PT 9585	240	1	For T V servicing electronic workshops etc 3 Pin socket
PT 9789	240	2	

Constant Voltage

Isolated constant RMS Voltage output

Type No	INPUT	OUTPUT
CV 9024	190-260 RMS	240V-1A
CV 9027	190-260 RMS	240V-4 17A

QUEENSLAND
Cnr Vernon Terrace & [illegible] St Newstead Qld 4006 [illegible]
Telex 4 [illegible]

WESTERN AUSTRALIA
611 Hay St Jolimont W.A. 6014 Ph (09) [illegible]

TASMANIA
Launceston GHE Electronics
76 York St Launceston Tasmania 7250 Ph [illegible]

Hobart GHE Electronics
162 Argyle St Hobart Tasmania 7000 Ph [illegible]

Audio

Type No.	PRIMARY IMPEDANCE	POWER	Details
45012	70 100V Line 4 8 16 ohm	4 WATTS	Line to speaker impedance
45035	600 ohm	0dbm	PCB Mounting Telecom approved
45065	600 ohm		
LT 347	600 ohm 600 ohm	20 dbm	Line isolation to Telecom 1053 1054

Control Circuit

For switchboards PRIMARY 240V 50 HZ Insulation to AS 3126

Type No.	IMPEDANCE	SECONDARY POWER	Details
PT 9169	32 24	1 88	SEC approved
PT 9170	32 24	3 12	
PT 9171	32 24	6 25	

Soldering Iron

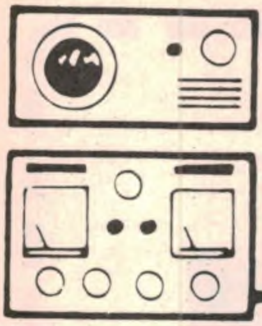
For low voltage soldering irons or similar applications PRIMARY 240V 50 HZ

Type No.	VOLTS	SECONDARY AMPS	Details
60158	3 3	30 Int	SEC approved

Bell and Chime Transformer

PRIMARY 240V, 50 HZ.

Type No.	VOLTS	SECONDARY AMPS	Details
60999	Choice of 5 8 12 and 16 Volts		Specially designed to power door bells and chimes Double insulated and short circuit protected



The Serviceman

Reader contributions month

It's catch-up time again this month. I have had so many reader contributions that are worth passing on that I will have to devote this month's notes to presenting them. They cover a range of subjects and will probably provide a refreshing change from the purely professional approach.

The first story comes from a regular contributor, J.E. of Bullcreek, Western Australia. It concerns a problem with a homemade "EA" amplifier. Here's how he tells it.

A problem which could trouble experimenters of a few years ago, who built equipment to their own designs, was that of RF instability which evidenced itself in the form of a plopping sound — often referred to as motorboating — and other unpleasant noises.

Today's hobbyists can build a wide range of electronic projects from magazines such as "Electronics Australia", using printed circuit boards, with an almost certain guarantee that they will work first time, because the bugs have already been eliminated by experts. I was therefore surprised when presented with an "EA" Playmaster Twin Stereo Amplifier (May — June 1979) with signs of RF instability.

It had been built in a metal cabinet smaller than that specified, with the result that the mains transformer had been mounted externally. The six power transistors were mounted on a "Z" shaped aluminium heatsink bolted to the rear of the metal chassis.

One advantage of this arrangement was that the bottom of the cabinet could be easily removed for access to the wiring side of the board. Apart from this the layout was identical with the original, although more compact. All components were new and the soldering was first class.

The audible symptoms, which seemed to be stronger on the right channel, were plopping noises and some background hum, both of which can be caused by a faulty main power supply filter. I bridged the 2500μF filter capacitor with another, but the fault remained.

Next I disconnected the main amplifier from the preamplifier by unsoldering the shielded leads to the base capacitors of Q6 and Q106 respectively. This did not make any difference, so the fault had to be associated with one or both of the main amplifiers (Q6 to Q9 and Q106 to Q109).

I then disconnected all DC power supply to the right main amplifier by removing the two links feeding the emitter of Q7 and the collector of Q8, and also lifted one end of the 100kΩ decoupling resistor feeding Q6 and the 1kΩ resistor feeding the base of Q7. The left amplifier then worked perfectly.

To confirm that the fault was, as I now suspected, in the right main amplifier, I restored the DC supply to it and disconnected the DC from the left amplifier. The fault immediately reappeared.

Instability

Tackling the right amplifier, I bypassed each capacitor with another of the same value in case one of them was open circuit. This had no effect, so I decided to see what clues I could find using my DVM and a simple demodulator probe which can provide comparative RF voltage measurements.

This indicated RF at a number of points. The readings tended to be erratic, but were highest on the leads of the driver transistor, Q7, a BD140. The frequency must have been very high because even the aluminium heatsink, which was firmly bolted to the metal chassis in several places, gave indications varying from 0.5V at one end to 2V at the other.

My first reaction was that Q7 was a

"rogue" transistor with an unusually high h_{fe} and F_t, so I replaced it with another of a different make, but without any improvement.

One of the standard cures for this problem is to fit a "stopper" resistor, such as is used in the base lead of Q3. I cut the copper foil to the base of Q7 at a point next to the transistor and bridged it with a 220Ω resistor which I thought should be more than enough for a power transistor. This had no effect and was removed and the foil repaired.

At this stage I was rapidly running out of ideas, but was still prepared to back the indications of the DVM that Q7 was the source of the RF oscillation. Most puzzling was the fact that the left amplifier, with almost identical layout, showed no signs of instability.

Almost as a last resort I decided to try to reduce the gain of Q7 by inserting a 4.7Ω in its emitter circuit in place of the link between it and the 40V DC supply. Then — oh joy — it worked perfectly. Smaller values were tried until, with 1Ω the fault returned.

To provide a margin of safety I decided to revert to the 4.7Ω resistor and, after cutting its leads to make the connections as short as possible, used it to replace the link between the emitter and the DC supply. Alas, the fault returned.

What now?

The only change, apart from the fact that the resistor was now on the other side of the board, was that the leads had been cut off almost next to the body of the resistor. Then I remembered that the RF readings on the heatsink suggested that the frequency must have been very high. If this was so then a straight piece of wire would have significant reactance. Perhaps the reactance of the leads was more significant than the resistance of the resistor.

To test this theory I took about 7cm of single strand wire, wound it into a coil on a 6mm former, and used it as the link between the emitter of Q7 and the supply rail. The amplifier then worked perfectly on both channels and all signs of RF instability, including those indicated by the DVM, disappeared.

I can only assume that the frequency of the RF instability was unusually high and that this small coil in the emitter circuit provided sufficient negative feedback at this frequency to prevent instability. A larger resistor may also have been effective.

I would like to have tried interchanging the two BD140s to see if it would shift the fault to the other channel, but there is a limit to the time one can afford to spend investigating unusual faults like this one, intriguing though they may be.

Thank you J.E. for a most interesting story. Like yourself, I would be most interested to know exactly why this fault occurred but, on the other hand, I have to agree that there is a very definite limit to the time one can spend investigating such things.

I did discuss it with a certain member of the "EA" staff, who is known as the "fountain head" (from which all knowledge flows!) but, at this distance, he could offer no suggestions which would solve the mystery. The best we can hope for is that someone who reads this, and may have encountered a similar situation, may be able to add something to the story.

A rash diagnosis

My next story comes from Mr K.H. of Bundaberg, Queensland.

I am a retired radio and TV serviceman from Victoria, now residing near Bundaberg, Queensland. I began working with Radio Corporation in Melbourne in 1945. I was trained and worked in the industry until just prior to colour TV. In all this time, I have been a regular reader of your articles and the magazine, and feel now that, as I have the time, I will try to give back a little for all the information, laughs, and pleasure I have received over those years.

I am enclosing a story that I think would be interesting to your many readers. I have also included a photograph of the offending part and a copy of the relevant section of the circuit diagram (not published). The story tells how the thought of a picture tube failure can shut off one's mind from observing other fault indications. Making such rash decisions was the very thing I used to tell my customers to be careful of.

When I was young, I read a report in "Radio, TV & Hobbies" that Sony had taken out patent rights for a single gun, three cathode colour picture tube, with vertical stripe phosphor colour bands. The reduction in EHT to excite the Trinitron colour tube intrigued me. So, when I purchased my first colour set, it was a Sony. It served us well until someone tripped over it in the dark one night and it landed flat on its face. That seemed to cause the picture to slowly get worse from then on, but I kept it going by increasing the preset colour controls when required.

In the meantime I retired and we moved to Queensland. So, it was here in Bundaberg that a second opinion was obtained on the cause of the poor picture. As I expected, it confirmed my suspicion of low emission.

During the following months, the set slowly blacked out completely and the cost of replacing the tube was considered. We discovered that a rebuilt tube was not available and a new tube

Make it with Kitronics, the low cost quality alternative

LOOK

FREE POSTAGE

LAB POWER SUPPLY
2 - 50V @ 5A (175W max)
EA May/June 83 kit $140
± 12V option - only $10
10 turn voltage control option ... $10

FUNCTION GENERATOR
Sine, triangle, square wave
4 Digit display
EA April 82 kit $85

LCR BRIDGE
10^{10}Measuring range
Digital precision pot readout
EA April 84 kit .... P.O.A.

TRANSISTOR ASSISTED IGNITON
Now includes all parts to make either the February or December 83 version.
Predrilled heatsink & lid
EA Feb/Dec 83 kit $35

VCR SOUND PROCESSOR
Pseudo Stereo from your mono VCR
5 band graphic equaliser
EA April 84 kit $57

WOBBULATOR & SOUND LEVEL SENSOR
Checkout hifi system response
Enables graphic equaliser setup
E.A. March 84 kit $62

KITRONICS

Mail Order: P.O. Box 126,
Epping, Vic. 3076.
Bankcard phone orders:
BH: (03) 439 3591 or
AH: (03) 435 0865.
Min. Bankcard order $5

cost more than the value we had for the old set. So a decision was made; a new colour set. The old set became valueless except for the bits and was placed out of sight while I dried the tears from my cheeks.

We have two daughters still living with us and, here in Bundaberg, we have two TV channels. Yes, they want to watch one program and my wife and I the other. At the,time, a black and white TV set was performing well for the girls, then Murphy arrived and the black and white set's power transformer primary shorted and I discovered that it was not worth repairing.

I brought out the Sony colour set and found, to my surprise, that it worked. It was not a wonderful picture but it did work and it made the kids happy again. Then a month or two went by and it gradually passed out again, causing the usual program hassles over one TV set.

One day recently, one of the children remarked that she had had the old set on, listening to the sound, and when it was turned off, the three basic colours appeared briefly. I took note and filed the information for future treatment. Could there be another fault? I considered it worth a further look and on checking I found that as the voltages collapsed, decreasing bands of red, green and blue appeared on the screen.

Off came the back and a "what have I got to lose" knock was scientifically applied to the picture tube neck. Guy Fawkes appeared in the gun and the power supply shut down. "That's it", I thought. "I won't have to worry about that TV set again", and turned it off. But I have had experience with these power supplies before, so I waited a minute and tried it again. There it was — a picture in full colour.

Meal time was on me, so I left the set running and when I returned, there was sound but no picture. Could I perform the miracle again? I had no luck this time. I always kept in the back of my mind the possibility of grounding the tube filaments and arcing the EHT over the base pins, as I used to do on the old black and white tubes, but I saved this for a last ditch attempt.

On the other hand, I was now mad enough to hit everything or anything. By tapping with almost destructive blows to the underside of the video amplifier colour board, I produced a part picture for a flash. I was on the track of something. A little more judicious bashing and I was at transistor Q454 (2SC633A).

It was time to take a look at the circuit diagram that I had procured from the manufacturer years earlier. Yes, if Q454 was leaky or shorted it could, without doubt, alter the critical gun supply voltages and cut off the tube. The transistor was removed and replaced. Good Lord, that was the fault. The picture appeared in all it's glory, better than it had been for years.

I studied the now removed transistor with my jeweller's eye glass, to check the transistor number. I noticed on the underside what looked like small dots of moisture, probably due to our humid climate. And on more careful study, I could see a gold tinge on the plastic case between the supposedly once gold plated leads. What I was looking at was very typical of a fault, well known to me, that used to be found on the base of a certain brand of 9-pin valves, it was caused by silver being deposited on the glass between the pins. Many old technicians will remember the havoc that this short between the pins caused. Well here I was, seeing the same fault in a new guise with solid state devices.

The faulty transistor (Q454). Note the metal deposition on the body of the transistor adjacent to the three leads.

I an enclosing some colour photographs which I took through my jeweller's eye glass. I hope they may reproduce well enough in black and white to allow the gold plating to be seen. I also hope that my discovery of this fault may help unravel other unsolved faults, particularly in humid climates. (P.S. The picture tube really is low in emission, but is still working fine.)

Thank you K.H for a most interesting story. As you commented yourself, it is all too easy to be sidetracked by the proven existance of one fault, and blame all the symptoms on that. I think there is a lesson there for us all.

As for the fault itself, I must confess that this suggestion is completely new to me, although I well remember the problem with the 9-pin valves. In fact, I'm sure that I ran such a story in these notes many years ago, though it would probably be too hard to find now. As K.H suggests, it was a very serious problem at the time.

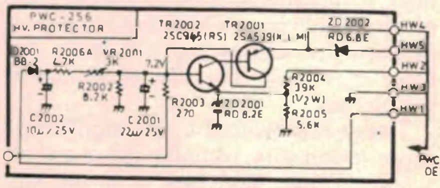
If this really is a new version of the old fault it may well explain some of the mysterious partial failures or loss of performance which most of us have encountered from time to time, in both transistors and ICs, and which seemed to run contrary to the generally accepted idea that solid state devices either work properly or not at all. Perhaps someone else has had a similar experience.

Rank protection circuit

My next contribution concerns a story I told back in September 1983 (goodness, how the time flies!). This concerned a Rank 2603 and, particularly, a high voltage protector circuit which this model employs. In those notes I happened to mention that I had little information about this circuit and would like to catch up on it.

The response to this casual remark was quite surprising and most gratifying. One gentleman, from Queensland was even kind enough to forward a complete 2603 service manual to the "EA" editorial office, who passed it on to me. My sincere thanks to him.

Another contribution came from Mr I.W., a professional serviceman from Bateau Bay, NSW, who gave his explanation of how the circuit functions. Having translated the slightly fractured English in the Rank manual and studied I.W.'s explanation — which was particularly well presented — here is a composite of the two. The circuit is from the Rank manual.



The circuit is designed to sense any excessive voltage at HW1, which is a pulse derived from pin 2 on the line output transformer, T552. In normal operation the emitter/base junction of TR2002 is reversed biased by about 1V by the zener diode ZD2001 and associated resistor network.

Under normal conditions the EHT is about 27kV. If for any reason it should rise to 33kV, or higher, the pulse at HW1 will rise to the point where the rectifier/ filter network, D2001/C2002, will produce a high enough voltage on the base of TR2002 to turn it on. This turns on TR2001.

Because of the positive feedback from the collector of TR2001 to the base of TR2002, both transistors bottom very rapidly. This introduces a virtual short circuit between HW4, connected to the 120V rail via R551, 3.3kΩ, and the cathode of zener diode ZD2001. Under these conditions HW4 drops to about 9V and, because of the 6.8V generated by ZD2002, HW5 drops to between two and three volts.

HW5 is connected to the horizontal oscillator (TR501) supply rail, normally at 13.5V. When it drops the horizontal oscillator ceases to function, output from the horizontal output transistor (TR503) falls and, with it, all voltages derived from this stage. The receiver is thus rendered inoperative.

Because of the feedback between TR2001 and TR2002, the system will remain locked in this condition until the receiver is switched off, and for about 10 seconds thereafter, until the positive voltage on the base of TR2002 falls due to leakage. Assuming that the fault is cleared before switching on again, the set will function normally.

According to I.W., a likely cause of excessive EHT is the failure (open circuit) of C553, from the collector of TR503 to deck. In these circumstances the EHT can rise high enough to punch through the neck of picture tube between the anode and the yoke. This is a similar condition to that occurring in other brands of receivers, and which has been described in these notes previously (Philips K9, July 1983).

A better heat source

And, finally, from G.H., a serviceman in Hyghett, Victoria, comes this brief comment: I read your column in this latest (December 1983) issue of "EA". I was quite surprised at the method used to heat sections of the K9 chassis to locate the fault. We have always used a cheap pistol grip hair dryer which I carry in my tool kit. This is a very easy way to cope with such a job. Then use a can of freeze and the job can be completed in a very short time. It may even avoid carting the set to the workshop.

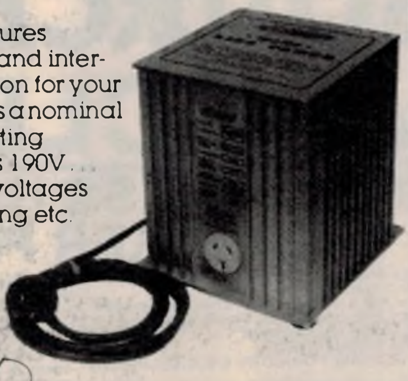
Keep up the column; I do appreciate being able to get a line on some very odd faults.

Thank you for the comments G.H., and I am glad to learn that you enjoy the notes, and may even find them useful on occasions. As for the method of heating the K9 — well, that's fair comment too. I am not averse to using a hair dryer on occasions — in fact I have been known to pinch Mrs Serviceman's unit when my own was out of commission or not readily available.

In this particular case, a hair dryer may well have been a better approach but the blanket just happened to be handy. Later, a radiator proved better than the hair dryer because it left both hands free to take measurements.

PROBLEMS WITH YOUR POWER SUPPLY?

A Line Tamer ensures constant voltage and interference suppression for your computer . . . gives a nominal 240V from fluctuating supplies as low as 190V . . . eliminates spike voltages caused by lightning etc.



YOU NEED A LINE TAMER®

There's a Line Tamer to suit your installation. Send for data.

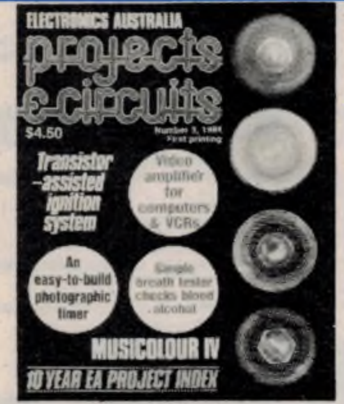
Ferguson Transformers Pty. Ltd.
331 High Street, CHATSWOOD 2067 Tel: (02) 407 0261
Telex: AA25728. Melbourne (03) 328 2843

· Registered Trade Mark of Ferguson Transformers Pty Ltd

FERGUSON

projects & circuits

Number 3



THE CONTENTS:

Audio, Video Projects
Video Amplifier for Computers and VCRs; Video Enhancer; Vocal Canceller; Stereo Simulator for Tuners and VCRs; Guitar Booster for Stereo Amplifiers.

Automotive Projects
Transistor-Assisted Ignition System; Breath Tester Checks Blood Alcohol Level; Low Fuel Warning Indicator; Speed Sentry for Cars; Audible Turn Signal Indicator.

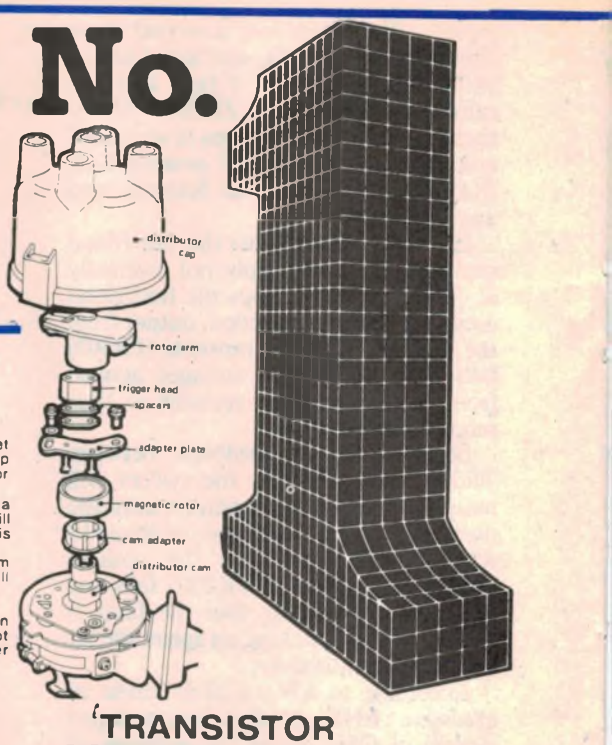
Mains Power Control Projects
Musicolour; Photographic Timer; Driveway Sentry; Touch-Lamp Dimmer.

Power Supplies & Test Equipment
Battery Saver for Personal Portables; Dual Tracking ±22V Power Supply; 3½-Digit LCD Capacitance Meter; In-Circuit Transistor Tester.

Miscellaneous
Nail Finder; Portable 3½-Digit Heart Rate Monitor. 10 Year EA Project Index.

Available from: Electronics Australia, 57 Regent Street, Chippendale, Sydney 2008. **PRICE $4.50,** OR by Mail Order: Send Money Order or Cheque to Electronics Australia, PO Box 163, Chippendale, NSW 2008. **PRICE $5.40.**

JAYCAR-YOUR No. 1 SOURCE FOR VEHICLE KITS



CONTACTLESS HALL-EFFECT "BREAKER POINTS"

A professionally engineered electronic ("breakerless") contact breaker system.
Yes, only Jaycar has a complete Hall-Effect triggerhead assembly designed to adapt to an extensive number of cars. Each kit contains the following:

- HALL EFFECT TRIGGERHEAD
- MAGNETIC ROTORS FOR BOTH 4 & 6 CYLINDER CARS
- OVER 6 CAM-LOBE ADAPTORS
- OVER 12 DIFFERENT ADAPTOR PLATES FOR YOUR PARTICULAR DISTRIBUTOR
- OTHER HARDWARE (i.e. SCREWS etc)
- YOU CAN REMOVE THIS SYSTEM AND RE-EQUIP YOUR CAR WITH THE ORIGINAL BREAKER POINTS WHEN YOU SELL THE CAR!
- AS EASY TO INSTALL AS A SET OF POINTS
- INSTRUCTIONS (SIMPLE-TO-FOLLOW) INCLUDED

This set is designed to fit most European and Japanese cars. In fact it will also fit many Australian cars fitted with Lucas, Bosch, Motorcraft, AC Delco or Autolite electrics. If you wish to check first, please send SAE for car/distributor list.

SEE EA DECEMBER 1983

Because we have no way of knowing, you get the fitting set for ALL of the distributors available. Basically you end up with a jar full of parts you don't need to use! (Perhaps for your next car?)
Quite frankly, we are amazed that we can supply such a comprehensive kit for this price. To produce a kit that will adapt to the dozens of different distributors around is amazing!
Remember, once you have installed a breakerless system it will never wear out and that part of your system will remain in tune FOREVER
Cat. KJ-6655
PLEASE NOTE: This system must be used in conjunction with an electronic ignition. The Hall-Effect device will not switch enough current to replace the contact breaker points on their own!

$29.95

TRANSISTOR ASSISTED IGNITION

REF: EA JANUARY 1983

$35

Latest version of this fantastically popular kit! The Jaycar kit comes COMPLETE down to the plastic TO-3 transistor covers, genuine heatsink and DIECAST BOX - as used in the original EA unit.
Beware of flimsy kits that use sheetmetal boxes.

This kit is designed to be used with contact breaker points. If you want Hall-Effect breakerless option may we suggest the KA-1505 version of this kit shown elsewhere on the page.
Cat. KA-1506

'TRANSISTOR ASSISTED IGNITION HALL-EFFECT "BREAKERLESS" VERSION

REF: EA DECEMBER 1983

$36.95

This kit is virtually identical to the KA-1506 except that it contains the interface electronics for the KJ-6655 Hall-Effect triggerhead.
Cat. KA-1505

NEW!! - DELUXE CAR BURGLAR ALARM

(Ref: EA May 1983) Great new design from EA. Ths one is very sophisticated. (Auxillary battery extra) Complete kit of parts.
Cat. KA-1550 **$69.50**

NEW - MOTORCYCLE INTERCOM (Ref: EA March 1984)

Now you can talk freely and safely to your pillion passenger with this handy kit!
Cat. KA-1533 **$39.95**

NEW - IGNITION KILLER

(Ref: EA March 1984) Handy little project fits under your car to foil thieves. At this price can you afford not to have one?
Cat. KA-1535 **$14.95**

THE RED FLASHER - (not illustrated)

A de-luxe Swiss switch with electronics to make it flash plus deterrent stickers to make your car look as if it has an expensive alarm.
Cat. KJ-7000 **$20.95**

NEW!!

"SPARKRITE" LOW COST CAR ALARM KIT

This low cost alarm is ideal for the budget conscious motorist. It has many features:

- ★ 10 amp output relay
- ★ Optional door, bonnet switch input
- ★ Accessory loop
- ★ Horn relay and headlamp output
- ★ Optional entry delay i.e. external disarm switch can be fitted obviating need for entry delay
- ★ Exit delay
- ★ Auto alarm disable. (To meet local noise/enviromental rules)

Staggering value - fully imported from the U.K.

ONLY $39.95

Cat. KJ-6662

ETI340 CAR ALARM

Ref: ETI April 1984

A versatile security system that provides full protection for almost any vehicle. This unit will protect your valuable vehicle from virtually any sort of interference - from hub-cap stealing to being towed away! It does not rely on voltage or current sensing to trip the alarm, but 'resonance microphones'. It can also protect 'perimeter accessories' like driving lights and racks. The project meets the major requirements of car alarms set down by the NRMA. We believe that this alarm is one of the most comprehensive that we have seen. Once again Jaycar has taken the no compromise approach.
The Jaycar kit includes two of the specified resonance microphones, original die-cast box etc (we supply "chocolate block" multiway connectors as well).
The complete kit is only $69.50 inc. sensors.
Extra sensors are available for $10 each Cat. AM-4000

$69.50

Sparkrite SX2000

A Reactive Discharge System
combines all features of the SX500 plus

- Reactive Discharge electronics combining all the advantages of both Inductive and Capacitive Discharge for maximum spark performance
- Gives the most thorough combustion of air/fuel ratios especially current lean mixture emission controlled engines
- Voted 'Accessory of the Year' and the best as tested by Popular Motoring Magazine
- Patented clip-to-coil fitting
- Systems Function Light as well as Static Timing Light
- The ultimate brand leading contact-breaker triggered system

$59

Cat. KJ-6650

Sparkrite TX2002

A Reactive Discharge System — with unique auxiliary circuit. Combines all features of the TX1002 plus

- Reactive Discharge electronics combining all the advantages of Inductive and Capacitive Discharge for maximum spark performance
- Gives the most thorough combustion of air/fuel ratios especially current lean mixture emission controlled engines
- Unique 3-way change over switch incorporating an auxiliary back up circuit. ELECTRONIC/OFF/AUXILIARY
- Robust die-cast case, fully resistant to moisture and heat
- The ultimate system - REACTIVE DISCHARGE - CONTACTLESS OR CONTACT TRIGGERED - AUXILLIARY BACK UP CIRCUIT - CLIP-TO-COIL FITTING - FOUR CONNECTIONS ONLY - ALL PARTS IN ONE BOX TO FIT OVER 500 APPLICATIONS

TX APPLICATIONS
No separate fixing kit required all parts in one box to fit more than 500 vehicles

$115

Sparkrite AT-80

$99

Cat. KJ-6660

HOW IT WORKS

An advanced feature of the Sparkrite AT-80 is the 'unique' arming facility. You do not have to drill the exterior body panels to fit the usual 'limited key number' switch. The AT-80 is armed with a special magnetic key fob which enables you to programme your personal security code through the windscreen to a special sensor pad attached to the inside of the screen. Your security code can be changed at any time by simply flicking a switch on the control module and re-programming your new code. A code acceptance light flashes in the windscreen sensor pad as the code is entered.

- Guards doors, boot, bonnet PLUS radio/tape and auxiliary fog/spot lamps. Also inhibits ignition.
- Flashes headlamps and intermittently sounds horn for both visual and audible alarm.
- Unique programmable personal code entry system to arm and disarm.

Sparkrite TX1002

$79

An Inductive Discharge System

- Can be operated utilising 'Hall Effect' triggerhead, or existing contact breakers
- Extended dwell inductive Discharge for maximum spark efficiency
- Three position switch
- Static Timing Light
- Systems Function Light
- Patented clip-to-coil fitting
- Robust die-cast case
- Fully waterproof
- Protected from the hostile environment of the engine compartment

TX-1002. Slightly lower powered version of the TX-2002, ideal for most 4 cylinder cars. All fitting pieces included!
Cat. KJ-6651

Cat. KJ-6651

VCR SOUND PROCESSOR KIT

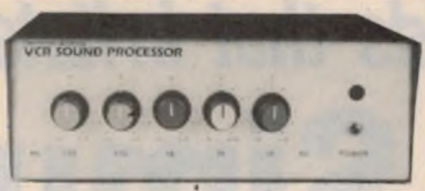
(Ref: EA April 1984)

Great new kit for Video Enthusiasts! ● Stereo Simulator ● 5 Band Graphic Equalisation ● Noise Filtering
The Jaycar kit once again is truly original - down to the genuine multicoloured knobs on the front panel (watch for substitutes). The only extra that you will need to buy is the optional whistle filter (Cat. EE-3814 $19.95)

Cat. KA-1545

$55

NEW!!



NOT NEW!! - EA DIGITAL CAPACITANCE METER

(Ref: EA September 1980) Ideal for a bench type mains powered application. Measures from 1pF to 99.99uF in only 3 ranges! Large easy to read LED display.

Cat. KA-1105

$59.90

DUAL TRACKING ±22V POWER SUPPLY

- Dual polarity can provide up to ±22V at up to 2 amps. Also has fixed output of +5V at 0.9A. Complete kit

Cat. KA-1410 **$89.50**

(Ref: EA March 1982)

MUSICOLOR IV

Sound to light effect with 4 channel chaser. There are 4 different chaser patterns plus a host of other features. Complete kit

Cat. KA-1010 **$89.90**

ASK FOR A NEW CATALOGUE!!

Mail Order customers, if you have not seen our new catalogue, boy are you missing out! If, (or when) you next buy from us by mail order just ask for a catalogue. It will be sent FREE with your order!If you have one and want one for a friend, that's fine too! Just ask!

SAVE UP TO $105 UNBELIEVABLE 'PHILIPS' SPEAKER BARGAIN

We have made a massive scoop purchase of genuine quality **Philips** European made Hi Fi speakers. They are so good they are used in the fabulous ETI 4000 series Hi Fi.
If you thought the 4000/1 or 4000/2 systems were out of reach of your pocket - THINK AGAIN!

WOOFER AD12250/W8
NORMALLY $99.50 SAVE $30.00
THIS MONTH $69.50
LOW MID AD70620/M8
NORMALLY $32.50 SAVE $5.00
THIS MONTH $27.50
HIGH MID AD02161/SQ8
NORMALLY $44.95 SAVE $5.00
THIS MONTH $44.95
TWEETER AD0160/T8
NORMALLY $19.95 SAVE $4.00
THIS MONTH $15.95

$201.90 value for $157.90 SAVE $44

EVEN CHEAPER for a stereo set i,e. 2 each of the above $315.80

SPECIAL 8 PIECE SET PRICE $299!!

Normal price for 8 speaker set $399!!

Crossovers 2 x 4 (ETI4000/1) $200 Cat. CX-2637
2 x 3 (ETI4000/2) $129.50 Cat. CX-2627

12/230V - 300W INVERTER

300VA of power at 235V from an ordinary 12V car battery
Superb Jaycar kit is complete

Cat. KA-1114 **$195.00**

(Ref: EA June 1982)

IONISER KITS

COMPLETE KIT

- High efficiency emitter head - Fits completely inside a high quality ABS box (NOT a metal lid) - Only 2-core mains flex protrudes from the box - You can pay over $80 for a built-up inferior unit!

Cat. KJ-6511

NORMALLY $45
THIS MONTH ONLY
$29
SAVE $16

SHORTFORM KIT

- runs directly from 240V mains
- low power consumption
- produces high intensity electric field
- output around 7.5kV
- will not necessarily produce ozone in standard form
- ideal for those who wish to 'try' an ioniser at an economical price

Cat. KJ-6510

NORMALLY $24.50
$15.00

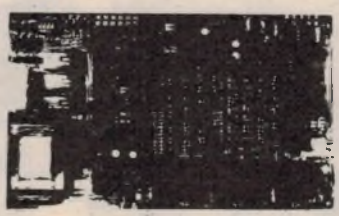
ETI644A

(See ETI Jan '83!!

DIRECT CONNECT MODEM

Ref. ETI October 1982

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



NEW MODEL

SHORTFORM KIT
Cat. KE-4600
ONLY $169

COMPLETE KIT
Cat. KE-4601
ONLY $199

Jaycar Incorporating **ELECTRONIC AGENCIES**

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

NUMBER 1 FOR KITS

POST AND PACKING CHARGES
$5 — $9.99 ($1.50) $10 - $24.99 ($3.20)
$25 — $49.99 ($4.50) $50 - $99.99 ($6.50)
$100 — $198 ($8.00) Over $199 ($10)
"Free INSURANCE for Road & Registered Post over $200"
All heavy or bulky items (over 20kg.) sent Comet Road Freight $12.00 anywhere in Australia.
SHOP HOURS CARLINGFORD, CONCORD & HURSTVILLE
Mon — Fri 9am — 5.30pm: Sat — 9am — 12pm. Thurs night 8.30pm (Not Concord)
SHOP HOURS SYDNEY
Mon — Fri 8.30am — 5.30pm. Sat — 8.30am — 12pm. Thurs night 8.30pm
MAIL ORDERS AND CORRESPONDENCE P.O. Box 185, Concord, 2137

Mail Order By BANKCARD Via Your Phone

Mask the sounds that irritate

by COLIN DAWSON

Noise Simulator

Sick of being woken by noisy neighbours or traffic? Fed up with barking dogs? The EA Noise Simulator provides a soothing noise, like rain on the roof or waves on the beach, to mask the sounds that irritate.

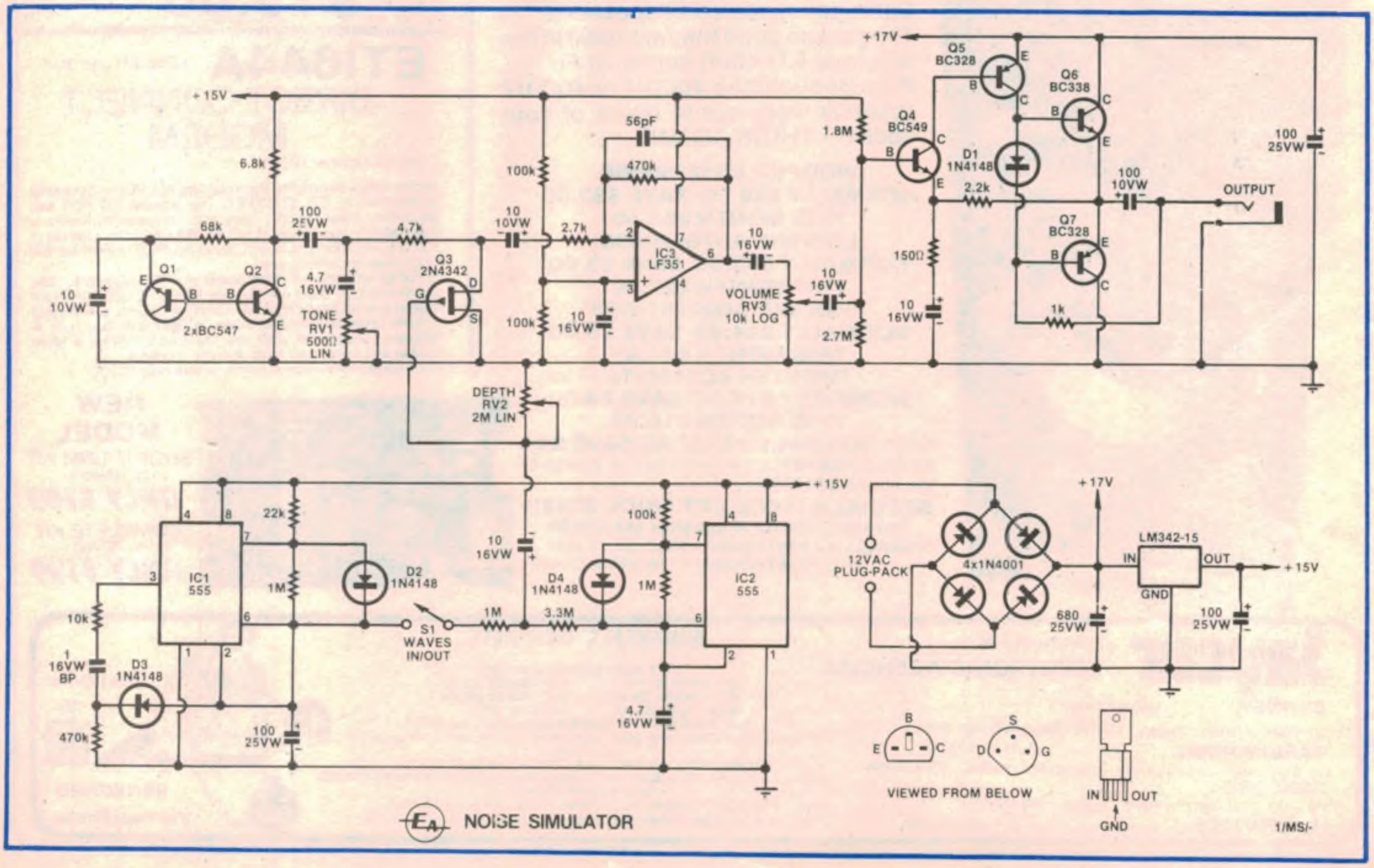
As many flat dwellers will know, modern high density residentials tend to have poor sound proofing. Between the numerous TV sets, stereo systems, tomcats, and noisy vehicles in the vicinity, the devotee of serenity can be driven to the point of distraction. Of course, some people have a high level of tolerance for noise pollution but, for those unfortunates who resort to stuffing their ears with cotton wool at 2am so that they can get some peace, the Noise Simulator may be a more pleasant solution.

The problem of getting a good "night's" sleep is more acute for shift workers who may in fact be trying to sleep during the day. And tinnitus sufferers, no matter when they are trying to sleep, have to put up with continual ringing in their ears. Both groups of people could benefit from a Noise Simulator.

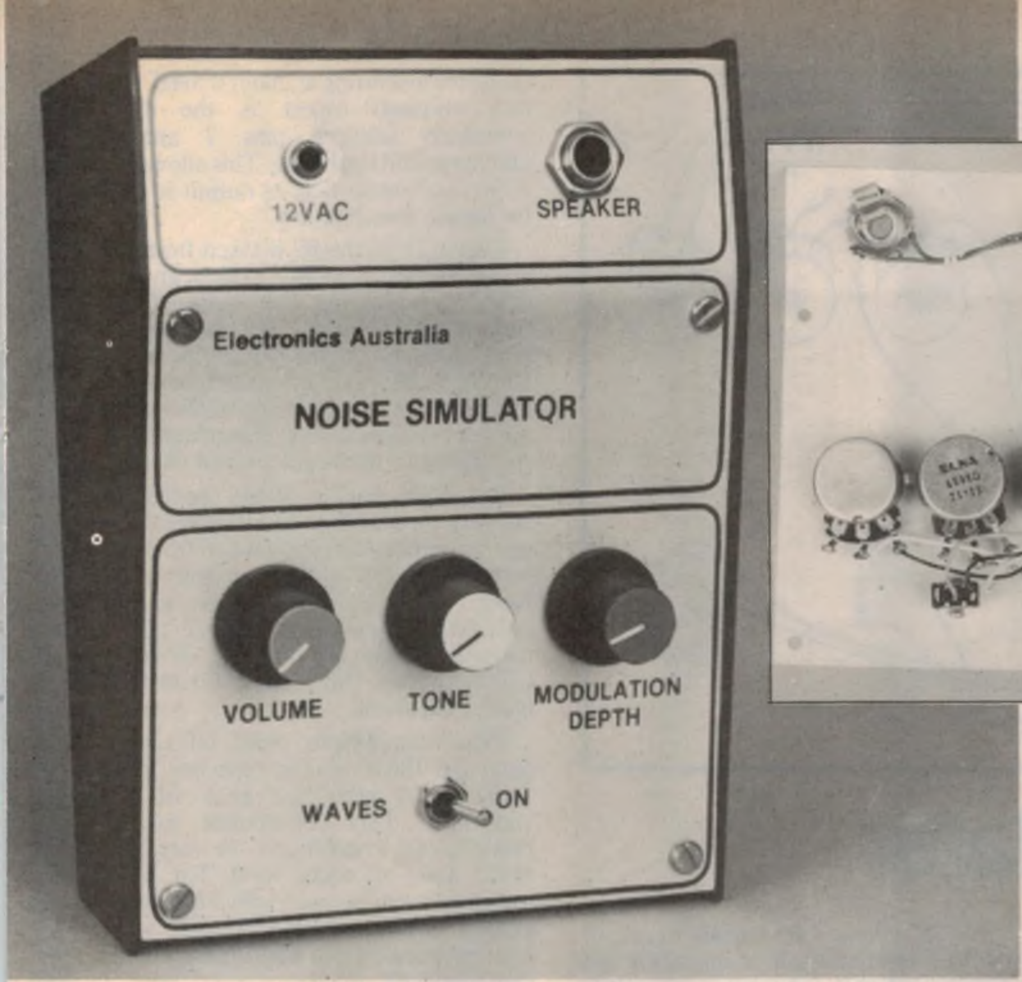
There are, of course, other ways to mask irritating sounds. An air conditioner provides a useful pseudo white noise source but is certainly not viable in this capacity alone. Similarly, a TV set tuned between stations may help but who could justify its all night operation. A radio tuned between stations can be quite acceptable — provided it has a tone control and can be powered from the mains. It should preferably have a large speaker (15cm or more). If your radio doesn't quite fit the bill, or is not portable, then a Noise Simulator may be a better solution.

There is another aspect of the Noise Simulator's operation which diverges slightly from the original concept. The noise can be modulated. In fact the design incorporates two modulation circuits which can provide a number of familiar sounds. The most startling is the surf simulation — sounds just like the beach with a high surf. This may be useful as a sound effect for recording or theatrical effects.

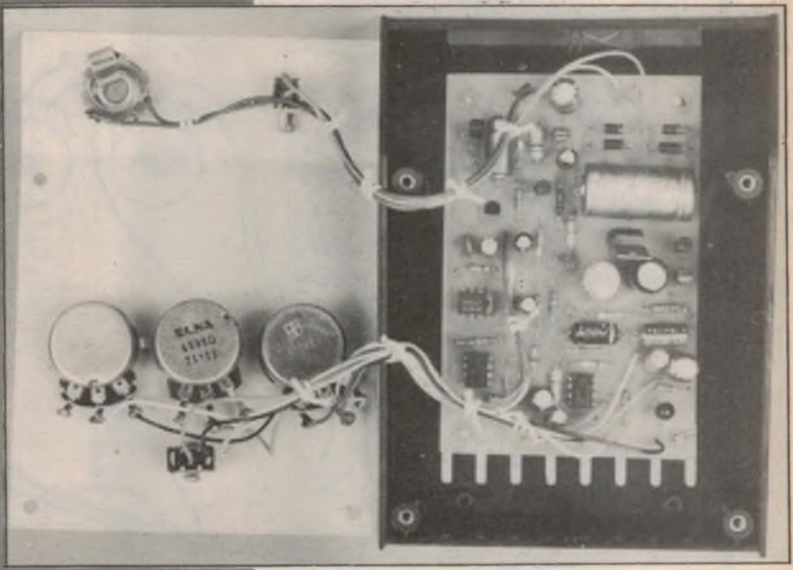
The depth of modulation can be adjusted so that the sound is more like that of a beach in the distance. Or the "waves" can be switched out to leave a simple repetitive modulation more like a rain storm.



EA NOISE SIMULATOR



Left: the finished unit and, below, interior shot showing board assembly and controls.



We estimate that the current cost of components for this project is approximately

$30

This includes sales tax but not the cost of a plugpack.

Part of the inspiration for this project came from an advertisement in an overseas magazine. We had already decided to design a modified white noise generator as a sound masker. We were undecided with respect to the surf simulation, until the advertisement. This described a device almost identical in concept, except that it had surf, rain and waterfall simulation. Besides noise masking, there was a claimed increase in "Alpha" sleep (we suppose that's an advantage — we're not too sure what "Alpha" sleep is!).

We are certain, however, that sleeping is preferable to lying in bed pondering the most satisfying form of retribution to the various noisy miscreants.

White noise

Actually, "white" noise — an equal distribution of sound energy across the audio spectrum — is not ideal for the function of noise masking. It tends to sound too urgent and irritating, like a tyre being deflated rapidly. Far more acceptable is a modified white noise, ie, with some of the high frequency content removed. The Noise Simulator has a tone control which provides an adjustable amount of treble cut. This can vary the sound from a hiss (useful for the surf simulation) to a rumble.

To mask irritating sounds, a rumble is the preferred noise. Most people will quickly become oblivious to this and hopefully the offending sounds will be relegated to "background" where they are not so troublesome.

As well as the big "breakers", we found that small fill-in waves were needed. It just doesn't sound right to have a thunderous wave arriving periodically with virtual silence in between. The circuit is designed so that the "big" waves and "little" waves can interact, producing a moderate amount of irregularity in the sound.

How it works

The most important parts of the circuit are the white noise generator and the amplifier. This accounts for about half of the components. The rest are used to derive the control necessary for the "effects" — it turns out that a convincing wave sound requires a surprising circuit complexity.

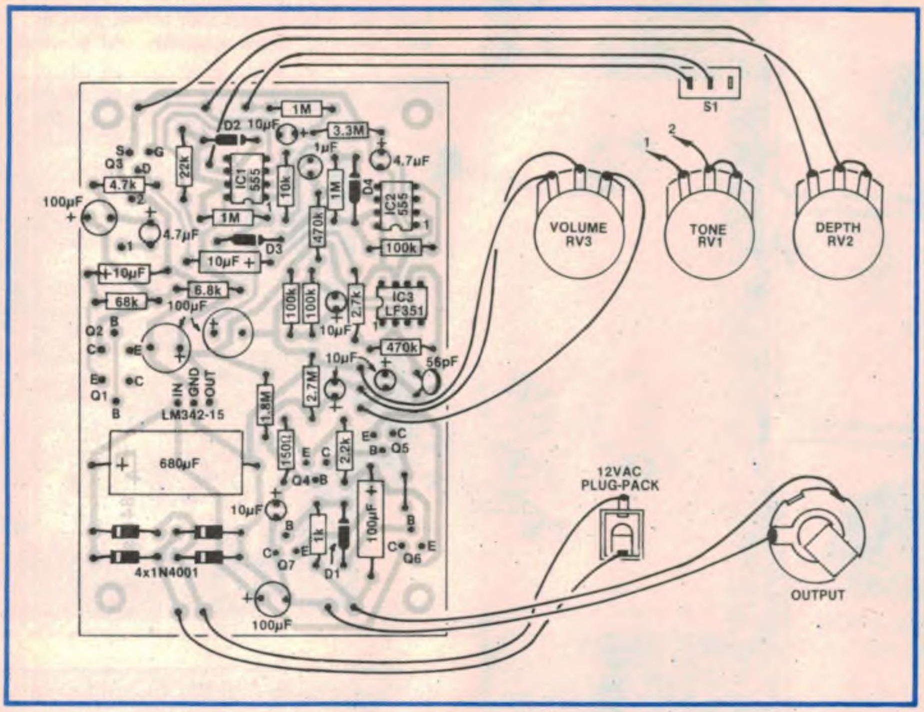
The white noise is actually generated by a reverse biased BC547 (Q1). Initially, various diodes were tried in this role but the BC547 proved more suitable for low voltage operation. Even with this device, a useful amount of white noise cannot be generated with a power supply of much less than 11V.

Given that the project may be operating for hours at a time, and the voltage limitation of the BC547, batteries are clearly out. Instead, a 12VAC plugpack is used. In fact, the output of these plugpacks will frequently be closer to 13V for this circuit, yielding 18V after rectification. Only the power amplifier section of the circuit operates directly from this "raw" supply. The rest of the circuit is powered via a 15V regulator.

Amplification of the white noise is provided by Q2, another BC547. About 600mV of signal will appear at its collector. This is fed to the tone control which consists of a 4.7μF capacitor and 500Ω potentiometer. Quite severe treble cut can be achieved with this control, providing the desired rumble.

The modified white noise is taken from the tone control and fed to the amplifier section of the circuit. The amount of noise reaching the amplifier can be affected by the modulation circuitry, but for the moment, assume that this is not working. A steady level of noise would therefore reach the inverting input (pin 2) of IC3. This is a FET input op-amp (LF351 or TL071) configured as an inverting amplifier with a gain of 37.

From IC3, the signal is fed to a 10kΩ volume control and subsequently to a four transistor power amplifier. With the tone control set for maximum treble cut, much of the sound energy has been removed from the signal. Consequently, quite high volume settings may be needed for a large room.



Noise Simulator

Only low volume settings will be needed when the tone control is set for minimum treble cut. This is particularly so if the "Waves" effect has been selected, since a certain amount of signal boost (above the normal level) will occur. This can be a problem with plugpacks limited to a few hundred milliamps output. Due to their inherently poor regulation characteristics, some plugpacks may not be able to maintain sufficient output voltage for the regulator to operate. This will introduce large amounts of hum into the signal at very high sound levels.

Q4, Q5, Q6 and Q7 form a simple direct-coupled audio amplifier. Q4 sets the output stage DC conditions and drives PNP transistor Q5. Q5, in turn, drives Q6 and Q7 which form a complementary output stage. The AC voltage gain is set to around 15 by the ratio of the 2.2kΩ and 150Ω resistors in the feedback network, while the 10µF capacitor in series with the 150Ω resistor curtails the frequency response below 100Hz.

Modulation

Let's take a look now at the modulation circuitry. The only interface between this and the generator/amplifier circuit is through the 2N4342 P-channel FET (Q3). This connects via a 4.7kΩ resistor to the tone control and, in conjunction with the "Modulation Depth" pot, provides a shunt path to ground for the signal.

No DC voltages are applied to any of the FET terminals and, in this mode, the drain/source path functions as a variable resistor, its exact value determined by the gate/source voltage. In this case, the latter is an AC voltage, from the modulation generators, and is applied to the gate via the 2MΩ Depth pot. As this voltage varies, so does the signal level from Q2 as applied to IC3.

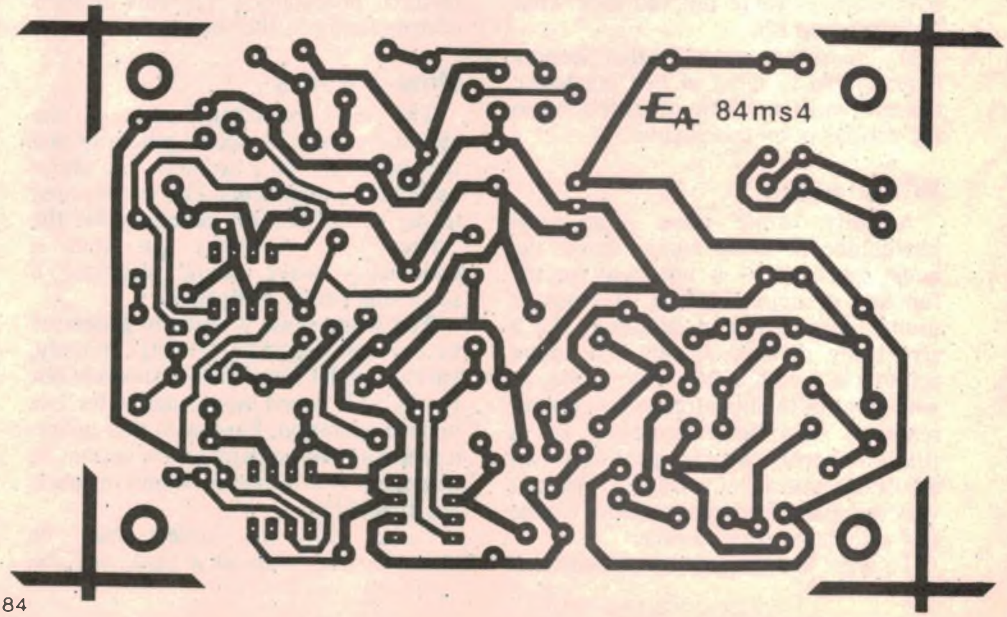
Each of the modulation circuits is based on a 555 IC operating as an oscillator with an asymmetic duty cycle. Consider the oscillator incorporating IC2 first, as this is the simpler of the two. It is basically a conventional 555 astable oscillator (operating at about 0.5Hz). The only unusual aspect is the diode connected between pins 7 and 6 (discharge and threshold). This allows the IC to oscillate so that its output is high for longer than it is low.

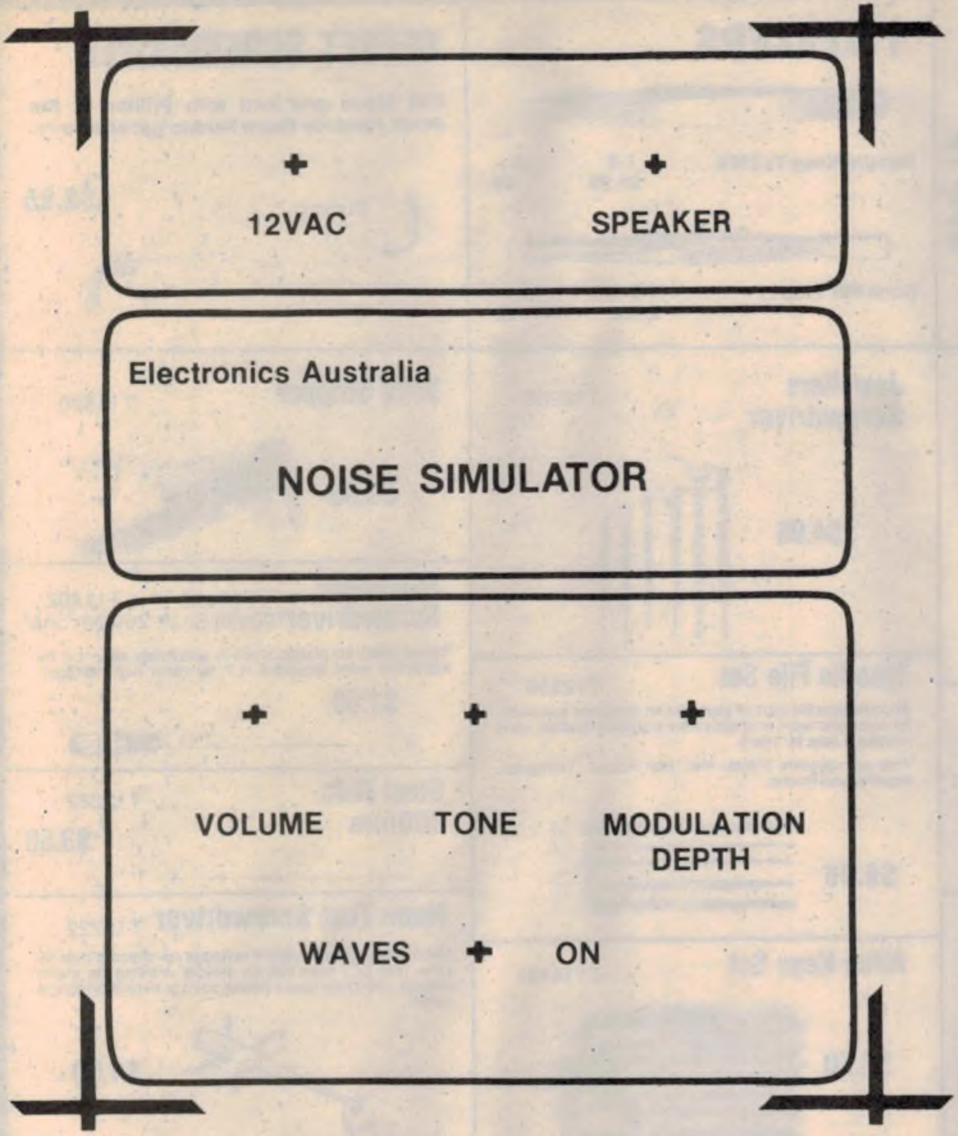
Output from the IC is taken from the 4.7µF timing capacitor which gives a sawtooth waveform. This control signal from IC2 is fed via a 3.3MΩ resistor and 10µF capacitor to the gate of the FET. Hence the FET is continually modulated to simulate a rain storm or small waves, the depth of modulation dependant upon the setting of the depth control (RV2).

IC1 also has a diode connected between its discharge and threshold pins and its output is similarly taken from the timing capacitor (100µF in this case). Notice, however, that there are several additional components around pin 3 (output). These are another diode, a 470kΩ resistor, 10kΩ resistor and 1µF bipolar capacitor.

These components bleed off charge from the 100µF timing capacitor for a brief period after the peak of the waveform. This corresponds to the crashing of a breaker and the very high initial decay of sound level. The bleed capacitor is referenced to pin 3 instead of ground so that it is effective only for a brief period after the peak of the 100µF charging cycle.

Here's how it works. Assume initially that the 100µF capacitor is charging towards 2/3 Vcc (ie, pin 3 of IC1 is high). During this time, D3 is forward biased. When the charge on the 100µF capacitor reaches 2/3 Vcc, pin 3 goes low and hence the cathode of D3 is also forced low via the 1µF bipolar capacitor. The 100µF capacitor now partially discharges via D3 and charges the 1µF capacitor. Once this has occurred, the circuit stabilises and reverts to the normal discharge mode.





PARTS LIST

1 PCB, 72 x 110mm, code 84ms4
1 plastic project box (Bimbox No. 6005 or similar)
1 6.5mm panel socket (mono)
1 6.5mm jack plug (mono)
1 3.5mm panel socket (mono)
1 3.5mm jack plug (mono)
3 knobs to suit potentiometers
1 SPST toggle switch

Semiconductors

2 BC547 NPN transistors
1 BC549 NPN transistor
1 BC338 NPN transistor
2 BC328 PNP transistors
1 2N4342 P-channel FET
1 LF351 or T1071 FET input op-amp
2 555 timer ICs
1 LM342-15 or LM340-15 regulator
4 1N4001 diodes
4 1N4148 diodes

Capacitors

1 680μF/25VW axial electrolytic
4 100μF/25VW PC electrolytics
1 100μF/10VW axial electrolytic
5 10μF/16VW PC electrolytics
2 10μF/10VW axial electrolytics
2 4.7μF/16VW PC electrolytics
1 1μF/16VW bipolar electrolytic
1 56pF ceramic

Resistors

1 x 3.3MΩ, 1 x 2.7MΩ, 1 x 1.8MΩ, 3 x 1MΩ, 1 x 470kΩ, 4 x 100kΩ, 1 x 68kΩ, 1 x 22kΩ, 1 x 10kΩ, 1 x 6.8kΩ, 1 x 4.7kΩ, 1 x 2.7Ω, 1 x 2.2kΩ, 1 x 1kΩ, 1 x 150Ω, 1 x 2.2MΩ log potentiometer, 1 x 10kΩ log potentiometer, 1 x 500Ω linear potentiometer.

The operation of IC1, then, is as follows: about once every 15s, the wave begins to build up. This takes only three or four seconds whereupon the wave breaks. For about 0.5s immediately after the break, a very rapid decay occurs. After this period, decay continues more slowly until the beginning of the next build-up.

Switch S1 in the output circuit of IC1 allows the sound of the large waves to be switched in or out of circuit as required. Since the output of IC1 is coupled to the FET gate circuit via a 1MΩ resistor, compared to the 3.3MΩ coupling resistor of IC2, it has a far greater effect on the sound.

Construction

The printed circuit board (PCB) is coded 84ms4 and measures 72 x 110mm. There is one wire link to be mounted on the board — this should be done first. The other components can then be mounted, starting with the small horizontal devices such as resistors and diodes.

We have prepared a Scotchcal front panel label which suits the plastic sloping front project box. If you intend to use this label apply it first so that it can be used for a template for drilling the front panel.

When mounting the input sockets, make certain that the 12VAC input and the speaker output do not share a common earth. This means that, with a metal front panel or Scotchcal label, one of the sockets (preferrably the 12VAC socket) should be insulated. This can be done by placing a short length — about 2mm — of plastic tubing over the shaft of the socket and placing an insulated washer under the retaining nut.

To test the Noise Simulator, set the volume to near minimum, the tone to low and the waves to Off. After applying power there will be a delay of about 2 to 4 seconds before any sound is produced (it takes that long for the white noise generator to become operative). Once the sound begins, vary the controls to verify the operation. Remember that only one wave occurs every 15 seconds.

BASIC ELECTRONICS

For the beginner, or for the hobbyist as a reference book and almost certainly the most widely used manual on basic electronics in Australia.

It is used by radio clubs, in secondary schools and colleges, and in WIA youth radio clubs. Begins with the electron, introduces and explains components and circuit concepts, details the construction of simple receivers. Separate chapters on test instruments, servicing amateur radio, audio techniques, stereo sound reproduction.

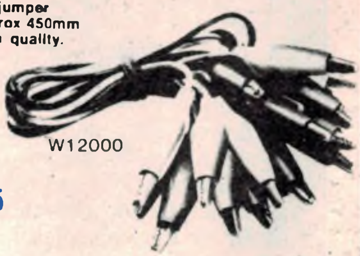
Available from "Electronics Australia", 57 Regent St, Chippendale 2008. PRICE $4.50 OR by mail order from "Electronics Australia", PO Box 163, Chippendale 2008. PRICE $5.40

JUNE PRE-STOCK TAKE SALE — DEDUCT 10%

TAKE 10% OFF ALL THESE TOOL PRICES FOR THIS MONTH

JUMPER LEADS

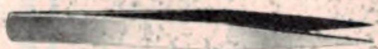
Set of 10 jumper leads approx 450mm long. High quality.



W12000

$4.95

TWEEZERS



Needle Nose T12375	1-9 $1.20	10+ .90

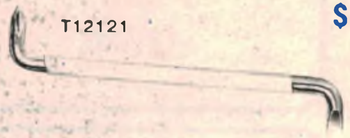
Duck Bill T12377	1-9 $1.20	10+ .90

OFFSET SCREWDRIVER

Flat blade one end with Philips at the other. Ideal for those hard to get at screws.

T12121

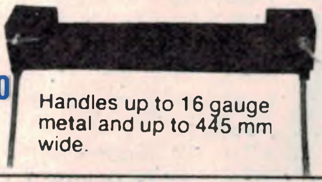
$2.95



Sheetmetal Bender

T12400

How often have you wished that you could afford a Pan Brake Bender. Well this unit is a close second for your workshop. Your own chassis, boxes, brackets, are all possible with the unique slotted clamping bar that allows complex corner bends.



$79.50

Handles up to 16 gauge metal and up to 445 mm wide.

Jewellers Screwdriver

T12200

$4.95

Wire Stripper

T11520

$9.95

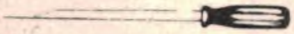
Alignment Screwdriver

T11401 100mm Shaft

T11402 200mm Shaf

Spring steel tip plastic shaft is absolutely essential for alignment work around E.H.T. or other high voltages.

$1.50



Tapered Reamer

T12370

Great for enlarging holes that are a bit too small. Enlarges from 5–20mm.

$6.95

Needle File Set

T12350

An indispensible part of your tool kit designed especially for electronic work or areas where a precise finished job is needed. Lasts for years.

This set contains 5 files: Flat, Half Round, Triangular, Square, and Round.

$9.95

Steel Rule 300mm

T12382

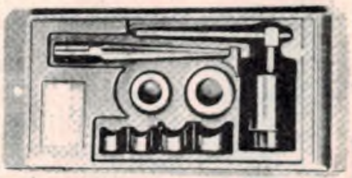
$3.50

Chassis Punch

T12360

Absolutely essential for an enthusiast, prototyping technician or serviceman. Cuts holes in metal up to 16 gauge or 1.6mm. Essential for building kits. Punch Sizes: 16mm, 18mm, 20mm, 25mm, 30mm.

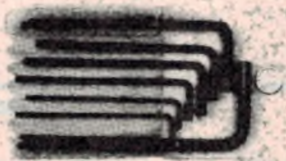
$18.95



Allen Keys Set

T11410

$2.50



Neon Test Screwdriver

T12222

Neon lights up to tell you if voltages are present over 90 volts (AC DC) essential for people working on mains circuits who know how a power point or extension cord is wired.

$1.50

6000 RPM Mini Drill 12V DC (Drill Bits)

T12302

$14.95

.6mm T12319
.8mm T12320
.9mm T12324
1.0mm T12325

ALL $1.50

12V DC operated great for PC work 1.2mm check capacity. Comes complete with 1mm Drill Bit.

Alignment Tool Set

T11400

Ever tried to adjust an IF can or coil using the wrong sort of tool or filed down knitting needles then, breaking the slug.
This set of tools will pay for themselves many times over, both in time and stopping you obtaining ulcers.

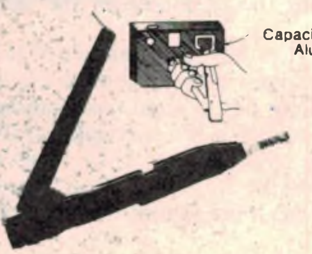
$3.95

Hand Nibbler

T12355

Easily operated hand NIBBLER cuts any shape hole in sheet steel—aluminium—copper—or plastic. Metal remains flat and straight after cutting. Does not add strain or distortion to edges. Cuts holes in preformed sheet metal (air-ducts, chassis, etc.) without distorting original form. Cuts in all directions.
Any design—angle—radius. Follows scribe lines easily. Best possible tool for cutting template and model parts from thin metal.

Capacity Steel .6mm
Aluminium 1.6mm



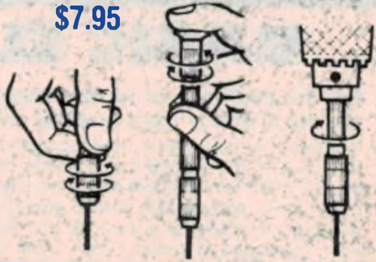
$16.95

Pin Vice

T12352

It's infuriating when all you need to do is drill one hole a little bit bigger and haven't got a drill that fits in your tool box. Buy one of these for drilling circuit boards, will hold drill bits, taps, files, etc. up to 3mm.

$7.95



Pearl Catch

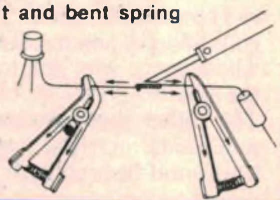
T12380

Dropped something in an odd spot? This Pearl Catch is what you need to get it out. Great for picking up small screws, pins, nuts, washers, resistors, etc. Also can be used for holding items in place.

$3.95

HEAT STOPPERS

A set of straight and bent spring loaded clamps



T12440

$3.50

ROD IRVING ELECTRONICS, 425 High St, Northcote, Vic; 48-50 A'Beckett St, Melb, Vic. Phone (03) 489 8866, (03) 489 8131. Mail Order Hotline (03) 481 1436.
Mail Orders to P.O. Box 235, Northcote 3070, Vic. Minimum P&P $3.00. Errors and omissions excepted.
Please address tax exempt, school, wholesale and dealer enquiries **RITRONICS WHOLESALE,** 1st Floor, 425 High St, Northcote 3070, (03) 489 7099, (03) 481 1923, Telex AA38897.

OFF ALL TOOL PRICES — SAVE! SAVE! SAVE!

HEAVY DUTY DIAGONAL CUTTERS AND WIRE STRIPPERS

T12035

$7.95

Jaws line up perfectly and will not twist or distort through use. The sharp cutting edges have two small holes. One is 1.2mm (0.05") and the other is 1.6mm (0.06").
Finish: Chrome plated with plastic insulated handles.

MICRO NIPPER

115mm

For delicate and intricate high precision electronic works.
Polished head with insulated handle.

T12050

$9.95

MICRO ROUND NOSE PLIERS 115mm IN LENGTH

Smooth jaws are round and tapered to a fine point (1.5mm x 3.5mm).
It can provide excellent precision work result.

$8.95

T12075

STUBBY SCREWDRIVERS 83mm IN LENGTH

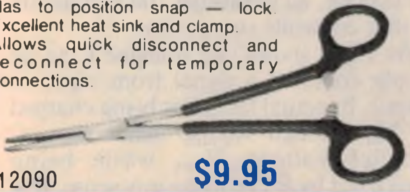
	PRICE 1-9	10+
T12110 **FLAT BLADE**	**1.40**	**1.20**
T12115 **PHILIPS HEAD**	**1.40**	**1.20**

NARROW FLAT BLADE (2.6mm BLADE)

	PRICE 1-9	10+
T12125 **BLADE LENGTH** 100mm	**.55**	**.50**
T12130 **BLADE LENGTH** 20mm	**.65**	**.55**

SURGICAL TYPE CLAMP

All stainless steel made. Box joints for added durability. 125mm long. Has to position snap — lock. Excellent heat sink and clamp. Allows quick disconnect and reconnect for temporary connections.



T12090 **$9.95**

MICRO LONG NOSE CUTTING PLIER

T12060

$8.95

Very fine point for delicate work in very confined areas.
Size: 125mm (5")
Finish: Polished head with plastic insulated handle with spring

FLAT NOSE PLIER

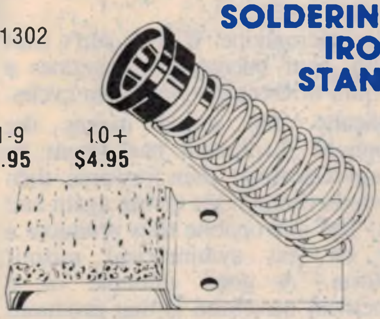
T12001

$7.95

Tip top of jaws are slender and flat. For repairing precise instruments, measurement apparatus, etc.
Finish: Plastic insulated handles.
Size: 115mm (4½"), Polished head. (A) 0.9 x (B) 0.8mm

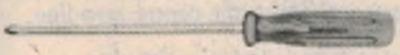
UNIVERSAL SOLDERING IRON STAND

T11302



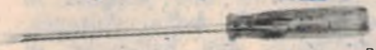
1-9 **$5.95** 10+ **$4.95**

PHILIPS SCREWDRIVERS



	BLADE SIZE	BLADE LENGTH	OVERALL LENGTH	PRICE 1-9	10+
T12170	00	75mm	130mm	**.60**	**.50**
T12175	0	100mm	175mm	**.90**	**.80**
T12180	1	125mm	210mm	**1.20**	**1.00**
T12182	3	150mm	256mm	**1.75**	**1.40**

MEDIUM DUTY FLAT BLADE (4.5mm BLADE)



	PRICE 1-9	10+
T12140 **BLADE LENGTH** 75mm.	**.70**	**.60**
T12145 **BLADE LENGTH** 150mm	**.80**	**.60**

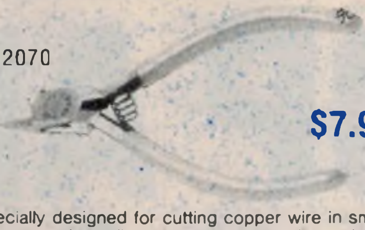
FULLY ADJUSTABLE MAGNIFYING GLASS

Flexible arm magnifier best suited for your desk bench or machine. Ground and polished 90mm glass lens in metal frame with ball joint and flexible arm which can be angled in any direction.
Length of flexible shaft: 190mm
Power: 2.2X

T12085 **$24.95**

TRANSISTOR NIPPER

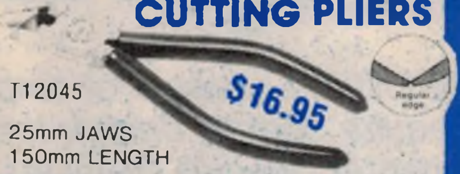
T12070



$7.95

Specially designed for cutting copper wire in small gauge and for delicate and intricate high precision works in electronics. The width of joint portion is 3/8" (10mm). Confidently recommended for assembling and repairing transistor radios, TV, Printed Circuit Boards, etc.
Finish: Polished head with plastic insulated handles.

HEAVY DUTY SIDE CUTTING PLIERS



T12045

$16.95

25mm JAWS
150mm LENGTH

SOLDER

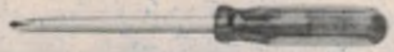
We carry a wide range of sizes and rolls of solder, as one size is not sufficient for every type of soldering job. (All are resin cored, Aust. made, 60/40 5 core solder.)

CAT NO	SIZE	ROLL WEIGHT	PRICE 1-9	10+
T31000	.71mm	250gm	**$8.95**	**$7.95**
T31002	.71mm	500gm	**$14.95**	**$13.00**
T31010	.91mm	250gm	**$7.95**	**$6.95**
T31012	.91mm	500gm	**$13.95**	**$12.50**
T31020	1.6mm	250gm	**$6.95**	**$5.95**
T31022	1.6mm	500gm	**$12.95**	**$11.95**

MINIATURE SCREWDRIVERS

Unobtrusive keep one in your top pocket. Great for screw on items like record players (needles and cartridges)

	PRICE 1-9	10+
T12100 **FLAT BLADE** 1.6mm x 55mm O/A LENGTH	.50	.40



T12102 **MINIATURE PHILIPS**	.60	.50

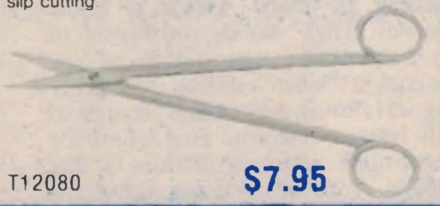
HEAVY DUTY SCREWDRIVERS

		BLADE LENGTH	OVERALL LENGTH
T12150	5.5mm BLADE	75mm	160mm
T12155	6.0mm BLADE	125mm	215mm
T12156	8.0mm BLADE	200mm	305mm

	PRICES 1-9	10+
T12150	1.40	1.20
T12155	1.65	1.40
T12156	2.00	1.75

PRECISION SCISSORS

Made from stainless steel for delicate work and non-slip cutting.



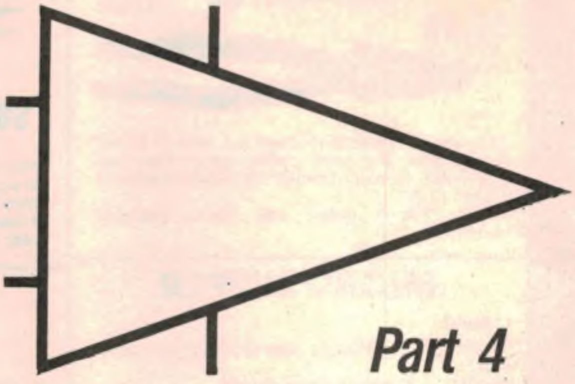
T12080 **$7.95**

SAVE 10% SAVE 10% SAVE 10% SAVE 10% SAVE 10%

ROD IRVING ELECTRONICS, 425 High St. Northcote. Vic: 48-50 A'Beckett St, Melb. Vic. Phone (03) 489 8866, (03) 489 8131. Mail Order Hotline (03) 481 1436
Mail Orders to P.O. Box 235, Northcote 3070, Vic. Minimum P&P $3.00. Errors and omissions excepted
Please address tax exempt, school, wholesale and dealer enquiries **RITRONICS WHOLESALE,** 1st Floor, 425 High St, Northcote 3070, (03) 489 7099 (03) 481 1923. Telex AA38897.

by BRYAN MAHER

OP AMPS Explained



Part 4

Amplifiers capable of amplifying DC signals require special design techniques. In this chapter, we will consider the implications of DC coupling, bandwidth, drift and high gain.

If we require a DC coupled amplifier circuit of high gain, it is not sufficient to simply couple together a number of ordinary designs. Neither should we attempt to achieve very high gain in one ordinary operational amplifier stage. So how should we do it? The answer is that we must begin at the input socket and design a complete system to meet our requirements.

But first, why would we want to go to all this trouble? We will look at this question from two points of view: individual stages using op amps, and large amplifiers of many stages.

Fun and music

Once upon a time, most electronic circuits were designed solely for reproduction of music or speech (or cricket). Radio transmitters and receivers, record players, and public address systems accounted for most of the effort expended and the inventiveness evident. Designs were small, large or huge but they all had one common feature: their voltage and current waveforms had a certain *symmetry*.

By this we mean that, by and large, whatever a voltage did above the zero line (positive excursions) it usually did much the same thing below the zero line (negative excursions). Most sounds correspond to a voltage waveform consisting of many cycles of some frequency. High sounds correspond to high frequencies; deep sounds to low frequencies; "harsh" sounds to steeply rising waveforms; and "round" sounds to gently rising waveforms. Sing a note for a short time and you produce a few complete cycles of a voltage waveform from a microphone. If they can't shut you up, your microphone generates a long train of complete waveform cycles.

Basically, the sound moves the microphone diaphragm back from its centre rest position, then forwards, then backwards through the centre again and so on. The microphone thus produces a more or less symmetrical output waveform. A good example of a symmetrical waveform is that produced by a sinewave generator as illustrated in Fig. 1. Note that the positive and negative signal excursions are symmetrical about the centre zero line.

The modern generation

Today, electrical signals are generated by a whole host of sources. A modern music group may have microphones and guitars generating the aforesaid bipolar signals, along with synthesisers and other digital signal generators. The common TV receiver is renowned for its strange voltage waveforms and delights in generating square wave voltages, triangular waves and half-cycles of sinewaves. Computers, terminals, and logic circuits live by generating square voltage pulses of single polarity as Fig.2 illustrates.

To cap it all off, we want amplifiers to increase the sensitivity of some of our DC voltmeters and oscilloscopes. *Voltage wave symmetry has been lost.*

So what? — you quickly retort — who cares? What does it matter if our voltage signals are symmetrical or not? Until single-sided voltage-pulses came along, many did not realise how fortuitous the double-sided voltage waveforms were to the circuit designer as the following story shows.

Fig.3 shows a very dated, and rather horrible, microphone preamplifier of medium gain. Glossing over such details as the awfully high output impedance, let's consider the average or quiescent circuit voltages. The base voltage divider on the input transistor provides a positive DC bias, some of which is cancelled by the emitter resistor (in a stabilising attempt). The quiescent voltage at the collector (2) is some function of the resultant bias, the transistor's temperature and the h_{FE}. These usually provide us with such a delightfully unpredictable set of numbers that it is very difficult to precisely predict the voltage at collector 2. But, you see, the world is indeed good to us for it doesn't matter at all.

For — lo and behold! — coupling capacitor C1 is usually described in the textbooks as being put there to remove the collector DC potential, leaving only the signal variations to pass on to the second stage. The real truth is that the coupling capacitor was put there because we have no idea what the collector voltage might be at different times on different days.

Let the transistor h_{FE} vary! Who cares if the operating conditions are different in summer or winter? So what if the quiescent collector voltage is 3V at lunch time and 5V at night when it's cooler! The coupling capacitor will erase all our sins; the world and the following stage will never know! We owe a lot to that humble component; just as well conditions allowed us to use it!

And just what were those conditions? Symmetry — yes, signal voltage symmetry — allowed us to use that indispensable little coupling capacitor. To explain, let's consider the real action of that erstwhile component.

As Fig.4 shows, we imagine C to be simply coupling a signal from input to output. In actual fact, C is being charged by V_{in} through R_{source}. After that, C supplies voltage V_{out} while being discharged by R. To make any sense, R is

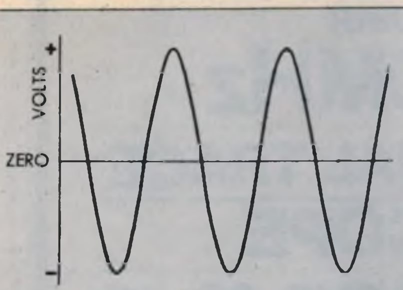


Fig. 1a: voltage output from a sinewave generator. Note waveform symmetry about the 0V line.

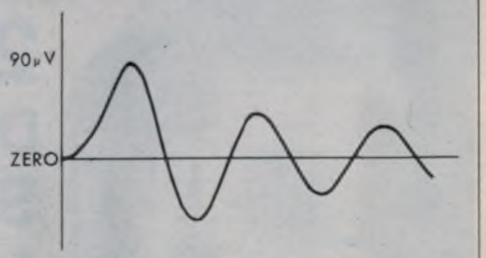


Fig. 1b: voltage waveform produced by a microphone in response to a sharp transient. The waveform still has approximate symmetry despite exponential decay and harmonic content.

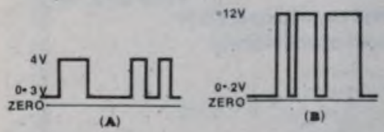


Fig. 2: digital logic gates produce voltage waveforms that are asymmetrical about the 0V line. These examples are from TTL (A) and CMOS (B) circuits.

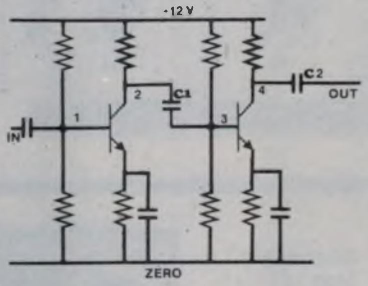


Fig. 3: early microphone preamplifier design. Coupling capacitors C1 and C2 isolate the collector DC potentials from the following stages.

much greater than R_{source}. Therefore the rate of discharge of C is simply the time constant RC. If R is measured in ohms and C in Farads, then their product (RC seconds) is the time constant of the coupling circuit. R is the parallel resultant of the physical resistive path to ground and the input resistance of the following stage.

Results

(a) When the input signal is a sine wave there is no problem. The output is also a sine wave with a phase shift.

(b) Fig.4 also shows a single-sided input voltage waveform, swinging between zero and positive voltages only and with a small mark-space ratio. Observe that at 1 the input and output rise to the same height, as we would expect. Between 1 and 2, V_{in} maintains a constant voltage (ie, the top of the waveform is level). But during this time, C is discharging through R and so the voltage V_{out} falls a little. This "droop" is actually due to the exponential discharge curve but, if short enough, looks approximately like a straight line sloping downwards.

By the time point 2 is reached, the output voltage is down to about 0.9V instead of the original 1.0V. Then, at 2, V_{in} drops by exactly 1V; ie, the potential on the left plate of C changes abruptly by −1V. Because the voltage across a capacitor cannot change instantly (it takes time for a capacitor to charge), this means that the voltage on the right plate of C must also drop abruptly by 1V.

So, theoretically, V_{out} should drop abruptly from +0.9V to −0.1V at time 2. And that's exactly what happens. Between times 2 and 3, V_{in} is zero so the capacitor simply discharges from its −0.1V state towards zero. Notice we said *towards* zero. *The capacitor does not discharge completely to zero.*

When time 3 arrives, the capacitor still has a small negative charge on its output plate, perhaps .01V. V_{in} rises by another 1V step at time 3, lifting the output plate of C from −.01V to +0.99V, which decays as before from +0.99V down to +0.89V by time 4. This time the 1V drop of V_{in} is accompanied by a drop of V_{out} from +0.89V to −0.11V; notice this level is a little lower than before.

Repeated pulses continue this trend, as shown in the diagram, with the step up and down always exactly 1.0V, and the overall level between each step slowly falling.

How far will these levels fall? Right down through the bench and onto the floor? No, not at all. It can be shown that equilibrium will be reached and the voltage levels will fall no longer when the area enclosed between the positive part of the voltage waveform and the zero line is equal to the area enclosed between the negative part and the zero line. The proof of that statement we won't go into; it involves a smattering of integral calculus and assorted mathematics. The strict statement of the theorem is that after equilibrium is reached the total integral of the waveform is zero over any complete number of cycles.

Mark-space ratio

For one-sided "square" voltage waveforms such as that in Fig.4b, we define the mark-space ratio as the ratio of the time that the voltage is high to the time it is zero. Fig.4b shows a mark-space ratio of approximately 1:9. Some readers may think that the expression "square wave" should really only apply to Fig.4c because it looks square, not rectangular. However, common practice is to use the expression "square wave" for any waveform with vertical sides, or nearly so, as long as the mark-space ratio is not too small.

Note that the absolute square wave Fig.4c has a mark-space ratio 1:1. An alternative expression also used is *duty cycle*, which is the percentage of up time in one complete cycle. Fig.4c thus has a 50% duty cycle and Fig.4b a 10% duty cycle.

The mark-space ratio has a profound effect on the depression of the single sided waveform below the baseline. Fig.4b shows only a small depression, but this is still sufficient for the "negative area" to be equal to the "positive area". Now observe in Fig.4c that a 1:1 mark-space ratio results in an output waveform that is symmetrical about the baseline.

But worse is to come. Consider Fig.4d where V_{in} is a single sided waveform from zero to +1V, with the waveform mostly high (ie, at +1V). TV vertical sync waveforms look like this. The resultant V_{out} discharges so much during the up time that it soon decays down to about +0.1V, with the 1V step down taking it down to −0.9V. The very large mark-space ratio of 9:1 quickly pushes the output waveform down until it is mostly negative.

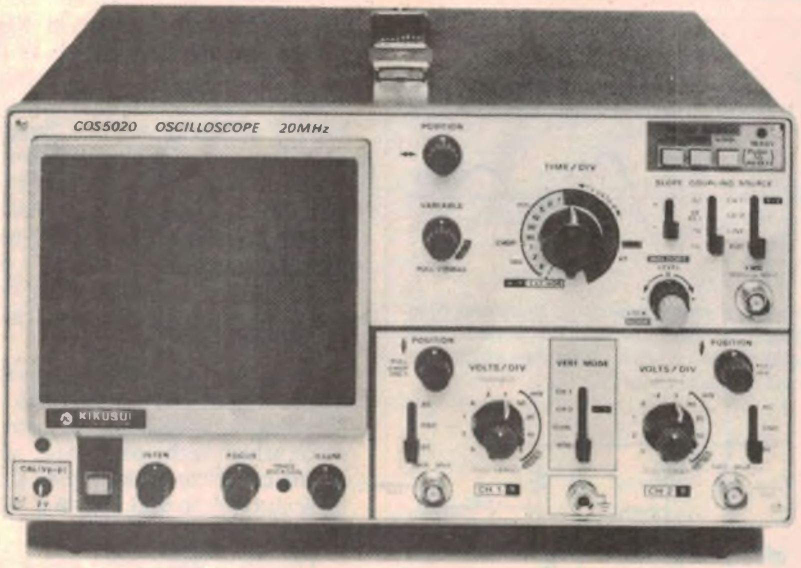
Uses

If our pulse were to be used for sound output there would be no trouble. Both V_{in} and V_{out} in Fig.4d would make much the same sound in a speaker. But that is not the usual purpose of such waveforms. Instead, they are mostly used in digital circuits where the presence of a pulse above some predetermined threshold for a certain time is the vital consideration.

Perhaps an industrial process produces small amplitude pulses which we want to count. We need an amplifier to bring them up to usable size, as well as a circuit to record how many times the input voltage waveform exceeded a threshold. We could, for example, choose a threshold of +0.8V as shown in Fig.5. A smaller threshold could be chosen, but this may lead to error because of noise and other voltage fluctuations.

Many industrial processes give rise to rather random strings of pulses of various lengths as depicted. The

WOOD FOR CHIPS ... WOOD FOR CHIPS ... WOOD FOR CHIPS ... WOOD FOR CHIPS ... WOOD FOR CHIPS ... WOOD FOR CHIPS ... WOOD FOR C



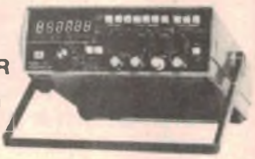
KIKUSUI 20MHz DUAL TRACE SCOPE

$469.00 INC PROBES

Compact and easy to operate for hobbyists and professionals

- 5mV/div sensitivity
- Hold-Off function
- CH1, CH2, Dual, Add, X-Y modes
- Intensity modulation
- 5mS to 2uS sweep delay
- 0.2uS to 0.5S/div sweep range

GFG-8016D FUNCTION GENERATOR



$319.00

Generates sine, triangle, square, pulse and ramp waves

• 0.2 to 2MHz • 20Vp-p open circuit output • VCF input - 10V gives 1000:1 ratio • Built-in 10MHz Counter (6 digit)

GAG-808A AUDIO GENERATOR

$199.00

Covers 10Hz to 1MHz

• 20Vp-p open circuit output • Sine and Square wave outputs • External sync • 600 ohm output impedance

GPS-3030 POWER SUPPLY

$193.00

Provides 30V at 3A

• Short circuit protected • Auto constant voltage constant current indication • High line and load regulation

GPS-3060 POWER SUPPLY

$334.00

Provides 30V at 6A

• Similar to GPS3030

DCM-100 CAPACITANCE METER

$92.00

Measures capacitance from 200pF to 2000 uF

• 3½ digit LCD display
• Crystal time base
• Front panel zero adjustment • Internal calibration adjustment
• Protection against charged capacitors

AT301 LOGIC PROBE

Checks TTL and CMOS circuits

• Multi-LED readout
• Memory function for single shots and low rep events • 50nS detectable pulse width
• 10MHz max input
• Overload protected
• Runs off 5-15V 25-40mA

$22.00

C16 IC CLIPS

$4.40

Simplifies checking of ICs

• Suits 16pin DIP spacing
• Gold plated clip contacts

B-123 1580 tie points

B-124 1680 tie points

B-135 2420 tie points

B-147 3260 tie points

A-TEK BREADBOARDS

• Ideal for experimenters • B212 under NSW Govt contract • No soldering or un-soldering • Nickel plated contacts • Blocks snap together for easy expansion

B-212 840 tie points

B-212 - 840 tie points **$16.00**

B-123 - 1580 tie points **$22.00**

B-124 - 1680 tie points **$23.00**

B-135 -2420 tie points **$33.00**

B-147 - 3260 tie points **$44.50**

8.30 to 5 Monday to Friday. 8.30 to 12 Sat.
Mail Orders add $3.00 to cover postal charges.
Next day delivery in Sydney add $5.00.
All prices EXCLUDE sales tax.
Tax exemption certificates accepted if line value exceeds $10.00

GEOFF WOOD ELECTRONICS

GEOFF WOOD ELECTRONICS PTY LTD
Incorporated in N.S.W.
656A Darling St, Rozelle 2039
(One door from National Street)
Tel: **810 6845**

bankcard
$10.00 minimum

specialising in electronic components for the professional and hobbyist.

OP AMPS Explained

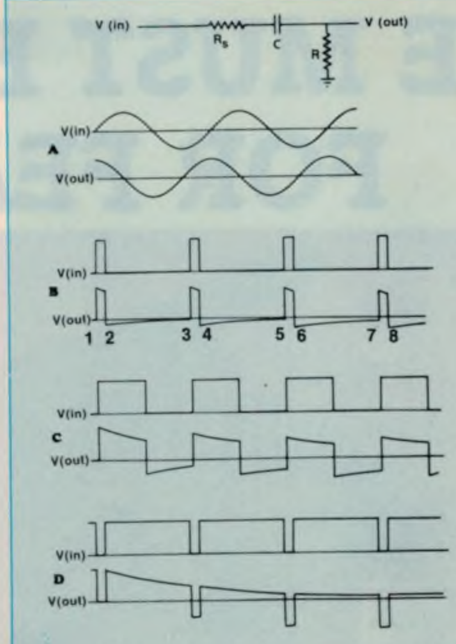


Fig. 4: the effect capacitor coupling has on various signals. Note particularly the effect on DC signals of different mark-space ratios.

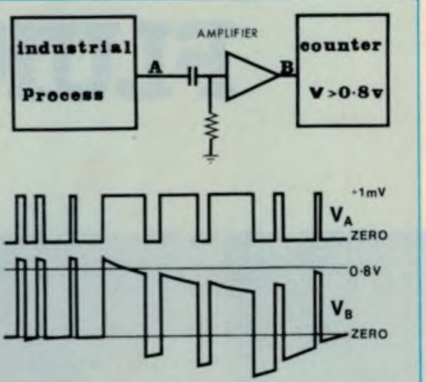


Fig. 5: how capacitive coupling can lead to errors. Some of the pulses at V_B will be missed by the counter due to signal depression below the 0V line.

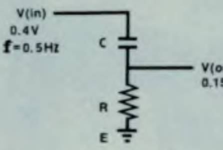


Fig. 6: X_c and R form a voltage divider where $X_c = 1/2\Pi fC$ is the reactance of the capacitor to sinewaves.

threshold counter circuit cannot be applied to V_A as the 1mV level is far too small to use. So it is applied to V_B with its zero to 1V excursions.

But look what the coupling capacitor has done! V_B has many different values of voltage below the baseline because it has many different values of mark-space ratio. Poor coupling capacitor! Guilty! No suitable threshold can be chosen for the counter circuit. No satisfactory equipment can be designed. The counter will inevitably miss some counts of the industrial process.

Other reasons

The foregoing is but one example of the havoc wrought by that shameful component, the coupling capacitor, on DC signals. Countless others could be cited.

Example two is a very short story of a student who decided one morning to measure the amplitude of a 0.4V 0.5Hz sinewave signal using an ordinary oscilloscope. He measured a quite erroneous value of 0.15V instead of 0.4V, as being not yet fully awake he left the oscilloscope input switched to "AC coupling". Thus, his low frequency signal was coupled to the oscilloscope's amplifiers via an internal coupling capacitor.

In the case of a sinewave, equally balanced above and below zero, no depression of the signal occurs. But what does happen is that X_c and R form a signal voltage divider, where X_c is the capacitive reactance of the capacitor to sinewaves. At frequency f, the reactance is

$X_c = 1/2\pi fC$ ohms

and the lower the frequency the higher the value of X_c in ohms.

At low frequencies, X_c is greater than R and much of the signal voltage is lost as in Fig.6. In this case only 0.15V is being developed across R as output. (The voltage drop due to X_c is not simply the remainder as vector additions are involved here).

The cure for the student's wrong measurement, by the way, was to switch the oscilloscope to DC coupling, which effectively bridges out the internal coupling capacitor.

Measuring instruments

All sorts of sensitive measuring instruments such as microvoltmeters, millivoltmeters, DVMs, CROs, low level wattmeters and null indicators must contain amplifiers to raise a small input signal level to a usable value. Instruments to measure DC current, voltage or power must therefore contain amplifiers capable of amplifying small DC voltages.

Fig.7 shows what happens is we try to amplify a 1mV DC signal using a capacitively coupled amplifier. If the instrument contains an amplifier with a gain of 1000 and an indicating meter requiring 1V DC for full scale deflection, then why shouldn't it behave as a DC millivoltmeter? If it works, a 1mV input should result in a full scale reading on the meter.

Of course, it won't work at all as the voltage diagrams in Fig.7 show. The meter does read 1V initially, responding to the first abrupt voltage change, but the reading then falls gradually to zero as capacitor C charges. Any effort to use very large values of C or R, or both, will just prolong the time constant and cause the meter reading to decrease to zero at a slower rate. But decrease it will, and nothing will make this circuit successful while that coupling capacitor is present.

DC restoration

When television was first invented, a crying need for a circuit to amplify DC signals came with it. The abrupt changes in voltage level from white picture to black picture, through to the tips of the sync pulses, are critical to the operation of a TV receiver. If these voltage levels are incorrect, your TV picture could lack contrast, roll or even be torn to bits. Other faults, such as failure to separate picture from sound, can follow as side effects.

The root cause of our problems is that the demodulated video signal is unbalanced about the zero line. It lacks symmetry. Early TV circuit designers used capacitor-coupled video amplifiers, then ingeniously devised additional circuitry to re-insert the correct amount of DC level. While this overcame any problems caused by the coupling capacitor, it represented a way out rather than an ideal.

Feedback requirements

Negative feedback around an amplifier stage can also cause problems due to phase shifts or time delays. As shown in Part 2 of this series, sufficient phase delay or lead can make negative feedback look like positive feedback. This will immediately cause instability in the amplifier if the gain around the loop is greater than one.

Getting back to Fig.7, the coupling capacitor-resistor combination causes a phase shift which varies according to the input frequency — a nasty situation indeed! As all our operational amplifier circuits, by their very nature, use heavy negative feedback, it is mandatory that DC coupling (ie no coupling capacitors) be used within any one stage. If feedback is applied around more than one stage, then DC coupling should be used overall.

The cure

Once upon a time, a circuit designer of great wisdom and experience gave his apprentice one piece of advice: "if a component gives you design touble, don't use it at all".

All the aforesaid sorry stories have one

FROM HOBBYIST T
FLUKE MUST BE YOUR FI
FOR FEATURES, Q

O PROFESSIONAL – RST MULTIMETER CHOICE UALITY AND VALUE

1 **8050A $540** ex tax $626.40 tax paid
- 4½ digit bench portable • 0.03% basic accuracy • 10uV, 10nA, 10mohm sensitivity • True RMS to 50kHz • dB with 16 reference impedances • Relative reference for comparing values • Mains/Battery option

8010A $360 ex tax $417.60 tax paid
8010A $470 ex tax $545.20 tax paid
(similar to 8050A)
- 8010A has 10A range and true RMS • 8012A has low ohms (0.001ohm resolution) • Both have conductance • Mains/Battery option

2 **8020B $269** ex tax $312 tax paid
- 3½ digit • 0.1% basic accuracy • Eight functions including conductance • Continuity beeper

3 **8021B $221** ex tax $256.20 tax paid
8022B $199 ex tax $230.80 tax paid
- 3½ digit • 0.25% basic accuracy • Diode test • Continuity beeper (8021B only)

4 **8024B $346** ex tax $401.20 tax paid
- 3½ digit • 0.1% basic accuracy • 11 functions including temperature with K type thermocouples • Peak hold on voltage and current • Logic detection and continuity testing • Audible and visible indicators

5 **8026B $276** ex tax $320.20 tax paid
- 3½ digit • 0.1% basic accuracy • True RMS to 10kHz • Conductance to 10,000Mohm • Diode test and continuity beeper

6 **8062A $387** ex tax $448.80 tax paid
- 4½ digit • 0.05% basic accuracy • Similar to 8060A without counter and dB • Relative reference • True RMS to 30kHz

7 **8060A $484** ex tax $561.40 tax paid
- 4½ digit • 0.05% basic accuracy • True RMS to 100kHz • Frequency counter to 200kHz • dB and relative dB • Microprocessor self diagnostics • Relative reference for comparing values • Direct resistance to 300Mohm

LOW COST 70 SERIES WITH ANALOG & DIGITAL DISPLAY

3 YEAR WARRANTY

8 **73 $99** ex tax $114.00 tax paid
- 3200 count display • 32 segment bar graph • 18 ranges • Automatic power down • 10A current range • Autorange • 0.7% basic accuracy • 2000 hour battery life

75 $129 ex tax $148.40 tax paid
All the features of the 73 plus:
- Audible continuity tester • Autorange/Range hold • 0.5% basic accuracy • Low mA range

77 $165 ex tax $189.80 tax paid
All the features of the 75 plus:
- Touch Hold function • 0.3% basic accuracy • Multipurpose protective holster

FLUKE MULTIMETERS CARRY A ONE YEAR MINIMUM WARRANTY AND ARE BACKED BY COMPREHENSIVE SPARE PARTS AND BACKUP SERVICE

ACCESSORIES TO INCREASE THE VERSATILITY OF YOUR FLUKE MULTIMETER

An extremely wide range of accessories is available for your Fluke multimeter. These include:

- **Y8100** – 200A/20A Hall Effect Current Gun with 2% accuracy from DC to 200kHz
- **801-600** – 600A current transformer with 3% accuracy from 30Hz to 1kHz
- **Y8101** – 150A current transformer with 2% accuracy from 48Hz to 10kHz
- **80T-H** – Touch and Hold probe for hard to reach measurements
- **83RF** – High frequency probe covering 100kHz to 100MHz
- **80T-150C** – Universal temperature probe 1°C accuracy from -50°C to +150°C. A wide range of temperature probes and thermocouple probes is available for temperature measurement
- **80K-40** – High Voltage probe measures to 40kVdc or peak ac
- **80K-6** – High Voltage probe measures to 6kV or peak ac with 1% accuracy
- **Y8105** – Rugged case holds multimeter and an assortment of accessories. One of a range of cases and pouches to protect your Fluke multimeter

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

bankcard

FLUKE®

SOLD & SERVICED IN AUSTRALIA BY

ELMEASCO
Instruments Pty. Ltd.

NEW SOUTH WALES
15 Macdonald Street
MORTLAKE
P.O. Box 30 CONCORD
NSW 2137
Tel: (02) 736 2888
Telex: AA25887

VICTORIA
21-23 Anthony Drive.
MT. WAVERLEY
P.O. Box 107 MT. WAVERLEY
VIC 3149
Tel: (03) 233 4044
Telex: AA36206

QUEENSLAND
243 Milton Road.
MILTON
P.O. Box 2360 BRISBANE
QLD 4001
Tel: (07) 369 8688
Telex: AA44062

SOUTH AUSTRALIA
99 King William Street
UNLEY
P.O. Box 1240 ADELAIDE
SA 5001
Tel: (08) 271 1839
Telex: AA88160

WESTERN AUSTRALIA
P.O. Box 95. GOSNELLS
WA 6110
Tel: (09) 398 3362

N.S.W. Ames Agency 699 4524 • George Brown 519 5855, (049) 69 6399 • Bryan Catt 522 4923 • DGE Systems (049) 69 1625 • Davred 267 1385 • Macelec (042) 29 1455 • Pauls Merchants 709 2311 • Radio Despatch 211 0191 • Sheridan Electronics 699 6912 • Standard Components 896 1755 ***N.T.*** Thew & McCann (089) 84 4999 ***A.C.T.*** George Brown (062) 80 4355 ***VIC.*** Radio Parts 329 7888 • Browntronics 419 3986 • G.B. Telespares 328 4301 • Elanco 428 4345 • Ellistronics 561 5844 • Stewart Electronic Comps 543 3733 • Sirs Sales (052) 78 1251 ***QLD.*** L.E. Boughen 36 1277 • Colourview Wholesale 275 3188 • ECQ Electronics 376 5677 • Electronic Shop (075) 32 3632 • W.G. Watson (079) 27 1099 • GEC Electrical Wholesale (079) 51 3155 • Nortek (077) 79 8600 • Solex (077) 72 2015 • Fred Hoe & Sons (07) 277 4311 ***S.A.*** Trio Electrix 51 6718 • Protronics 212 3111 • Lab Service 278 7488 ***W.A.*** Atkins Carlyle 321 0101 • Protronics 362 1044 • Dobbie Instruments 276 8888 • Cairns Instrument Services 325 3144 ***TAS.*** GHE Electronics (002) 34 2233 & (003) 31 6533

OP AMPS Explained

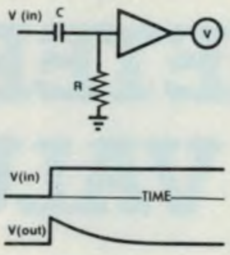


Fig. 7: this figure shows an unsuccessful attempt to drive a DC voltmeter using a capacitively-coupled amplifier. The DC voltmeter responds to V(out) and so is quite useless.

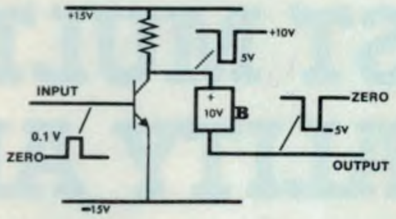


Fig. 8: basic DC-coupled amplifier. A 100mV input signal is amplified to provide a −5V swing at the collector (+10V to +5V). Block B subtracts the +10V quiescent collector potential thus providing a 0 to −5V output. With this arrangement, zero input will give zero output which is what we want.

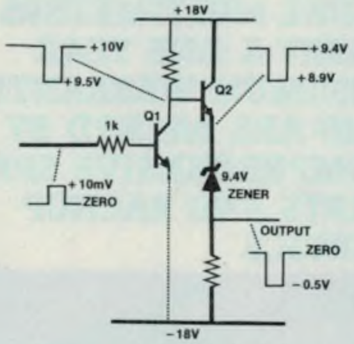


Fig. 9: first steps in constructing a DC-coupled amplifier. The quiescent resting potential of Q1 is +10V. Thus we use the emitter-base potential of emitter follower Q2 (0.6V) and the zener voltage 9.4V to subtract 10V from Q1's collector.

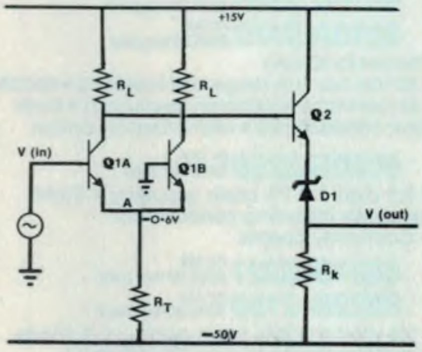


Fig. 10: DC-coupled amplifier using long tailed pair to stabilise Q1 collector current. Though workable, the −50V rail is inconvenient and diode D1 has no gain.

factor in common, one source of trouble: that ubiquitous coupling capacitor! Clearly the cure is not to use a larger capacitor, nor a different type, nor a more expensive one. No! The cure is not to use one at all!

But wait! Fig.3 showed clearly that some designs are rather uncertain of their DC output levels and we only got away with it by using coupling capacitors to hide all our errors. So the panic begins — can we really design amplifiers so well that the output DC level is well known, predictable and quite stable? If so, then that DC collector potential in Fig. 3 will be a known quantity. The trick is to devise some method whereby we subtract a known DC voltage from the collector circuit without changing the signal content. Fig.8 shows the basic idea.

Requirements

There are two requirements for this scheme to work:

1. The collector resting voltage must be stable at some value when the input is reduced to zero.
2. The subtraction circuit we construct must provide a constant DC voltage drop across it and, at the same time, appear as a low impedance so that we do not unduly attenuate the signal passing through it.

All integrated circuits on the market intended for use as operational amplifiers fulfil both requirements. Should we wish to design our own circuits, as has been done in some EA record playing preamplifiers, we must achieve both requirements ourselves. We will consider some of the standard methods in use.

Fig.9 shows Q1, the original amplifying transistor, with a gain of −50. Q2 is an emitter follower and D1 is a 9.4V zener diode. Q1's collector resting potential is +10V when there is no signal input, falling to +9.5V when a 10mV signal is applied to the base.

The zener voltage drop (9.4V) and Q2's base-emitter drop (0.6V) are subtracted continuously from Q1's collector potential to provide output V_{out}. With zero input, $V_{out} = 10V - 9.4V - 0.6V = 0V$. This is always the design aim: zero input should give zero output.

Because each component used has those stated voltage drops at all times, the circuit can follow changes as slowly as we like. No component is low frequency dependant and no low frequency phase shifts occur. There is no charge-discharge effect and the amplifier will respond at any low frequency right down to 0Hz, ie. it is DC coupled. Naturally we still have the high frequency limitations common to all amplifiers.

Of the two requirements listed above, the second, that the zener plus Q2 base-emitter voltage drop be a constant 10V and appear as a low impedance, is well satisfied. But the first, that Q1's collector resting voltage be stable, is *not* well met by the simple circuit shown in Fig.9. The quiescent voltage on Q1's collector is a function of collector current which, in turn, varies according to temperature and rail voltage. Therefore, we must improve our first basic effort to stabilize collector current.

The favourite method is to use a *long tailed pair* as in Fig.10.

The long tail pair

The beautiful DC stability of the long tail pair is due to the fact that resistor R_T, the "tail", has a very high value. High value resistors are sometimes described as "long", a term that probably originated in the early days of wireless when megohm carbon resistors had to be physically long to achieve that high value. We all know Mr Ohm's famous law about current, resistance and voltage, but do we realise its subtle implication? It implies that when two resistors are in series, the larger has the greatest influence in deciding the value of the current.

In Fig.11, we place a high voltage and a high resistance in a box and, through terminals A and B, connect it to a much lower resistance outside. The outside world has very little control over the current flowing under these conditions. That is decided almost entirely by the things within the box. In fact, the box seems to the outside world as being hell-bent on generating its own current no matter what we do outside. That box seems to us to be a *constant current generator.*

So too, in Fig.10, the −50V rail and R_T form a constant current generator, with Q1 and R_L acting as the outside world. This is because R_T = 500,000 ohms is by far the highest resistance present. Thus the total current through both halves of Q1 and R_L is held at almost a constant value and is not greatly influenced by temperature changes in the transistor.

Now let's specify Q1A and Q1B as a matched pair which are thermally coupled together on a common silicon substrate (ie, the transistors will always be at equal temperature). This will cause them to share current i_T equally as they

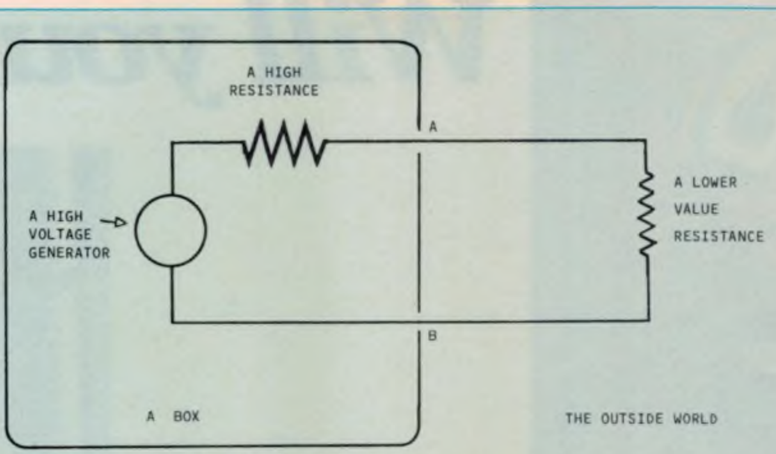


Fig. 11: basic constant current generator.

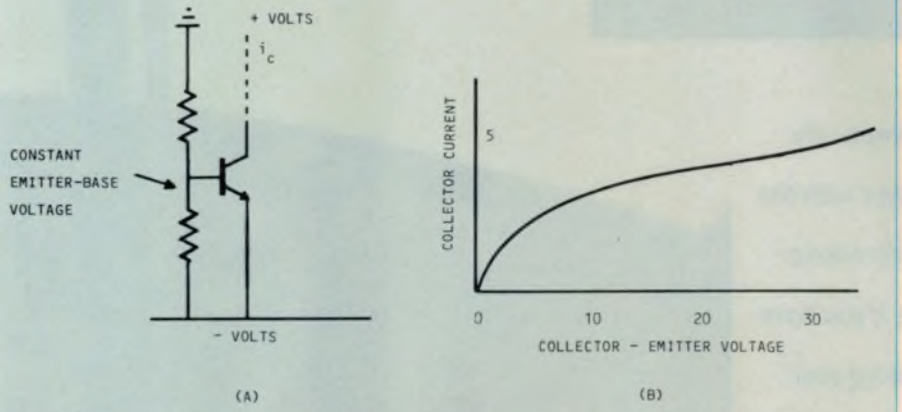


Fig. 12: improved constant current source. If temperature remains constant, an approximately constant collector current flows as curve B indicates. More complex designs may have improved characteristics. Collector current scale in B is milliamps for 20 microamps base current.

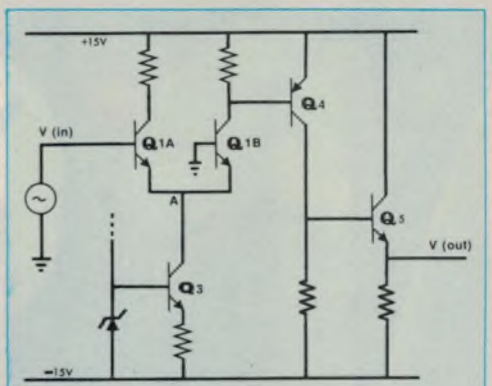


Fig. 13: improved high gain DC-coupled amplifier. Q1A and Q1B form the input balanced long tail pair, Q3 is the constant current tail, and Q4 contributes gain and carries out the DC level shifting function. Q5 is an emitter follower stage to give low output impedance.

have a common bias system provided by a negative voltage of about −0.6V at A. Note that both bases are returned to ground zero. No further bias circuitry is necessary.

With zero input to Q1A, the resting potential at Q1A's collector remains constant at +10V. A positive signal on Q1A's base, however, causes Q1A to pass more collector current. Therefore, Q1B must pass less collector current since the sum of the two collector currents is a constant equal to i_T. Hence, Q1A's emitter voltage at A will not change.

That rings a mental bell! Here we have a changing signal and changing individual currents in Q1A and Q1B, but no change in voltage at A! Could it be that A is another example of a virtual earth? Yes! It's true! It's similar to our earlier discussion on the "virtual earth" at an operational amplifier's summing junction.

The inability of the voltage at A to change in the presence of an input signal means that A *appears* to be at ground potential, at least for *changes* in signal, despite the −0.6V DC potential there. This fact has a far-reaching implication. It means that no degeneration of gain occurs in the tail resistor R_T. Thus, there is no need to bypass R_T as we usually did to the emitter resistors in those awful little single-sided amplifiers as in Fig.3.

Improvements

Though Fig.10 will work, a −50V supply is both inconvenient and expensive. We need to make a few improvements to the circuit, particularly to the constant current source.

Consider the transistor stage shown in Fig.12a. This has a constant emitter-base voltage and thus operates with constant collector current. Even reasonably wide changes in collector-emitter voltage have little effect on collector current as Fig.12b shows.

So Fig.12a behaves as a constant current source and can thus be substituted for R_T in Fig. 10. The big advantage of this scheme is that we no longer require a high voltage (−50V) supply; a −15V supply can be used instead. Beauty! That was easy.

Now if you would like more improvements, consider that while Q2, D1 and R_k in Fig.10 are nice stable components, they contribute no gain. By substituting transistor Q4 as in Fig.13, we can perform the DC shift function and derive some gain at the same time. Q3 performs the aforesaid tail function (ie, it functions as a constant current source) while emitter follower Q5 provides a low output impedance. Integrating such an amplifier is slightly more complicated as both NPN and PNP transistors must be fabricated on the one silicon chip.

Fig.13 is a simplification of the type of circuit commonly used in op amp ICs. If you wish to see such circuits, you will find them drawn in detail in manufacturer's databooks, such as National Semiconductor's "Linear Integrated Circuits". Any of these integrated amplifiers may be used to assemble one operational amplifier stage as in Figs.14 or 15. As shown, both phase reversing and non-reversing circuits are simple to put together with a handful of components. Any one stage is thus fully DC-coupled from input to output, enjoying all the desirable properties mentioned above.

Performance limits

Many applications demand quite high gain, so we should consider the gain range available from circuits. Figure 4.14, the phase reversing case, has an overall closed loop gain given by:

Approximate gain = $-R_f/R_i$

and as shown in the first part of this series:

True gain = $(-R_f/R_i)[G/(1 + G + (R_f/R_i))]$

where G is the open loop gain of the amplifier, R_i the input resistor, and R_f the feedback resistor. These expressions allow us to design low gain amplifiers with accuracy limited only by resistor tolerance. A gain of −1 is quite in order, and even fractional gains are quite legitimate if required.

The upper limit on usable gain is an interesting question. Typical values of G

Will your

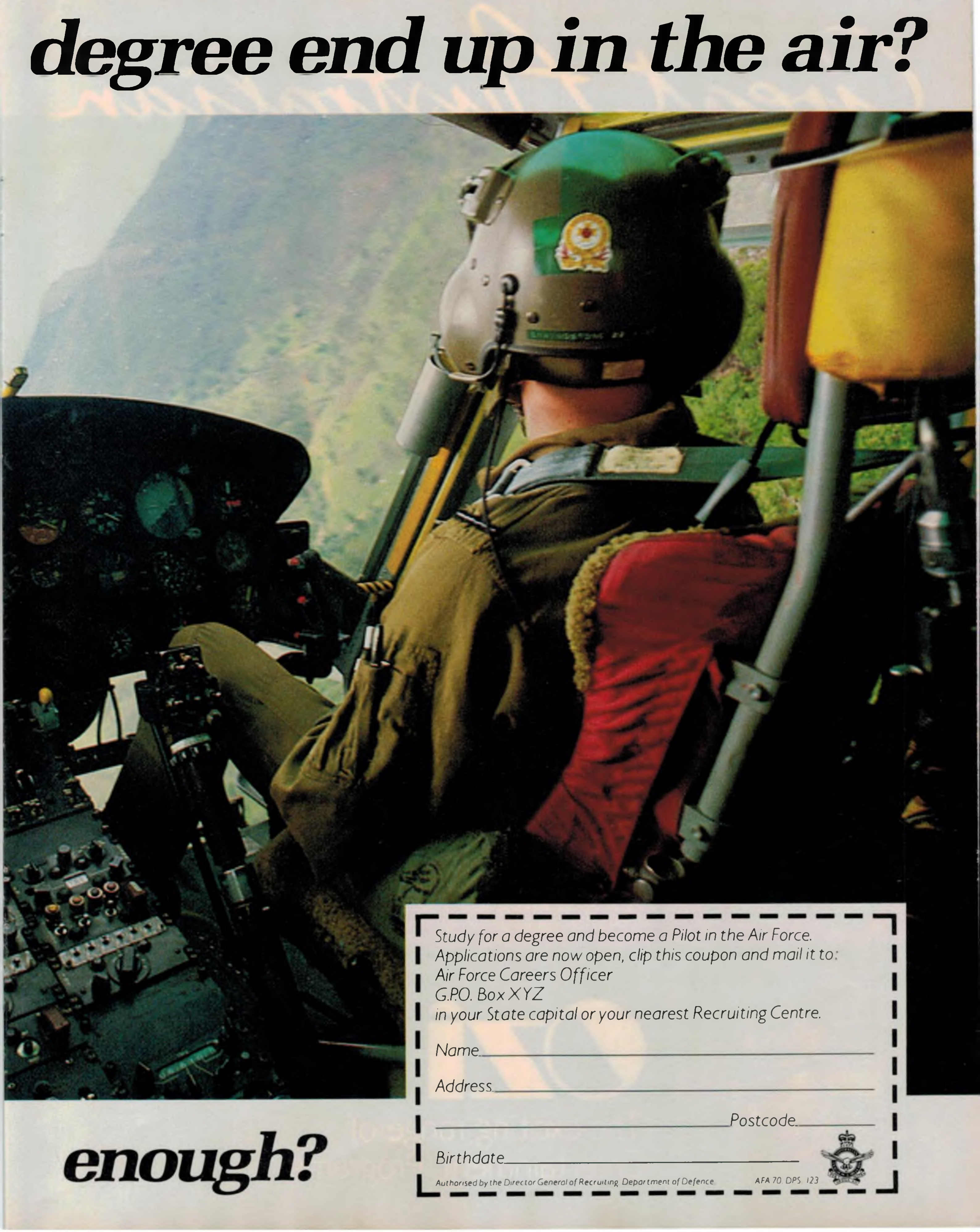
Studying a degree course doesn't automatically lead to professional employment. Except with the Royal Australian Air Force. You can undertake a Science degree while securing a future. If you have matriculated or are currently undertaking your matriculation, are an Australian citizen or eligible to apply for Australian citizenship, are under 20 on the 1st February of your intended year of entry and are able to meet our selection requirements you will be offered a career that will lead you to becoming an Officer and a Pilot. Studying at the RAAF Academy as well as the new Australian Defence Force Academy.

With the military training that will stand you apart from other students.

And you will receive excellent pay while you study.

So don't be left wondering what to do with your degree. Join Australia's Air Force and get your career off to a flying start.

Are you good



Study for a degree and become a Pilot in the Air Force.
Applications are now open, clip this coupon and mail it to:
Air Force Careers Officer
G.P.O. Box XYZ
in your State capital or your nearest Recruiting Centre.

Name____________________

Address____________________

____________________Postcode________

Birthdate____________________

Authorised by the Director General of Recruiting, Department of Defence. AFA 70 DPS 123


Great Australian Originals
AFRICAN SAFARI
Cops & Robbers
GAMMARON
VIC 20 PROGRAMS
OziSoft
Personal Computer Software Catalogue
for Commodore 64, VIC 20, Atari, Sinclair & other personal computers
Entertainment
Programming
Educational
Home Management
Business Systems
PINGO
Underworld of Kyn
2 Player
Ask for a free Catalogue
CAVEMAN
C64
OziSoft™
The exciting range of Entertainment Programs

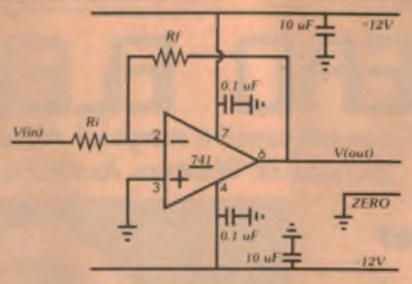


Fig. 14: phase inverting operational amplifier. The closed loop gain is approximately —Rf/Ri (see text).

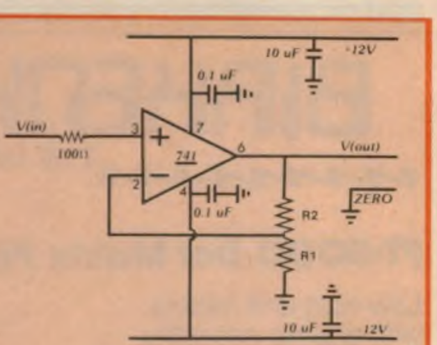


Fig. 15: non-inverting operational amplifier. The closed loop gain for this circuit is approximately (R1 + R2)/R1.

for common integrated amplifiers are 25,000 (minimum) for the 741, 60,000 (minimum) for the LM3D8A, and 800,000 (measured) for the LM725CH. A little calculation shows that DC gain error for a 741 is quite small for closed loop gains of up to 100. Table 1 tells the story.

TABLE 1

Closed Loop Gain	Gain Error
-1	0.01%
-10	0.05%
-100	0.5%
-1000	4%
-10,000	29%
-50,000	Impossible

High frequency problems

If we choose an op amp IC without an in-built compensation capacitor C_x (eg, LM301, LM308), then we must add C_x ourselves. The correct value for common amplifier chips, as described in part 2 of this series, is:

C_x = 33pF/(closed loop gain).

Closed loop gains of 1 and 10 thus require C_x = 33pF and 3.3pF respectively. For gain 100, we simply leave the capacitor out as the stray capacitance approximates the required 0.33pF. Gains of 1000 or 10,000 theoretically require .033pF and .0033pF, but both are smaller than the stray capacitance and so are not realisable. A closed loop gain greater than 100 thus results in severe high frequency loss.

Integrated amplifiers which do contain C_x built into the chip, (eg, 714, AD545, LH0052) use a compensation capacitor suitable for gain = 1. This means that the IC will be overcompensated at higher gains and will thus have restricted bandwidth.

Gain limit

On both counts, limit by errors and limit by high frequency losses, we cannot build an operational amplifier with a closed loop gain much above 100 over the entire audio bandwidth. At the same time, amplifiers for voltmeters, motor controllers and other low frequency applications can require closed loop gains up to 1000. Gains of this order (and with just 0.1% DC error) are achievable using products like the LM725 which has an open loop gain of approximately 1,000,000.

For higher gain or lower error (eg, in applications such as six figure digital voltmeters), special hybrid amplifiers are available with open loop gains up to 100,000,000.

Large gain amplifiers

Being now convinced that, for high gain, we must build a multistage system, let's look at some workable ideas. One point to remember is that output from the first stage will be amplified by subsequent stages. In practice, this calls for careful design of the first stage in order to ensure adequate low noise performance.

In Part 3 last month, we saw that noise generated by the first semiconductor junctions is the major noise source. This can be minimised by careful design and also by reducing the bandwidth of our amplifiers to no more than is necessary.

DC offset of the output voltage is another problem. The DC drift is measured by connecting the input to ground (ie, V_{in} = 0) and measuring the output voltage with a DC voltmeter. Ideally this output voltage should be zero, any departure from zero being a measure of the offset.

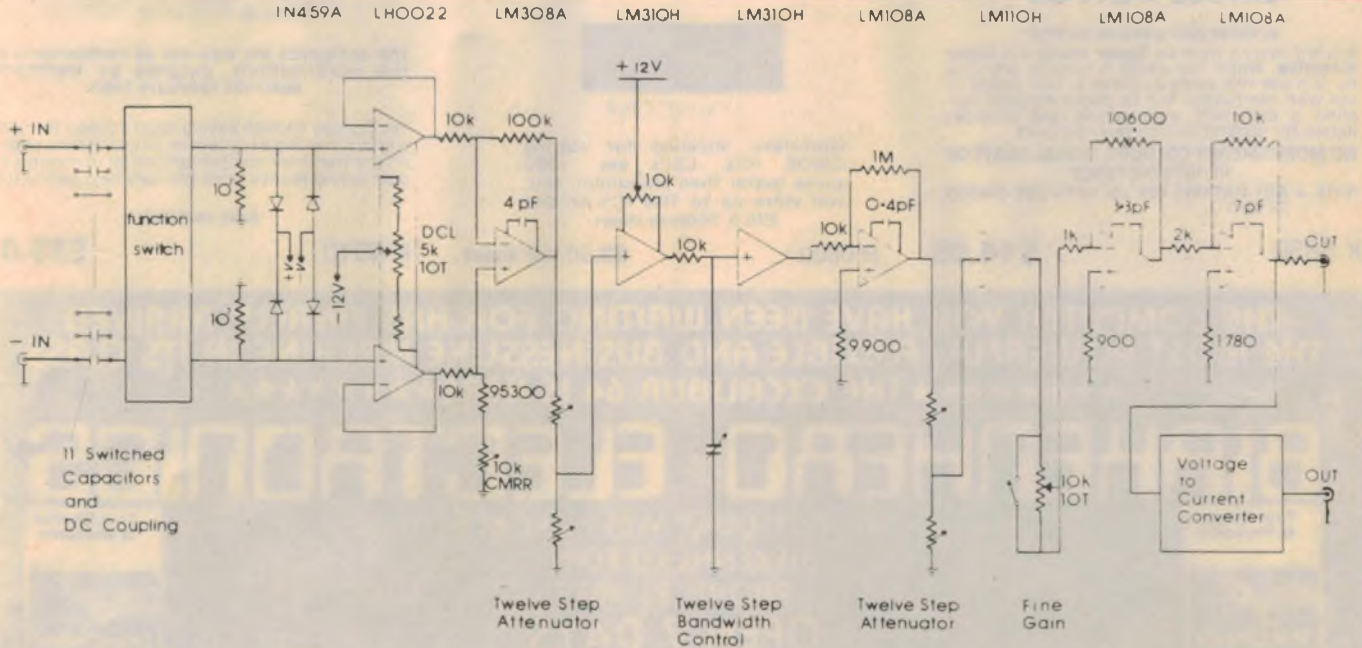


Fig. 16: abbreviated circuit for high gain DC-coupled amplifier (gain 50-50,000; bandwidth DC to 30kHz).

BIRKENHEAD ELECTRONICS

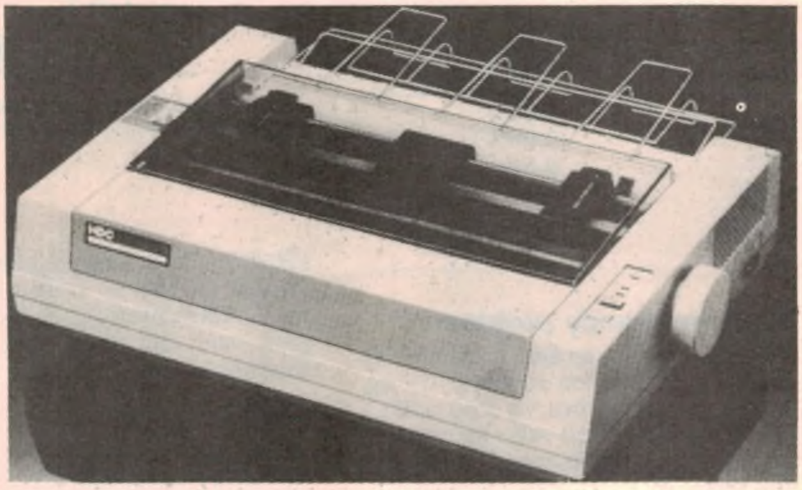
THE MOST comprehensive range of Altronics Products
outside of Western Australia.

FT-5000 Dot Matrix Printer

Low-cost and reliable
with graphic capability
Elite, Pica typefaces
Enhanced with selectable
62 characters memory capacity
100 CPS & MUCH MORE

FOR
VERY
LITTLE WAS $550

NOW **$499.50**



VIDEO AMPLIFIERS

Video has been booming for quite a while, finally a range of video accessories in kit form.
Two video amplifiers for both VCR and Computer use, a brand new **Video Enhancer** and our popular **VCR Stereo Synthesizer**. All four represent outstanding value for money and all are assembled with **Altronic's Extra Care**.

SINGLE OUTPUT

INVERSE AND NORMAL OUTPUT

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

NO MORE SMEARY COLOURS, SIGNAL BEATS OR RF INTERFERENCE

NOTE ★ **NOT SUITABLE FOR USE WITH LIVE CHASSIS TV SETS.**

K 5850 . . . . **$14.95**

VIDEO ENHANCER

Here's a **simple** but **effective** video Enhancer that is super **easy to build** at a fraction of the cost of commercial models.
Unit sharpens picture detail, and can actually improve the quality of a copy by amplifying the top end of the video signal.

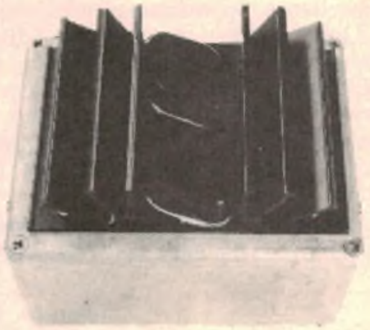
AT LAST A VIDEO ENHANCER KIT

K 5825 . . . . **$35.00**

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

H 0600 **$3.50 per sheet**

TRANSISTOR ASSISTED IGNITION WITH DWELL EXTENSION



The ALTRONICS Kit includes all components for the modifications, detailed by Electronics Australia February 1983.

Yes, it's bad enough paying $2.00 a gallon for petrol without wasting a fortune on an out of tune engine. Fit this transistor assisted ignition kit in minutes and start saving money from the very next petrol stop.

Easy to Build!

K 4010 . . . . **$35.00**

THE COMPUTER YOU HAVE BEEN WAITING FOR HAS FINALLY ARRIVED
THE MOST POWERFUL, FLEXIBLE AND BUSINESSLIKE MACHINE IN ITS CLASS
★★★★★★★★ THE EXCALIBUR 64 IS HERE ★★★★★★★★★

BIRKENHEAD ELECTRONICS

Your Cheque Is Welcome
TeleCheck

SHOP 71 QUAY WEST ARCADE
BIRKENHEAD POINT
PHONE: 81-4077
OPEN 7 DAYS

Your Cheque Is Welcome
TeleCheck

As a basis for comparison of different designs, it is common practice to express the drift of a stage as the measured offset at its output divided by the stage closed loop gain. This is called *"offset referred to the input"*. It assumes that the offset at the output is simply the offset of the front end junctions amplified by the stage gain.

While reduction of bandwidth does reduce noise, it has no effect on offset in a DC-coupled amplifier system. We have two choices: either cleverly design the stage so that the offset is insignificant, or invent some ingenious offset correction scheme. For the time being, we will consider the first choice only. The latter scheme is used in *chopper amplifiers* and will be discussed next month.

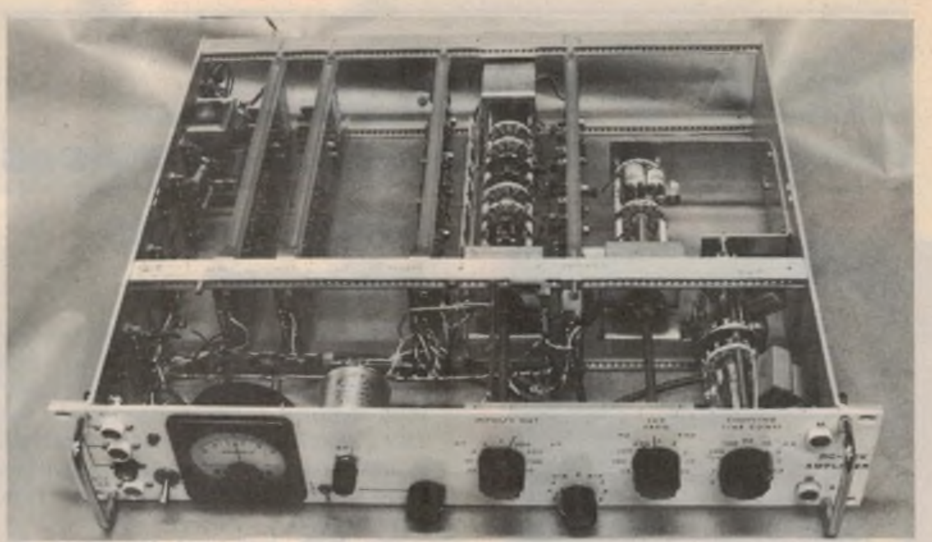


Fig. 17: practical realisation of the circuit shown in Fig. 16.

Pure DC amplifier

Figs.16 and 17 depict a pure linear amplifier with bandwidth from DC to 30kHz (reducible by switching if required); overall gain switchable from 50 to 50,000; and switchable AC or DC-coupling of the inputs. Two potentiometers were used to initially set the output of the amplifier to zero. The drift rate achieved (less than 60µV after warm up) is extremely small for a pure amplifier — see Fig.18.

The term *pure amplifier* means that this circuit contains no tricks. It is a simple linear system that achieves low DC offset by dint of careful design and stable DC supply rails. All components were carefully chosen for high-stability, while the low current drain assures cool operation.

Each stage in Fig.16 is an excellent example of current op amp design practice. The four diodes following the function switch provide input stage protection, the LH022s act as unity gain high input impedance voltage followers, and the LM308A provides a gain of −10.

All LM310 and LM110 stages are unity gain voltage followers and are used to provide high stage input impedance following an attenuator or filter. The leftmost LM108A provides a gain of −100 while the two LM108As at the right provide gains of −10 (variable) and −5. Total overall gain with attenuators at maximum, is the product from left to right:

Gain = (+1) (−10) (+1) (+1) (−100) (+1) (−10) (−5) = +50,000.

Note that the bandwidth of the amplifier is maintained by carefully selecting the compensation capacitor for each stage, the value chosen being close to 33pF/(stage gain). Four design criteria essential for achieving low drift are used in Fig.16:

- Each gain stage input has a path to ground (or to a low impendance output point) not greater than 11kΩ.
- Each unbalanced amplifier stage (LM108A) has the signal applied to its inverting input and a compensating resistor connecting from its non-inverting input to ground. This compensating resistor is equal to the parallel resultant of the input resistor and the feedback resistor.

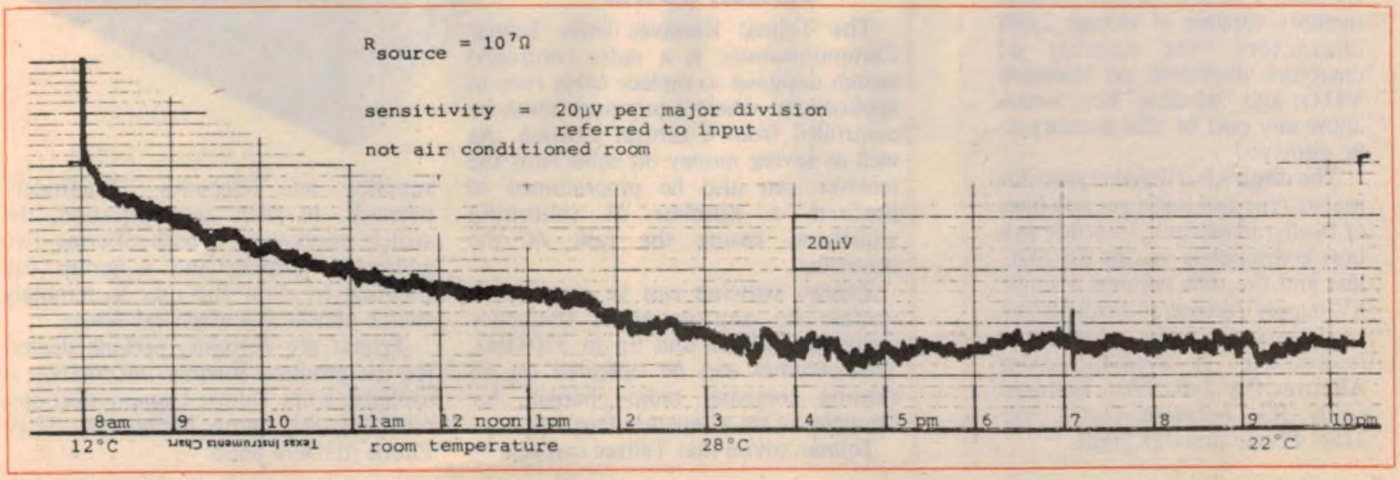
The reason for the compensating resistor is as follows. Because all gain stages have an input bias current, a small DC voltage is present on each LM108A input when the input resistor is connected to 0V. This spurious voltage is not only affected by temperature changes but is amplified along with the wanted signal. The compensation resistor cancels this effect by introducing an equal voltage on the non-inverting terminal.

Thus, the first LM108A stage in Fig.16 uses a 9.9kΩ compensating resistor which is the parallel resultant of R_i = 10kΩ and R_f = 1MΩ.

- Stable ±12V regulators are used to provide the supply rails. The supply voltage drifts from its nominal value by no more than 100µV.
- All resistors used are 1% metal film types.

So endeth the fourth lesson. Next month we will take a look at differential inputs and examine some very clever tricks used when even higher gain and lower DC offsets are necessary.

Fig. 18: measured drift rate for the DC-coupled amplifier shown in Fig. 17 and 18 (see text).



New Products...

Product reviews, releases & services

Portable terminal for hand-held data entry

Alfatron Pty Ltd has announced a new portable terminal, the Profort 801, a compact unit which fulfils the same functions as a conventional video display terminal. Features include a buffer memory capable of storing 2,048 characters (the number of charcters displayed on ordinary VDTs) and "window" keys which allow any part of this memory to be displayed.

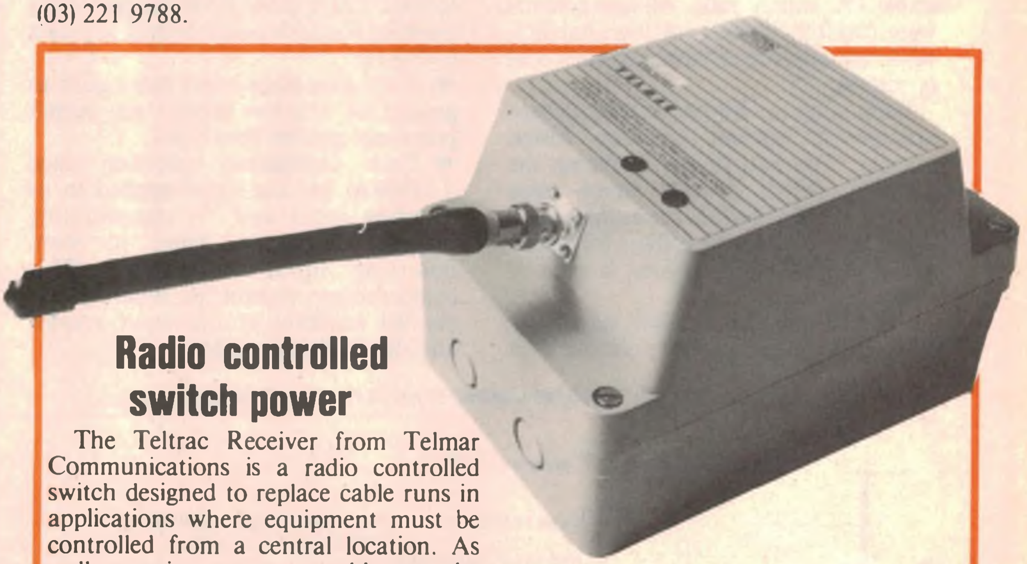
The display is a liquid crystal dot matrix type and reads out two lines of 16 characters each. Interface to a host computer is via an RS-232C line and the unit requires a single 5V supply connected through the serial interface. Further information is available from Alfatron Pty Ltd, 1761 Ferntree Gully Rd, Ferntree Gully, Vic 3156. Phone (03) 758 9000.

Versatile laser bar code scanner

Intermec has released a new laser bar code scanner for industrial and commercial applications. The new Laser 1600 features a helium-neon laser and optics which allow codes to be scanned on flexible and curved surfaces as well as labels which are hard to reach with pen-type readers.

The high scan rate (40 scans per second) means that even dirty or smudged labels can be read correctly in most cases, while legible labels allow an increased throughput as scanning time per label is considerably reduced. Low density codes can be scanned from up to 30cm from the reader and the depth of field of the scanner means that no special techniques are required of operators.

The 1600 can also be mounted in a fixed position and triggered by remote control for applications such as conveyor belts and automated warehousing. Further information is available from Intermac Australia Pty Ltd, 9 Woodbine Court, Wantirna, Vic. 3152. Phone (03) 221 9788.



Radio controlled switch power

The Teltrac Receiver from Telmar Communications is a radio controlled switch designed to replace cable runs in applications where equipment must be controlled from a central location. As well as saving money on cable runs the receiver can also be programmed to perform a number of switching sequences, easing the task of the controller.

Taltrac switches can be supplied to operate on any permitted frequency including 27MHz and up to 520MHz. The switches can be operated on an existing company radio channel, for example, or on a separate frequency.

Telmar advise that Teltrac can also be supplied on Telecom's "Telefinder" network. In such an application, the switch appears as a page offering two addressed outputs and a group call function to allow the user to remotely switch almost any electrical device.

Telmar are currently seeking dealers for the product. Further information is available from Telmar Communications, 604 City Rd, South Melbourne, 3205. Phone (03) 690 8666.

New chips for stepper motor control

Ellistronics now has available the new SGS L297 stepper motor controller and the L298 dual bridge driver, described as the "simplest, most compact and efficient way" to drive bipolar stepper motors.

Together with a few passive components, the two chips form a complete microcomputer-to-stepper motor interface with simple step and direction inputs and drive capability of up to 200W. The combined unit directly drives motors at up to 2A and 46V per phase using a pulse width modulation scheme. Applications include carriage positioning in computer printers or control of machine tools, while for light duty applications the L298 can be replaced with the L293E, a dual bridge rated at 1A/36V per bridge.

For further information contact Ellistronics Pty Ltd, 797 Springvale Rd, Mulgrave, Vic 3170. Phone (03) 561 5844.

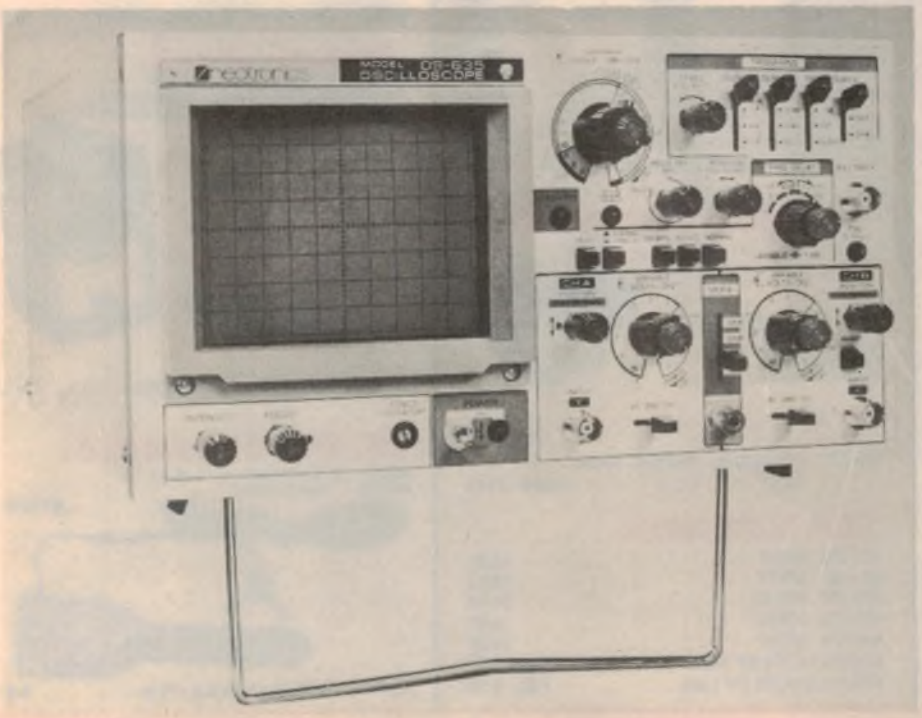
New test gear released by Neotronics

Neotronics now has available the Model OS 635 dual trace 35MHz oscilloscope with a 150mm rectangular tube providing an effective display area of 8 × 10 divisions (one division equals 10mm). The vertical deflection range is 5mV/div to 10V/div and can be increased to 1mV/div at reduced bandwidth. Four sweep modes are available: normal, auto, single and delayed trigger. In the delayed trigger mode a delay of from 100ms to 1μs is available.

Also available from Neotronics are the new Aaron model MM-220 and MM-230 3½-digit digital multimeters. The hand-held units feature automatic ranging on AC, DC and resistance, a diode test facility and audible continuity tester. Voltage measurement ranges are from 200mV to 1000V DC and from 200mV to 750VAC. Resistance ranges are from 200Ω to 20MΩ and AC and DC current ranges from 200μA to 10A. Both models are based on a custom-made 80-pin LSI chip.

Overload protection is standard (except on the 10A range) and includes transient protection to 6kV. On the voltage ranges maximum input is 1100V while resistance ranges can handle a maximum 250V. Two type AA batteries are used to power the instruments, with typical battery life quoted as around 500 hours.

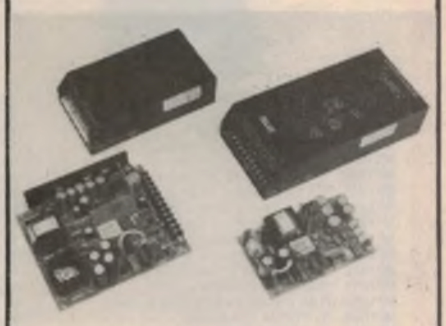
An 8-page catalog on the range of Neuberger panel meters is also available from Neotronics. Full specifications and pricing deatils are included in the manual. For details of Neotronics oscilloscopes, multimeters and other test equipment contact Neotronics, PO Box 289, Newport, NSW, 2106.



NEW!

LOW COST SWITCHERS

Here is a range of switching power supplies for the budget conscious user. They are designed especially for micro to medium computer systems and use a series flyback design to provide multiple outputs.



Model	Outputs	Output	Max. power	Price
HSC40-20	5V 3A, 12V 2.5A	open frame	40 Watt	$60
HSC40-31	5V 2.5A, 12V 2A, −12V 0.25A	open frame	40 Watt	$60
HSC55-41	5V 6A, −5V 0.5A, 12V 2.5A, −12V 0.5A	enclosed	55 Watt	$80
HSC75-32	5V 3A, 24V 2.2A, −12V 0.2A	open frame	75Watt	$95
HSC125-40	5V 10A, 12V 3.5A, −12V 0.5A separate 12V 2.5A	enclosed	125 Watt	$150

- Short circuit protection
- Over power protection
- Input surge protection
- 90-130V or 180-260VAC user selectable
- Input frequency 40-440Hz
- Overvoltage protection

ALL PRICES PLUS SALES TAX AND FREIGHT.

DELIVERY FROM STOCK

AMTEX
ELECTRONICS

A DIVISION OF TELCON
AUSTRALIA PTY LIMITED

36 Lisbon Street,
Fairfield NSW 2165

Telephone (02) 728 2121.
Telex 27922.

SAVE 20% THIS MONTH SAVE 20% THIS MONTH SAVE 20% THIS MONTH

TRANSFORMER AND PLUG PACKS

TAKE 20% OFF ALL THESE PRICES THIS MONTH ONLY

OFFER EXPIRES JULY 15, '84

ECONOMY IMPORTED MODELS

		1-9	10+
M12155	Trans 240V 6-15V 1A tapped	$5.95	$4.95

M12156	Trans 240V 6-15V 2A Tapped	$7.95	$6.95

M12851	Trans 240V 12.6V CT 150MA	$3.95	$2.95

M16672	Trans 240V 15-30V 1A Tapped	$8.95	$7.95

FERGUSON TRANSFORMERS

PRINTED CIRCUIT BOARD MOUNTING

M21002	PL9/5VA 4.5-0-4.5V @ 0.56A	9.95
M21004	PL12/5VA 6-06V @ 0.42A	9.95
M21006	PL15/5VA 7.5-0-7.5V @ 0.33A	9.95
M21008	PL18/5VA 9-0-9V @ 0.28A	9.95
M21010	PL24/5VA 12-12V @ 0.21A	9.95
M21012	PL30/5VA 15-0-15V @ 0.17A	9.95
M21014	PL40/5VA 20-0-20V @ 0.1A	9.95
M21016	PL161/5VA	13.95
M21024	PL18/12VA 9-0-9V @ 0.67A	14.95
M21026	PL24/12VA 12-0-12V @ 0.5A	14.95
M21028	PL30/12VA 15-0-15V @ 0.4A	14.95

LOW PROFILE CHASSIS MOUNTING

M21030	PL12/20VA 6-0-6V @ 1.67A	17.95
M21032	PL15/20VA 7.5-0-7.5V @ 1.33A	17.95
M21034	PL18/20VA 9-0-9V @ 1.11A	17.95
M21036	PL24/20VA 12-0-12V @ 0.83A	17.95
M21038	PL30/20VA 15-0-15V @ 0.67A	17.95
M21040	PL40/20VA 20-0-20V @ 0.50A	17.95
M21042	PL1.5-18/20VA 1.5-18V @ 1.11A	27.95
M21044	PL12/40VA 6-0-6V @ 3.33A	19.95
M21046	PL15/40VA 7.5-0-7.5V @ 2.67A	19.95
M21048	PL18/40VA 9-0-9V @ 2.22A	19.95
M21050	PL24/40VA 12-0-12V @ 1.66A	19.95
M21052	PL30/40VA 15-0-15V @ 1.33A	19.95
M21054	PL40/40VA 20-0-20V @ 1.0A	19.95
M21056	PL30-9/40VA 15-0-15 & 9V for MP	27.95
M21058	PL12/60VA 12V @ 5.0A	24.95
M21060	PL15/60VA 15V @ 4.0A	24.95
M21062	PL18/60VA 9-0-9V @ 3.33	26.95
M21064	PL24/60VA 12-0-12 @ 2.5A	26.95
M21066	PL30/60VA 15-0-15 @ 2.0A	26.95
M21068	PL/4060VA 20-0-20 @ 1.5A	26.95
M21070	PL30-9/60VA	29.95

GENERAL PURPOSE TRANSFORMERS
Conventional Construction

Universal Mounting Brackets

M21090	PF2565 12.6-0-12.6 @ 0.5A	28.50
M21092	PF 3577 28-0-28V @ 2A	37.50
M21094	PF3783 35-0-35V @ 5.0A	79.95
M21096	PF3787	26.50
M21098	PF3788 30V, 27V, 24V, 18V, 6V @ 4A	47.50
M21100	PF3993 20-0-20V @ 1.5A	29.50
M21102	PF4244 16-0-16V @ 9A	53.50
M21104	PF4354	69.50
M21106	PF4361/1 35-0-35V @ 2.5A	47.50
M21108	PF4362 35-0-35V @ 4A	59.50
M21110	PF4363 47-0-47V @ 3A	59.50
M21112	PF4673	52.50
M21114	PF4405 9v @ 10A	49.95

A.C PLUG PACKS

A.C. Plug Adaptor

M21140	PPB4/1000 AC Plug Pack	19.95
M21142	PPB8/1000 AC Plug Pack	19.95
M21144	PPB12/500 AC Plug Pack	19.95
M21146	PPA12/670 AC Plug Pack	18.95
M21148	PPA12/450 AC Plug Pack	18.95
M21150	PPC12/1250 AC Plug Pack	24.95
M21152	PPC18/830 AC Plug Pack	24.95

ARLEC TRANSFORMERS

Series AL7VA

M21180	AL7VA/6V 6V @ 1.16A	9.95
M21182	AL7VA/9V 9V @ 0.77A	9.95
M21184	AL7VA/12V 12V @ 0.58A	9.95
M21186	AL7VA/15V 15V @ 0.46A	9.95
M21188	AL7VA/18V 18V @ 0.38A	9.95
M21190	AL7VA/24V 24V @ 0.29A	9.95
M21192	AL7VA/30V 30V @ 0.23A	9.95
M21194	AL7VA/40V 40V @ 0.18A	9.95

CONVENTIONAL

M21200	2150 6.3V @ 2.5A or 12.6V @ 1A	24.95
M21204	5502 22V @ 2.5A or 44V @ 1.25A	22.50
M21206	5503 17V @ 11.5V @ 4A	34.50
M21208	5504 15V @ 2A	14.95
M21212	5508 6.3 @ 4A or 12.6 V @ 2A	22.50
M21214	5578 Stepdown 115V 40VA	43.50
M21216	5579 6.3V AC @ 1A	7.95
M21218	5755 40V AC CT @ 2A	17.95
M21222	6625 25V AC @ 0.5A	9.50
M21228	7243 4 Tapes, 19V to 50V @ 2A	37.50
M21230	7309 12V AC @ 2.5A	17.50
M21234	7311 24V AC @ 4.2A	29.40
M21238	9585 240V AC-240V AC @ 1A	67.50
M21240	9789 240V AC-240V AC @ 2A	159.00
M21246	60202 7 Taps, 12V-30V @ 3A	34.50
M21248	60203 2X15-30V @ 2A	39.50
M21250	60291 12.6V @ 7A or 25.2v @ 3.5A	29.50

MODEM TRANSFORMER

PCB pins, spacing 25mm, Equipment to Line, 15mm between Equipment pins, 25mm between Line pins.

		1-9	10+
M10230	600-6000HM (45035) Modem Trans	19.50	17.50

AUDIO TRANSFORMERS

M21120	OP590		49.50
M21122	OP592		39.50
M21124	MT522		39.50
M21126	MT620		9.95
M21128	MT627		14.95
M10216	1KCT/8 O/P Trans	1.00	0.90
M10226	500CT/8 O/P Trans	1.00	0.70

PLUG PACKS

Power Pack

240V AC to 3, 4.5, 6V DC — 300mA 1.6 metre cord with unique plug adaptors Sizes, 2.5, 3.5 phone plug and 2.5mm DC plug

M19003

$9.95

M19003	Plug Pack 3, 4.5, 6V-300MA	*9.95*

240V AC to 3, 4.5, 6V DC — 300mA 1.6 metre cord with unique plug adaptors Sizes, 2.5, 3.5 phone plug and 2.5mm DC plug

M19001

$9.95

M19001	Plug Pack 6, 9, 12VDC—300MA	9.95

Power Pack

240V AC to 6, 9, 12V DC — 500mA 1.6 metre cord with unique plug adaptors Sizes, 2.5, 3.5mm phone plug and 2.5mm DC plug

M19005

$14.95

M19005	Plug Pack 6, 9, 12V-500Ma	14.95

DC/DC Convertor

800mA 6, 9, 12V with multi-plug adaptor — fused output

M19020

M19020	DC/DC Plug Pack 6,9-12V in	9.95

BARGAIN PRICES AT ROD IRVING ELECTRONICS

ROD IRVING ELECTRONICS, 425 High St, Northcote, Vic; 48-50 A'Beckett St, Melb, Vic. Phone (03) 489 8866, (03) 489 8131. Mail Order Hotline (03) 481 1436.
Mail Orders to P.O. Box 235, Northcote 3070, Vic. Minimum P&P $3.00. Errors and omissions excepted.
Please address tax exempt, school, wholesale and dealer enquiries **RITRONICS WHOLESALE,** 1st Floor, 425 High St, Northcote 3070, (03) 489 7099, (03) 481 1923, Telex AA38897.

New Products...

New switchmode power supplies

Scientific Electronics has released details of their newest power supply, the switch mode SM45AD1. Designed and manufactured by the company, the new supply has four output rails providing a total capacity of 45W.

Standard outputs are +5V at 4A, +12V at 1.5A, −12A at 0.5A and −5V at 0.1A, but output rails to customer specifications are also available. All outputs are protected against short circuits and the positive rails have over-voltage protection.

The SM45AD1 meets Telecom specification 1302 for test equipment, with isolation greater than 3.5kV and efficiency claimed as better than 70% at full load. Dimensions are 85 × 254 × 60mm. As with all power supplies from Scientific Electronics, the SM45AD1 is supported by a five year warranty and local technical back-up.

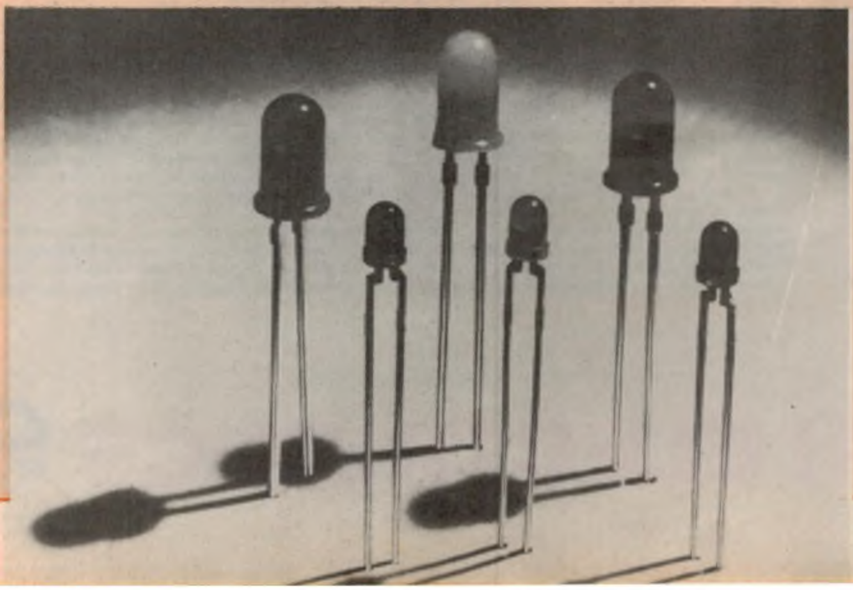
Scientific Electronics has also added to its range of "Invert-A-Lite" modules with new 18W and 36W units designed for low energy slimline fluorescent fittings. The new solid-state inverters are available to operate from 12V to 24V DC supplies and are fully encapsulated. Features include screw terminals for easy installation, quick start, and protection against reverse polarity inputs or unloaded outputs. No ballast or starter need be used with the inverters.

Other inverters are also available with outputs of from 8 to 40W and input voltages from 6 to 110V (although some units are only available on special order). For further information contact Selectronic Components Pty Ltd, 25 Holloway Drive, Bayswater, Vic. 3153. Phone (03) 762 4822.

More LEDs with in-built resistors

Hewlett-Packard has expanded its range of resistor-LED lamps with 5V and 12V types, in T-1 and T1¾ packages, in high efficiency red, yellow, green and standard red. The LED's save space and cost because they incporate current limiting resistors as an integral part of the package. TTL and battery-operated circuits are particularly suitable for applications of HP's Series 1100, 1600 and 3100 and 3600 LEDs.

For further information contact Hewlett-Packard Australia Ltd, PO Box 36, Doncaster East, Vic 3109. Phone (03) 895 2895.



NEW REVOLUTIONARY 3D TV $135

NOW A KIT TO CONVERT YOUR COLOUR TV SET TO GIVE A THIRD DIMENSIONAL EFFECT ON THE SCREEN!

Make the Olympic Games something to be remembered.

Can be fitted to any RGB drive colour TV via 4 leads An illuminated switch is provided to switch the process on and off Two pairs of Carl Zeiss custom made red and cyan spectacles are provided with each kit The TV red signal amplitude ideally should be 4 to 10 V but the adaptor can handle up to 200V max via a plug fitted on the unit There are three preset controls to match the ABDY adaptor unit precisely to the biassing conditions of the red amplifier, input load, output load and bias impedance The adaptor unit produces 0.7 us delay in the red amplifier to the picture tube cathode The kit employs the latest electronics to update your TV to the anaglyphic by delay process to give 3D in colour

$135.00 tax incl.
(plus $6.00 for p.and p.)
Our technicians can fit it for you for only $35.00.

MAIL ORDERS TO:
P.O. Box W245, Warringah Mall,
Brookvale, N.S.W. 2100
Bankcard Welcome.

For more information please send in for a brochure or call in for a demonstration at

abdy® AUSTRALIA

70 Wanganella St.
BALGOWLAH
(02) 949 7703

DICK SMITH ELECTRONICS

No 1

and proud of it!

Others can claim all sorts of things. But don't be conned by the Johnny-come-latelys with their "I'm alright Jack" attitude!

1st *with direct import prices — cutting out the middleman!*

1st *with 14 day satisfaction guarantee — no risk!*

1st *with **reliable** mail orders: over 75,000 regular customers cannot be wrong!*

1st *with a **choice** of delivery: from post to air express, we've got the lot.*

1st *to guarantee 24 hour mail order despatch (we've had customers from Western Australia **receive** their orders less than 24 hours after placement!*

1st *with order-by-phone (not just the first in electronics, either: the first company to offer Bankcard ordering by phone in Australia!)*

1st *to completely computerise electronic mail orders: offering fantastic speed and service. accuracy.*

1st *to include a catalogue **free** in the electronics magazines -and our enthusiast's catalogue is still regarded as far and away the best in Australia!*

1st *to give bulk discounts to **everyone** - not just the trade!*

1st *to expand interstate and overseas - with even more expansion planned! (The others are still lost trying to find their own backyards!)*

1st *to set up a network of stores and re-sellers right across Australia and New Zealand: you're never far from friends!*

1st *to give the customer the advantage of unbelievable buying power - you reap the benefit.*

STORE LOCATIONS

NSW	Cnr. Swift & Young Sts.	**ALBURY**	**21 8399**
	Parramatta Rd & Melton St	**AUBURN**	**648 0558**
	T55 Terrace Level	**BANKSTOWN SQ**	**707 4888**
	613 Princes Hwy	**BLAKEHURST**	**546 7744**
	Oxford & Adelaide Sts	**BONDI JCT**	**387 1444**
	531 Pittwater Rd	**BROOKVALE**	**93 0441**
	147 Hume Hwy	**CHULLORA**	**642 8922**
	162 Pacific Hwy	**GORE HILL**	**439 5311**
	315 Mann St	**GOSFORD**	**25 0235**
	4 Florence St	**HORNSBY**	**477 6633**
	Elizabeth Dr & Bathurst St	**LIVERPOOL**	**600 9888**
	173 Maitland Rd	**NEWCASTLE**	**61 1896**
	Lane Cove & Waterloo Rds	**NORTH RYDE**	**88 3855**
	George & Smith Sts	**PARRAMATTA**	**689 2188**
	The Gateway, High & Henry Sts	**PENRITH**	**32 3400**
	818 George St	**RAILWAY SQ**	**211 3777**
	6 Bridge St	**SYDNEY**	**27 5051**
	125 York St	**SYDNEY**	**267 9111**
	Tamworth Acde & Kable Ave	**TAMWORTH**	**66 1961**
	263 Keira St	**WOLLONGONG**	**28 3800**
ACT	96 Gladstone St	**FYSHWICK**	**80 4944**
VIC	Creswick Rd & Webster St	**BALLARAT**	**31 5433**
	Cnr Hawthorn Rd & Nepean Hwy	**BRIGHTON (EAST)**	**592 2366**
	260 Sydney Rd	**COBURG**	**383 4455**
	Nepean Hwy & Ross Smith Ave	**FRANKSTON**	**783 9144**
	205 Melbourne Rd	**GEELONG**	**78 6766**
	399 Lonsdale St	**MELBOURNE**	**67 9834**
	Bridge Rd & The Boulevarde	**RICHMOND**	**428 1614**
	Springvale & Dandenong Rds	**SPRINGVALE**	**547 0522**
QLD	293 Adelaide St	**BRISBANE**	**229 9377**
	166 Logan Rd	**BURANDA**	**391 6233**
	Gympie & Hamilton Rds	**CHERMSIDE**	**359 6255**
	Cnr Gold Coast Hwy & Welch St	**SOUTHPORT**	**32 9863**
	Bowen & Ruthven Sts	**TOOWOOMBA**	**38 4300**
	Ingham Rd & Cowley St West End	**TOWNSVILLE**	**72 5722**
SA	Wright & Market Sts	**ADELAIDE**	**212 1962**
	Main South & Flagstaff Rds	**DARLINGTON**	**298 8977**
	Main North Rd & Darlington St	**ENFIELD**	**260 6088**
WA	Wharf St & Albany Hwy	**CANNINGTON**	**451 8666**
	William St & Robinson Ave	**PERTH**	**328 6944**
	Centreway Acde, Hay St	**PERTH**	**321 4357**
TAS	25 Barrack St	**HOBART**	**31 0800**
NT	17 Stuart Hwy	**STUART PARK**	**81 1977**

Dear Customers,

Quite often, the products we advertise are so popular they run out within a few days. Or unforeseen circumstances might hold up shipments so that advertised lines are not in the stores by the time the advert appears. And very occasionally, an error might slip through our checks and appear in the advert (after all, we're human too!) Please don't blame the store manager or staff: they cannot solve a dock strike on the other side of the world, nor fix an error that's appeared in print. If you're about to drive across town to pick up an advertised line, why not play it safe and give them a call first . . . just in case!

Thanks.

Dick Smith Electronics

STORE HOURS

All Dick Smith stores are open for trading during the normal trading hours for their particular area (either 9–5.30 or 8.30–5). Many stores are also open for late night trading. Please ring the store concerned for their particular hours.

bankcard welcome here

SPEEDY PHONE/ BANKCARD ORDER SERVICE

Just phone your order and Bankcard details — it's so simple!

(02) 888 2105

Orders only on this number.

Enquiries: **(02) 888 3200**

HEAD OFFICE & MAIL ORDER CENTER:

P.O. Box 321, North Ryde
NSW 2113
Tel: **(02) 888 3200**

Post & Packing Charges

Order Value	Charge
$5-$9.99	$2.00
$10.00-$24.99	$3.50
$25.00-$49.99	$4.50
$50.00-$99.99	$6.00
$100 or more	$8.00

Terms available to approved applicants through . . .

HFC

100% AND PROUD OF IT'

MAJOR RESELLERS

● **Atherton Qld**: Maarten's Music Centre, 55 Main St 91 1208 ● **Ballina NSW**: A. Cummings & Co. 91-93 River St 86 2285 ● **Bowral NSW**: Barry Gash Electronics, 370 Bong Bong St 61 2577 ● **Broken Hill NSW**: Hobbies & Electronics, 37 Oxide St. 88 4098 ● **Bundaberg Qld**: P.M. Electronics Takalvan St 72 8272 ● **Cairns Qld**: Electronic World Shop 27 K-Mart, Westcourt Plaza, Mulgrave Rd. 51 8555 ● **Campbelltown NSW**: Fishers 'Chip' Shop, Shop 3, 274-276 Queen St, 27 1475 ● **Coffs Harbour NSW**: Coffs Harbour Electronics, 3 Coffs Plaza, Park Ave 52 5684 ● **Darwin NT**: Ventronics, 24-26 Cavanagh St 81 3491 ● **Deniliquin NSW**: Deni Electronics, 220 Cressy St 81 3672 ● **East Maitland NSW**: East Maitland Electronics 99 High St 33 7327 ● **Echuca Vic**: Webster Electronics 220 Packenham St ● **Gladstone Qld**: Purely Electronics Shop 2 Cnr Herbert & Auckland Sts 72 4321 ● **Goondiwindi Qld**: Border T.R.C. 50 Marshall St 71 2353 ● **Gosford NSW**: Tomorrows Electronics & Hi Fi 68 William St 24 7246 ● **Inverell NSW**: Lyn Willing TV 22A Evans St 22 1821 ● **Launceston Tas**: Advanced Electronics 5A The Quadrant 31 7075 ● **Lismore NSW**: Decro Electronics 3A/6-18 Carrington St 21 4137 ● **Mackay Qld**: Stevens Electronics 42 Victoria St 51 1723 ● **Maryborough Qld**: Keller Electronics 218 Adelaide St 21 4559 ● **Morwell Vic**: Morwell Electronics 95 George St 34 6133 ● **Mt Gambier SA**: Hutchesson's Comm. 5 Elizabeth St 25 6404 ● **Mildura Vic**: McWilliams Electronics 110A Langtree Ave 23 6410 ● **Port Macquarie NSW**: Hall of Electronics, Horton Centre, Horton St 83 7440 ● **Nelson Bay NSW**: Dales Dynamics Cinema Mall Stockton St ● **Orange NSW**: M & W Electronics 173 Summer St 62 6491 ● **Port Lincoln S.A.**: Basshams T.V. & Computerworld 22 Liverpool St ● **Rockhampton Qld**: Purely Electronics 15 East St 21 058 ● **Shepparton Vic**: G.V. Electronics Centre 189B Corio St 21 8866 ● **Townsville Qld**: Tropical TV 49 Fulham Rd. Vincent Village 79 1421 ● **Wagga NSW**: Wagga Wholesale Electronics 89 Forsyth St ● **Whyalla SA**: Mellor Enterprises Shop 2 Forsythe St 45 4764

DICK SMITH ELECTRONICS

A766/JL

New Products...

"Zip-on" tubing shields against RFI

Now available in Australia, Zippertubing jackets are flexible cable shields with a zip-lock closure, available in various materials for shielding wire and cables from electromagnetic interference. Standard cable coverings can be combined with a choice of shielding materials, either laminated or sewn inside the jacket. A tinned copper wire braid incorporated in the jacket allows easy connection of ground terminations.

Suggested applications include shielding of cables in communications installations, computer systems and sensitive audio equipment from radiated interference, and the reduction of crosstalk between adjacent cables. The ease of installation of the shielding jackets means that equipment can be treated "in situ" immediately the RFI problem becomes evident.

Zippertubing jackets are distributed in Australia by the Adimex Trading Company, PO Box 219, Ringwood, Vic.

Optical power meter checks lasers

The Ando AQ-1111 Optical Power Meter is a portable device for measuring optical and laser power output. Two types of sensor are available for the unit, one a silicon photodiode sensor for short wavelengths (600 to 1100nm) and the other a germanium type for longer (1000 to 1700nm) wavelength.

Three different display modes are available: watt, absolute level (dBm) and relative level (dB).

Options for the power meter include a GP-IB (IEEE-488) interface, a fibre connector adaptor and a battery pack. The GP-IB interface allows the power meter to be connected to any computer or other automatic control device.

Ando also has available a chopped Light Power Meter and a range of electro-optical converters and LED light sources for optical power measurement applications.

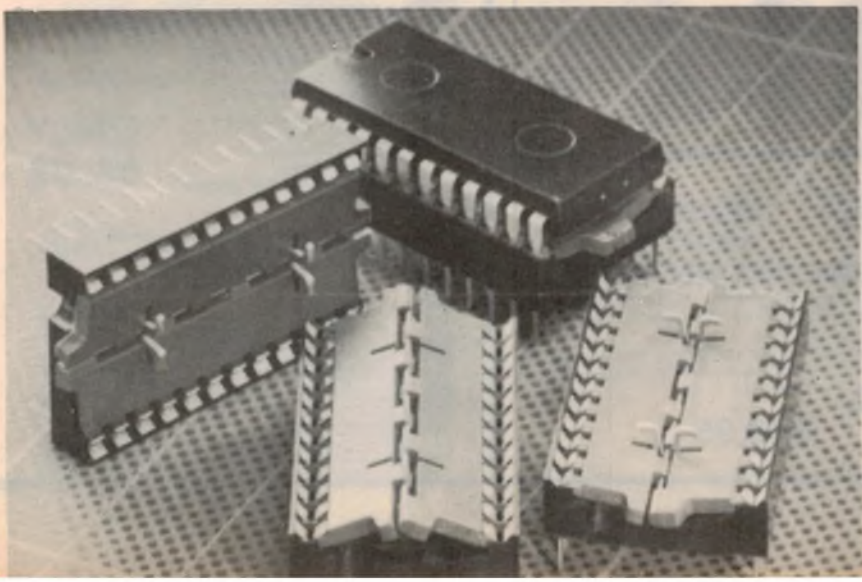
Further information is available from Paton Electronics, 90 Victoria St, Ashfield, NSW, 2131.

Zero insertion force IC socket

Mayer Krieg & Co now has available what is claimed to be the world's first "No Insertion Force" IC socket with dimensions conforming to standard sockets. Compatible size means that the NIF socket can be used in place of ordinary sockets without changing the board layout. High density layouts can be achieved by laying the low profile sockets side-by-side.

The NIK socket is based on a hinged, locking top plate. In use, an integrated circuit is placed on the socket so that it comes to rest on two centrally mounted spacers. When the tabs at the ends of the socket are pressed down the lockplate is activated and clamps the socket contacts against the pins of the chip. No force is exerted on the IC until it is correctly postioned in the socket.

NIF sockets can be supplied in 24, 28, 40 and 48 pin sizes. Further information is available from Mayer Krieg & Co, GPO Box 1803, Adelaide, SA, 5001. Phone (08) 233 6766.



4-CH STAGE CONTROLLER

18 SW/BLE Functions 1000 watts per ch. Rope light ext. built in mic. sw/s Inductive loads. Manual or Auto operation.

$220

HOSE TYPE ROPE LIGHTS

6 Colours practically unbreakable manufactured by our company. 10 metres

$150

4 ARM SPINER

W/Gec 4515 Lamps
240 Volts

$240

PIN SPOTS

W/Gec 4515 Lamp
240 Volt

$49

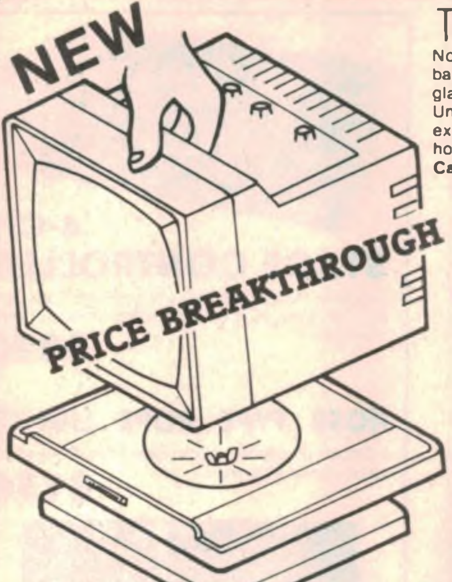
REHEARSAL STUDIOS NOW AVAILABLE

For brochures and Price List

Cashmore Enterprises Inc Pty Limited

356 Liverpool Rd, Ashfield 2131
(02) 798 6782 (02) 799 6129

HIRE — SALES — INST — SERVICE
PA SYSTEMS — DISCO'S — LIGHTING
SPECIAL EFFECTS

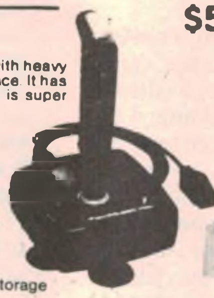


TILT-BASE FOR MONITORS

Now you can mount your monitor on a swivel/tilt base to maximise the viewing angle (and reduce glare) of your computer monitor.
Until now tilt bases were expensive or only fitted to expensive monitors. Now you can have one in your home for under $30!!!
Cat. XM-4540

$29.95

JOYSTICKS



These quality units are the self centering type with heavy duty suction cups which definitely keeps it in place. It has silver plated switch contacts, a pistol grip and is super responsive.

Cat. XA-5630 without plug
$19.50
Cat. XA-5610 suit MicroBee
$29.50

MICRON DATA CASSETTE

A recorder designed soley for the purpose of data storage now at an unbelievable price.

- Slide volume control a must for quick checking of levels
- tape counter a must for easy location of programs
- Inbuilt piezo transducer enables you to listen to tape

6V DC operation - use with MP-3010 plug pack ensures low hum level (optional $12.50)
- Robust construction of both internal mechanism's and external case.

Cat. XC-4900

$49.50

NEW

ONLY

$59.95

FLOPPY DISK STORAGE CASE

Fantastic price breakthrough. A must for serious P.C. users. Will take up to 50 x 5¼" floppies in sets of 10. Compartments lift up and lock in place for easy identification of disk files. ABS resin case. Dimensions: 400mm long 180mm wide by 170mm high. Translucent plastic lid. Quality!
Cat. XC-4780

REMEMBER! Some items are in such short supply that you may miss out. When you order hardware or software, please specify 2nd and 3rd alternatives to avoid total disappointment.

SAVE $100

SUPER 80/AMUST DP80

MASSIVE SCOOP PURCHASE has enabled us to bring you a quality 80 CPS Matrix Printer at our lowest price ever!
We expect these to sell **FAST** so get in **EARLY** to avoid disappointment!

Your "Super 80" printer will enable you to print **letters, reports, graphics generated pictures**, etc. and importantly for the programmer Hard copy of **program listings**.
Operating under software control from any general purpose micro-computer the Super 80 features **13 different print types** including emphasized (LETTER QUALITY). **Bidirectional print action** ensures **smooth, quiet operation.**
228 ASCII CHARACTERS, HANDLES 4" to 10" PAPER - STANDARD CENTRONICS INTERFACE
Cat. XP-4600

NORMALLY $499 SAVE $100
NOW $399

ASK FOR A NEW CATALOGUE!!

Mail Order customers, if you have not seen our new catalogue, boy are you missing out! If, (or when) you next buy from us by mail order just ask for a catalogue. It will be sent FREE with your order! If you have one and want one for a friend, that's fine too! Just ask'

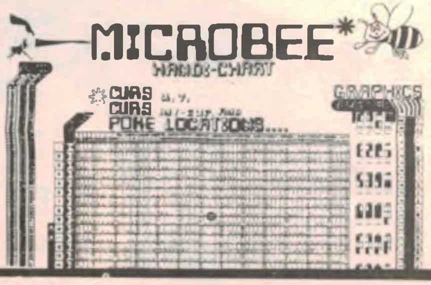
MICROBEE HANDY CHART

This great new wall chart is a must for every MicroBee owner. It measures 600mm x 740mm.
It gives:

- ★ Screen Poke locations
- ★ Graphic codes
- ● ASCII equivalents
- ★ Memory map
- ● Expansion socket pinouts

Cat. XB-9400

ONLY
$6.95



AT LAST! "CENTRONICS" PRINTER CABLE FOR MICROBEE

At last a ready-built cable (1 metre long) which enables you to plug your MicroBee straight into a Centronics-type printer!
Cable assembly includes interface electronics (74-LS123) in the rear of the Centronics plug. A Cannon 'D' plug is at the other end.
Cat. XP-4650

$49.95

MICROPROFESSOR SELLOUT
BELOW COST!!!

Once only bargains on the MPF-II. All prices are **35% off** our normal and are **below our cost.** Only a few of each item available. Personel shoppers must telephone first!!

Cat. No	Description	Normal	Special
YC1300	MPF-II 64K Colour	$399	$259
YC1304	Joystick	$37.95	$24.50
YC1305	Ext. Keyboard	$60	$39
YC1306	Diskdrive Controller	$72	$46.50
YC1310	Disc Drive	$528	$339
XP4610	MPF-II Printer	$299	$194
YS4202	"Gobbler"	$12.95	$8.40
YS4204	"Panic"	$12.95	$8.40
YS4210	"Beatle"	$12.95	$8.40
YS4212	"Sabotage"	$12.95	$8.40
YS4214	"Head On"	$12.95	$8.40
YS4216	"Autobahn"	$12.95	$8.40
YS4218	"Gomaku"	$12.95	$8.40
YS4220	"X Games"	$12.95	$8.40
YS4220	"Screened"	$12.95	$8.40

This fantastic Microcomputer was reviewed in ETI Oct 1982. They were very enthusiastic about it, the printer and its legal Apple* software compatibility (around 90%). If you always wanted an Apple but just could not afford it, this could be a fantastic opportunity to get the nearest thing at **a fraction** of the normal price!!

* APPLE is the registered trademark of APPLE INC.

COMPUTER CASSETTES

Exceptionally good quality, leaderless blank cassettes in the usual plastic cases.

	C10	
Cat. XC-4710	1-9 $1.20	10 up $1.10
	C20	
Cat. XC-4715	1-9 $1.30	10 up $1.20
	C30	
Cat. XC-4720	1-9 $1.50	10 up $1.40

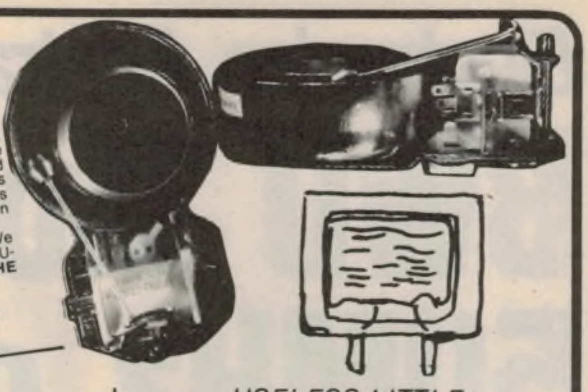
CACOPHONY SALE!!
MASSIVE SCOOP PURCHASE
HUNDREDS OF APPLICATIONS
FROM ONLY 75¢!!!!

Jaycar has bought the entire surplus stock of a coaxially mounted electric bell - as used in the Telecom 'Gondola' telephone! This unique bell is actually TWO bells - one mounted coaxially inside the other. The striker is mounted between the rims of the bells and is electromechanically driven. The unit runs on AC from about 17-48V.

The exciting part, however, is the price!! We purchased the bells FAR BELOW MANUFACTURERS COST - so **YOU REAP THE BENEFIT!!**

Cat. LA-5270

START YOUR OWN CACOPHONY!!
1-9 $1.50 ea: 10-24 $1.25 ea:
25-99 $1.00 ea: 100+ 75¢ ea



IEC-320 STYLE 240V LINE CORDS
½ NORMAL PRICE!

Scoop buy of 3 wire mains cords with IEC-320 style line socket moulded on one end. NORMALLY $3.95

SCOOP BUY PRICE $1.98 each (June only)

Cat. WM-4522

ASK FOR A NEW CATALOGUE!!

Mail Order customers, if you have not seen our new catalogue, boy are you missing out! If, (or when) you next buy from us by mail order just ask for a catalogue. It will be sent FREE with your order! If you have one and want one for a friend, that's fine too! Just ask!

USELESS LITTLE
TRANSFORMERS

Help us get out of a dilemma!! What are we going to do? we purchased the entire manufacturers stock of what is basically a transformer with fairly limited applications. It is small (measuring 25x19x18mm) and has a ferrite core. The primary has 1300 ohms (not centre tapped) and secondary 8 ohm impedance. We estimate that it could pass about 800mW before saturation.

WE HAVE 15,000 OF THEM!!!
So we have a dilemma!
You can have a BAG OF 10 FOR $2.00
You can have a BAG OF 50 FOR $5.00
You can have a BAG OF 100 FOR $8.00
You can have a BOX OF 1000 FOR $50.00!!
THAT'S AS LOW AS 5 CENTS EACH!!

Cat. MM-2540

CAR COMPUTER—PRICE SLASHED!
— HUGE SCOOP PURCHASE —

BELOW MANUFACTURER'S COST!!

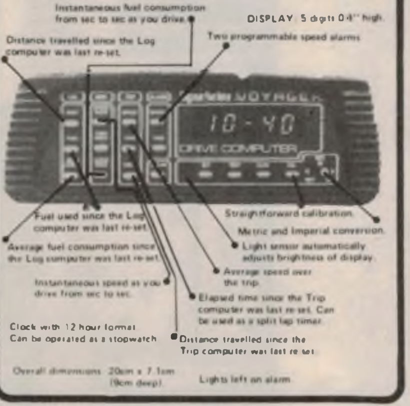
ONLY $125 COMPLETE
MASSIVE SAVING OF $74

AS REVIEWED
OCT '82
EA (p.26-28)
ETI NOV '82 (p.26)

CAT. XC2010

NEW IMPROVED MODEL!

VOYAGER OPERATING FEATURES



The Voyager is available from the following dealers at your convenience:

Jaycar Sydney (City)	264 6688/267 1614
Jaycar Concord	745 3077
Jaycar Carlingford	872 4444
Jaycar Hurstville	570 7000
Zap Electronics	Parramatta Hornsby
Rod Irving	
Melb A'Becket St	(03) 347 9257
Northcote	(03) 489 8131
Altronics Perth	(09) 328 1599

or by mail order to
Jaycar
Box 185
Concord 2137

Mail Order By
BANKCARD
Via Your Phone

FULL 90 DAY WARRANTY

At $199 the Voyager Car Computer represented absolutely outstanding value for money. No one else had such a low priced, **FULL FUNCTION** car computer. The Voyager is the only low-cost unit that will give you full consumption (the most important feature in a car computer) in both metric litres 100km **AND** good old **MILES PER GALLON!**

At $199 many, many hundreds have been sold. **NOW** you can grab one **absolutely complete** for only $125 — a saving of 37% or $74!

The Voyager comes absolutely complete with all fitting hardware — even down to a roll of insulation tape! Installation generally takes between 4 and 6 hours depending on vehicle.

Spare Flow Sensors: Jaycar will be supporting this product for many years to come. To avoid problems changing cars, why not buy a spare fuel flow sensor? They are about the only things that wear out.

Cat. XC2036

ONLY **$29.50**

Jaycar Incorporating **ELECTRONIC AGENCIES**

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

NUMBER 1 FOR KITS

POST AND PACKING CHARGES

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

"Free INSURANCE for Road & Registered Post over $200"
All heavy or bulky items (over 20kg.) sent Comet Road Freight $12.00 anywhere in Australia.

SHOP HOURS CARLINGFORD, CONCORD & HURSTVILLE
Mon – Fri 9am – 5.30pm: Sat – 9am – 12pm: Thurs night 8.30pm (Not Concord)
SHOP HOURS SYDNEY
Mon – Fri 8.30am – 5,30pm Sat – 8.30am – 12pm: Thurs night 8.30pm
MAIL ORDERS AND CORRESPONDENCE: P.O. Box 185, Concord, 2137

Mail Order By
BANKCARD
Via Your Phone

Electronics Australia reviews the

BWD Model 821 50MHz oscilloscope

Recently released by BWD, the Model 821 is an Australian-made CRO that offers excellent value for money. Features include 50MHz bandwidth, dual trace operation and comprehensive facilities.

by JOHN CLARKE

Right from the outset, we were impressed with the Model 821 50MHz oscilloscope from BWD Instruments Pty Ltd. BWD is an Australian company that, over the years, has built an enviable reputation for high-quality test equipment. This new CRO will do nothing to tarnish that reputation.

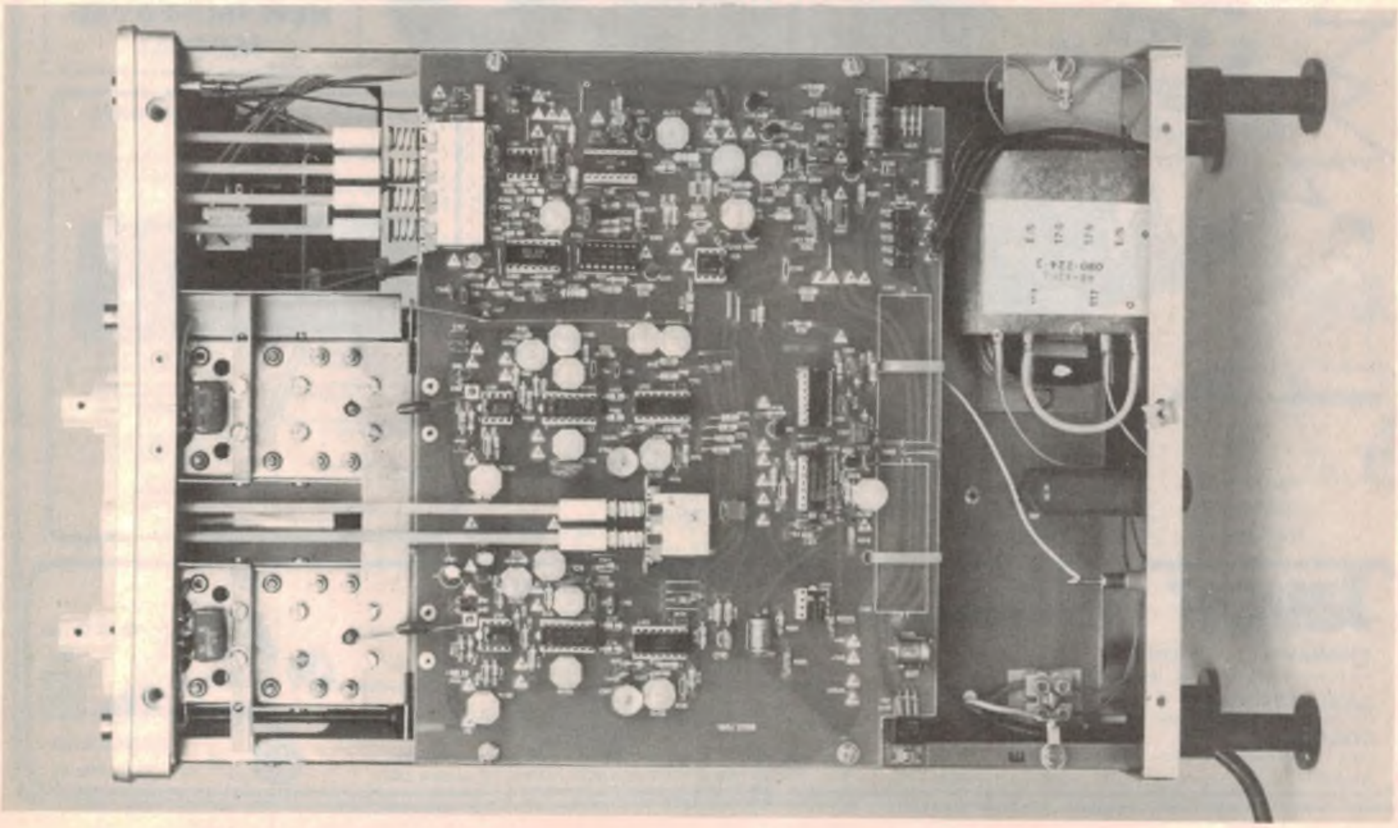
In fact, it makes a welcome change to review an item of electronic test equipment that is of Australian manufacture. As this review will show, the Model 821 is highly competitive when compared to its imported rivals, both in terms of finish and performance. It has all the features of the imports and offers a few more tricks besides.

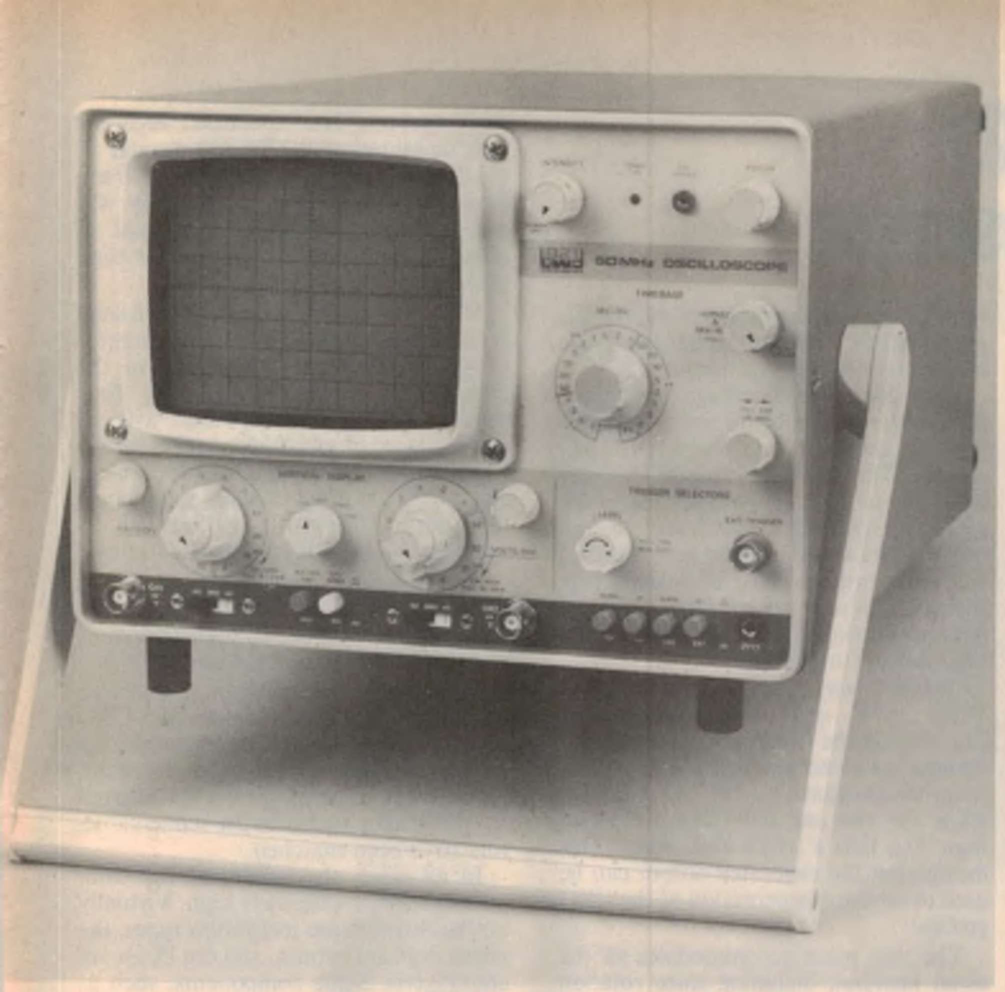
At first glance, the Model 821 looks much the same as its rivals although the green highlights used in the colour scheme are a little unusual. The unit measures 250 x 430 x 178mm (W x D x H) and is supplied complete with an instruction manual and two P32 100MHz probes. With most CROs, probes are an optional extra.

The front panel is very well laid out. It has an uncluttered appearance and there is ample room between the controls for easy finger access. As is the fashion these days, the vertical sensitivity controls are mounted directly beneath the CRT (cathode ray tube) while the timebase control is mounted to the right.

The CRT is a blue phosphor PDA (post deflection acceleration) type fitted with an internal 10 x 8 division graticule (1 division = 9.5mm). Internal graticules are now virtually a standard feature on

View inside the BWD Model 821. The standard of construction is excellent.





new CROs and have the advantage of eliminating parallax error when taking readings. In addition, this unit features 10, 90 and 100% markings on the CRT face to assist in determining pulse rise and fall times.

The quality of the on-screen trace is exceptional. We have yet to see a trace as fine and as clear as it is on this CRO.

The vertical sensitivity controls comprise the usual 5-2-1 stepped attenuators, each covering the range from 20V to 5mV/division. In addition, concentric variable attentuators with detented calibrate positions extend the input signal range to about 50V/division. By pulling the concentric knobs, the sensitivity is multiplied by 5 to give a minimum input sensitivity of 1mV/division.

The 20V/division position is useful for observing the full 250VAC mains waveform when using a divide-by-10 probe. When displaying mains waveforms in this way, both channels can be comfortably accommodated on the screen. This is the first CRO we have seen with this capability and is a feature that we like.

Another excellent feature is the complete lack of DC shift when switching from one setting to another. This is due to fact that the attenuators are ahead of the preamplifier stages. In some imported CROs, part of the attenuation is carried out after the preamplifiers. While this is a simpler method (it reduces the number of compensation components needed), it can cause a DC shift on the trace when switching from one setting to another.

In addition to the attenuators, the vertical channel controls comprise the vertical position controls; input coupling switches (AC, GND, DC); a mode selector switch (CH1, CH2, ALT, CHOP and ADD); and finally a pushbutton switch to invert CH2. This last feature converts the ADD facility on the mode selector switch so that it subtracts CH2 from CH1.

Trigger selection

Trigger selections can be either INTERNAL or EXTERNAL. For INTERNAL, either CH1 or CH2 can be selected as the trigger source or, alternatively, the mains frequency can be used for triggering as selected by the NORMal/LINE switch. When the EXTERNAL position is selected, triggering is initiated by a signal applied at the EXTernal TRIGGER input.

For all types of inputs, selection can be made for + or − slopes and NORMal/TV triggering. The Trigger level can be adjusted with the LEVEL knob and either AUTO or manual triggering is available by pulling this knob for non-auto.

For the TV trigger selection, there is a video sync separator circuit which gives

"HEY"

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

SINCLAIR SPECTRUM HOME COMPUTER

	$
Sinclair ZX Spectrum-16K RAM	299.00
Sinclair ZX Spectrum-48K RAM	399.00
Sinclair ZX Printer	169.00

HARDWARE

Spectrum 16k	299.00	Microdrive Blank Cartridges Pack of 4	69.00
Spectrum 48k	399.00	RS-232 Leads	49.00
Ram Upgrade Kit	110.00	ZX 2 Interface	79.00
ZX Printer	169.00	ZX 2 Cartridges	39.00
Printer Paper Pack 5 rolls	25.00	Ingersoll 35cm RGB Colour video monitor	594.00
Spectrum Microdrives	149.00		
ZX 1 Interface	149.00		

SOFTWARE

Biorhythms	22.50	Club Record Controller	22.50
Space Raider	19.50	Embassy Assault	19.50
Chess	25.00	Cyrus Is Chess	27.70
Planetoids	19.50	ZX Forth Language	44.00
Flight Simulation	25.00	Small Business Accts	39.00
Backgammon	19.50	Hungry Horace	19.50
Vu-file	27.50	Horace Goes Skiing	19.50
Vu-calc Spreadsheet	25.00	Horace and the Spiders	19.50
Vu-3D Graphics	25.00	The Hobbit	44.00
Adventure A, Planet of Death	22.50	Flippit	27.70
Adventure B, Inca Curse	22.50	Chequered Flag	22.50
Adventure C, Ship of Doom	22.50	Cattel IQ Test	38.10
Adventure D, Espionage Island	22.50	History 1	22.50
Reversi	25.00	Inventions	22.50
Collectors Pack	22.50	Music 1	22.50
		English Literature	22.50
		Zeus Assembler	38.10
		Monitor/Disassembler	38.10
		Penetrator	22.50

EDUCATION

NEW RELEASES RETAIL INC

● Cargo	33.00	● Learn to Read 5	35.00
● Gilder	33.00	● Early Punctuation	26.00
● Survival	33.00	● Speech Marks	26.00
● Magnets	33.00	● The Apostrophe	26.00
● Learn to Read 1	35.00	● Capital Letters	26.00
● Learn to Read 2	35.00	● Castle Spellerous	26.00
● Learn to Read 3	35.00	● Alphabet Games	26.00
● Learn to Read 4	35.00	● Micro-Prolog	83.50

LOOKING TO BUY A MULTIMETER?

NEW MODEL FROM PARAMATERS

(INCLUDES A 12 MONTH WARRANTY)

MODEL 7040

Low Cost ● 3½ Digits ● 0.1% Basic DCV Accuracy ● 28 Ranges ● 2000 Hour Battery Life ● Hi-Lo Volt Resistance Tests ● Overload Protected on All Ranges ● Current Ranges to 10 Amps

$99.00

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

DAVID REID ELECTRONICS LIMITED
127 York Street, Sydney, 2000
or Telephone (02) 267 1385

BWD Model 821 50MHz oscilloscope

automatic frame lock for timebase settings between 0.1s to 100μs and line lock above 50μs/division. One very useful feature of this circuit is that it will also demodulate a modulated carrier, enabling the envelope to be displayed. This will be handy when working on VCRs, colour TV receivers and other video equipment.

Timebase calibration is in 21 steps in a 1-2-5 sequence from 0.2μs to 1s/division. The horizontal position switch provides a x10 magnification of the trace when pulled out. This extends the trace calibration to a minimum .02μs/division.

At the extreme clockwise setting of the timebase control is the XY position. This converts CH1 to Y and CH2 to X (the vertical and horizontal axis respectively) and allows Lissajous displays for phase and frequency comparisons of two waveforms. For this to be effective it is important that the X and Y amplifiers show minimal phase shift with frequency. The 821 excels here by phase shifting less than 2° from DC to 200kHz.

MIX-MAG control

To the right of the timebase control is the VERNIER and MIX-MAG (mixed magnification) control. When the control is pushed in, it operates as a rotary vernier and reduces the timebase speed by at least 2.5 times at its maximum setting. When the control is pulled out, the MIX-MAG facility is engaged and the timebase is locked in its calibrated position.

The MIX-MAG control has a rather unusual effect on the waveform. When the control is fully clockwise, the timebase is displayed with normal x1 magnification. If, however, the control is rotated, the right hand side of the trace is magnified by 10 while the left hand side of the trace remains at normal x1.

In practice, the percentage of the trace displayed at x10 magnification is dependent on the setting of the MIX-MAG control. This can be varied all the way from 0% to 80% of the trace for sweep speeds up to 2μs/div. This feature is unique to BWD oscilloscopes and is useful when the extra expense of delayed triggering facilities is not warranted. It also has the advantage of being easier to use than delayed triggering.

Another very useful feature is the 1kHz 0.5V p-p calibrated output available on the front panel. This output voltage has an accuracy of 1% at normal room temperatures (+15°C to +35°C), while the rise and fall times are better than 5μs into a 1MΩ/40pF load. This means that the calibrated output can be used to set the compensation of the CRO probes.

The rear panel accommodates all the usual facilities, including trace rotation and astigmatism screw adjustments, Z modulation input, and timebase gate output. The Z modulation input requires about +4V to blank the trace at normal intensity, while the timebase gate output is 0V during the sweep and +3V during blanking.

Test results

We measured the bandwidth of the Model 821 as 3dB down at 50MHz, which is right on specification. The waveform was usable right up to 95MHz at which point the oscilloscope had problems with triggering. In the XY mode, CH2 has a bandwidth of 1.5MHz.

In general, the 810 offers excellent performance. The timebase accuracy was measured at 0.32% for normal x1 settings and 0.68% for x10 and x100 settings. Vertical calibration accuracy was measured as 1.5% for both x1 and x5 gain. These figures are far better than those specified by BWD.

We were also impressed with the solid construction and well engineered interior of the BWD Model 821. Most of the components are mounted on four separate printed circuit boards, with all ICs mounted in sockets for ease of servicing. For the most part, the component types used are quite familiar and include 4000 series CMOS ICs, LF351/353/356 op amps, and CA3086 transistor arrays.

The diodes and transistor type numbers are also familiar and are supplied by a National Semiconductor, Fairchild, Motorola, RCA and Philips.

In fact, with the exception of specialised parts such as the switches and CRO tube, virtually all the components are readily available in Australia. Even so, service requirements should be referred to BWD since many of the semiconductors have been matched.

In all cases, the quality of the components used is extremely high. Virtually all the resistors are metal film types, the preset pots are cermet, and the PCBs are epoxy glass. Some components, such as the power transformer, beam rotating coil, converter transformer and CRT shield, are specially manufactured by BWD for the Model 821.

The two P32 probes are also of good quality and incorporate x1, GND and x10 settings. Several special tips are provided with the probes and include the standard hook, a BNC plug and several plastic fittings. These latter are used to shroud the probe tip so that it may be applied directly to an IC pin without the danger of shorting onto adjacent pins.

Finally, the service manual supplied with the Model 821 is very well written. It describes the various controls, measurement techniques, adjustment and maintenance procedures, and lists the full specifications. And unlike many of its competitors, BWD give the purchaser a full set of circuit diagrams, together with a written circuit description and PCB layouts.

To summarise, at $850 +16% sales tax it would be difficult to find a CRO to equal the performance of the Model 821 from BWD. Its excellent specifications and original features make it highly competitive, both in Australia and overseas.

An additional upmarket model is also available from BWD: the 60MHz Model 835 (with delayed triggering) for $1550 plus sales tax.

For further information contact BWD Instruments Pty Ltd, Miles St, Mulgrave, Victoria 3170; or 10 Euston St, Rydalmere, NSW 2166.

projects & circuits **Number 3**

THE CONTENTS:

Audio, Video Projects
Video Amplifier for Computers and VCRs; Video Enhancer; Vocal Canceller; Stereo Simulator for Tuners and VCRs; Guitar Booster for Stereo Amplifiers.

Automotive Projects
Transistor-Assisted Ignition System; Breath Tester Checks Blood Alcohol Level; Low Fuel Warning Indictor; Speed Sentry for Cars; Audible Turn Signal Indicator.

Mains Power Control Projects
Musicolour; Photographic Timer; Driveway Sentry; Touch-Lamp Dimmer.

Power Supplies & Test Equipment
Battery Saver for Personal Portables; Dual Tracking ± 22V Power Supply; 3½-Digit LCD Capacitance Meter; In-Circuit Transistor Tester.

Miscellaneous
Nail Finder; Portable 3½-Digit Heart Rate Monitor; 10 Year EA Project Index.

Available from: Electronics Australia, 57 Regent Street, Chippendale, Sydney 2008.
PRICE $4.50, OR by Mail Order: Send Money Order or Cheque to Electronics Australia,
PO Box 163, Chippendale, NSW 2008. **PRICE $5.40.**

bwd INSTRUMENTS

THE INNOVATIVE AUSTRALIAN

BWD's Model 821 oscilloscope is a dual-trace unit with 50 MHz bandwidth, 1 mV to 20 V per division sensitivity and a special 'mix-mag' expanded trace function

The mix-mag facility, unique to the BWD 821, enables you to get a 10 times magnification of any proportion of the trace from 0% to 80% simply by pulling and turning a knob.

Normal x10 magnification is incorporated and the trace can be expanded to x100 using the mix-mag function to provide facilities similar to a delayed sweep CRO but without the complexity.

The mix-mag facility can be used to magnify each line to examine teletext, sync pulse or video signals of VCRs, television receivers or studio equipment.

821 **50MHz MIX-MAG**

Superb value ... Just **$850**
Plus Tax

Other features of the BWD 821 include: a 7ns rise time from 5 mV/div., 20ns/div maximum sweep speed, 75MHz triggering, TV line and frame triggering selection, bright trace with 6kV EHT and internal tube graticule.

Two 100MHz probes are included, a x1 and a x10. High sensitivity vertical amp inputs enable low level signals to be viewed, such as from tape recorder heads, pickups and microphones, etc.

The BWD 821 is suited to use in communications, industrial control, research and development, video and microprocessor applications.

Designed and manufactured in Australia by
BWD Instruments Pty. Ltd.
PO Box 325, Springvale, Vic 3171
Miles Street, Mulgrave, Vic 3170 Australia
Phone National (03) 561 2888
International 613 561 2888
Telex 35115

For further information on the BWD 821 or any instrument in the BWD range, please contact: —

Vic. (03) 561 2888
N.S.W. (02) 684 1800
Qld. (07) 369 1277
S.A. (08) 268 2766
W.A. (09) 277 7000
Tas. (002) 23 2842

★ ★ ★ *ASK FOR OUR FREE COMPREHENSIVE CATALOGUE* ★ ★ ★

TOTALLY NEW!

DIGITAL-ANALOGUE IN THE ONE PANEL METER!

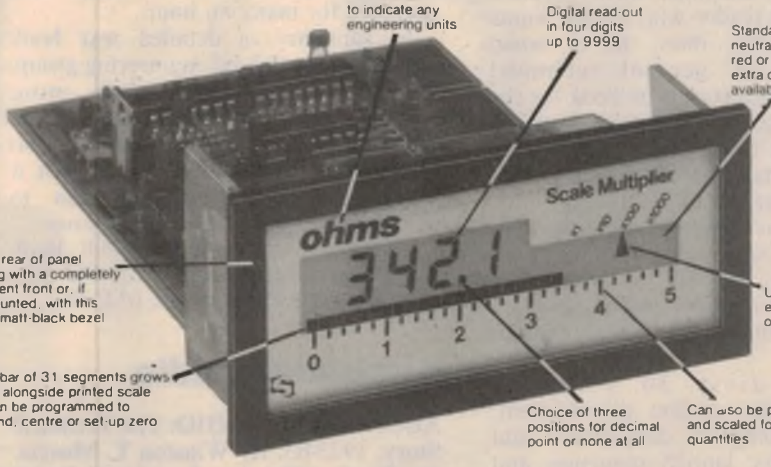
SIFAM

HARMONY

C & K is proud to present a totally new concept in panel meters by Sifam (U.K.)

- First panel meter of this type in the World.
- Dual display shows both digital and analogue readout.
- Programmable! is micro processor based.
- Universal mode offers selection of any one of 64 pre-programmed ranges built into these precision instruments.

Phone now for free, comprehensive technical literature!



Can be programmed, calibrated and scaled to indicate any engineering units

Digital read-out in four digits up to 9999

Standard LCD display is neutral (dark grey) but blue, red or green available at extra cost. Illumination also available as optional extra

Front or rear of panel mounting with a completely transparent front or, if front-mounted, with this optional matt-black bezel

Up to 5 flags to indicate either scale multiplier or function selected

Trend-bar of 31 segments grows or falls alongside printed scale and can be programmed to left-hand, centre or set-up zero

Choice of three positions for decimal point or none at all

Can also be programmed and scaled for non-linear quantities

C&K COMPONENTS

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

Agents Melb 598 2333/Adel 277 3288 Bris 36 1277
Perth 458 7111 Hobart 34 2233/Launceston 31 6533

Books & Literature

Satellite communications

MANUAL OF SATELLITE COMMUNICATIONS by Emanuel Fthenakis. Published 1983 by McGraw-Hill Book Company, USA. Hard covers, 351 pages, 228mm x 145mm, illustrated with photographs and diagrams. ISBN No. 0 07 022594-X. Recommended retail price $71.85.

This is an in-depth text book aimed at communication engineers faced with the need to upgrade their background to encompass the commercial communication satellite scene. In view of the impending establishment of Australia's own satellite system, AUSSAT, there may well be those in the Australian communications scene who require a text book of this type.

The author is senior vice president of Fairchild Industries, with responsibility for the space, communications and electronics group. Previously he worked at Bell Laboratories, General Electric's Space Division, the Philco-Ford Space Division (as founder and director), and the American Satellite Company. He also teaches a graduate level course in space and communications at the University of Maryland. It is from this latter role that this book has evolved.

As might be imagined, this is no book for the casual reader who simply wants to add a little more to a broad background of general technical knowledge; in short, it is no book for the amateur (using the word in its broadest sense), or the cattle station handyman wishing to install a satellite antenna and down-converter for TV reception.

But for the engineer, involved in graduate or post-graduate studies, the book should contain a wealth of information. Some idea of the coverage can be obtained from the chapter headings.

(1) The first 20 years of communications satellite development; (2) System description, deployment, and cost; (3) Orbits, launch sequence, and positioning on station; (4) The communications spacecraft; (5) Spacecraft communications system; (6) Earth stations and terrestrial links; (7) The space communications link; (8) Linear systems and signals, summary of fundamental principles; (9) Random processes and noise; (10) Analog modulation; (11) Digital communications; (12) Coding and forward error detection; (13) Transmission impairment; (14) Networks and systems; plus five appendices.

The author claims that, for various practical reasons, "... the depth of presentation has had to be limited in some cases." And, "Since there are several excellent references ... I did not attempt to deal with these (certain) subjects with strict mathematical rigor." In spite of this we feel sure that the serious student will find more than enough mathematics to keep him occupied for many an hour.

In summary, a detailed text book aimed at a specialised engineering group, for whom it will undoubtedly prove extremely valuable. Unfortunately, the high price may deter some students who might otherwise benefit from it, but it would make an useful addition to technical college and similar libraries.

Our copy from McGraw-Hill Book Company Australia Pty Ltd, PO Box 239, Roseville, NSW 2609. (P.G.W.)

Australian radio

AUSTRALIAN RADIO: The Technical Story, 1923-83. By Winston T. Muscio. Published 1984 by Kangaroo Press, Kenthurst, NSW Australia. Hard covers, 137 × 220mm, 243 pages. Some illustrations. ISBN O 949924 82 2. $19.95.

The author of this new book, Winston Muscio, has been a long-time personal friend of this reviewer, with interests in common at both a personal and a professional level. I was delighted when he told me of his plan to do what many in our generation have contemplated but few have actually attempted: namely to set down the history of Australian radio as they have observed it — in this case over a period approaching 50 years.

He does so as an Associate in radio engineering of the original Sydney Technical College, a member of the Institution of Engineers (Aust) and a senior member of the Institution of Radio and Electronics Engineers (Aust).

Significantly, while he pursued his wide-ranging career mainly in the formal engineering and administrative environment of STC, Winston Muscio remained an enthusiast at heart, reading widely and always ready to discuss technical subjects outside his everyday activity. It was not surprising, therefore, that during the preparation of the book, he spent a considerable time chasing up references and going through file copies of "Wireless Weekly", "Radio & Hobbies" and "Electronics Australia" to refresh his memory of past practice and past events.

His book opens with a general survey of broadcast receivers and broadcast reception through the years (chapters 1 & 2) and of Communication Receivers (chapter 3). The emphasis is on trends rather than statistics or specific models.

Chapters 4 to 8 inclusive cover Broadcast Transmitters, Communications Transmitters, Mobile Radio Systems, Multiplexed Communications Systems, and Integrated Radio Communications Systems. All of these were areas where the author acquired special expertise in the STC/ITT Group, but which are not well understood by the average enthusiast.

In chapters 9, 10 and 11, the author steps out of his role as a formal radio engineer, to be revealed as an audio enthusiast from way back and as someone who spent an interim period full-time in the audio industry. The subjects here are: Audio Frequency Reproduction, Record Playing Equipment (from early phono pickups to the compact disc) and Magnetic Tape Recording Equipment.

There is final comment on FM broadcasting in Australia, the patent situation over the years, a brief bibliography and a comprehensive index.

The book has been very carefully compiled and is well written by an author who has considerable natural ability in this area.

It should make fascinating reading for

all who have been involved in — or been observers of — the technical side of Australian radio. But, more than that, it is a book which can round out the background of a younger generation of engineers and students, giving them a feeling for what has gone before.

"Australian Radio — The Technical Story" should be available through technical and university booksellers but, if necessary, inquiries can be directed to Kangaroo Press Pty Ltd, 3 Whitehall Rd (PO Box 75), Kenthurst, NSW 2154. In the latter case, remit $19.95 plus $1.50 to cover pack and postage. Recommended. (W.N.W.)

MicroBee applications

WILDCARDS by R.A. Burt, P.T. Ford and A. Nallawalla. Volumes 1 & 2. Published 1983 by BF&N Publishing, Williamstown, Vic. Soft covers, 210 × 278mm, 100 pages (Vol. 1), 120 pages (Vol. 2). Illustrated with charts and tables. ISSN 0811-577X.

Sub-titled "A potpourri of applications notes and tips for the MicroBee Personal Computer", these two volumes were written by a group of three Melbourne MicroBee users who pooled their experiences and resources to produce the books.

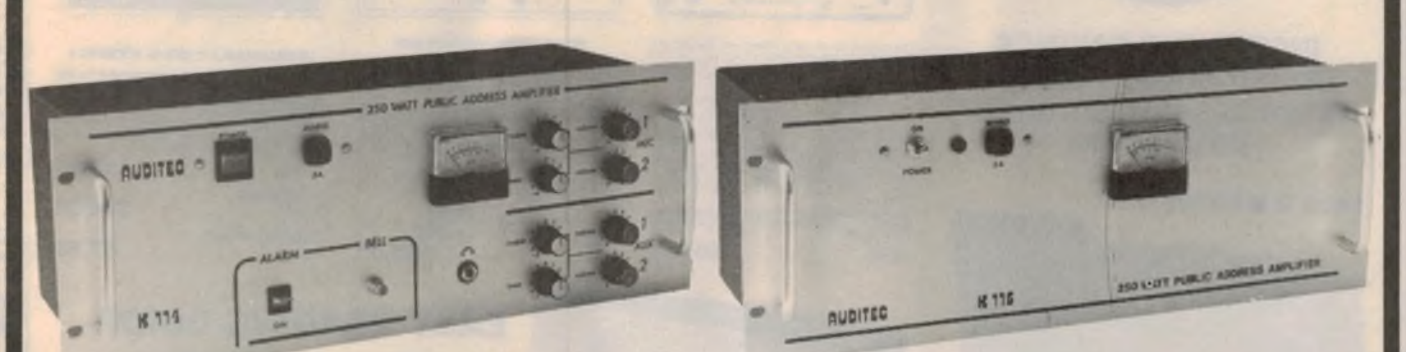
Volume 1 has six chapters covering general programming style and tape handling, sound and music, utility programs, graphics, games and printers. Twelve appendices are also included with illustrations of graphics characters, aids to the creation of programmable characters, routines for cursor positioning, a blank table for records of the user's program variables, Microworld Basic tokens, a memory map and hex, decimal, binary and ASCII conversion tables.

Throughout the book each point discussed is illustrated with example programs and helpful charts and diagrams. The sections on graphics, music and games alone make Volume 1 worthwhile, but the inclusion of useful utility routines and general advice to users adds further value.

Volume 2 continues the theme with sections on machine language, sorting, more utility programs, conversions from other versions of Basic (including the NOS-BASICODE broadcast over shortwave by various European stations), more graphics techniques, games programs and peripherals, including disk drives. Four appendices are provided covering Microworld equivalents to other versions of Basic, printer control and escape codes, a seven page memory map (very detailed) and a questionnaire on the reader's preferences for Wildcards Vol. 3!

This volume is slightly longer than the previous book but the material is all new. Colour is also dealt with for the first time. Both these books are designed for "intermediate level" readers who have worked through the MicroBee manual and would like to go further. Together they contain a wealth of information for the MicroBee user in a clear and understandable style. Our review copies came direct from the publisher, but some retailers have the volumes, at around $15 for Vol. 1 and $16 for Vol. 2. (P.V.)

AUDITEC PA for RELIABILITY



K114

250 WATT
AMPLIFYING
SYSTEM

K115

250 WATT
POWER
AMPLIFIER

AUDITEC

AUDITEC AUSTRALIA
PTY. LTD. (inc. in N.S.W.),
10 Waitara Avenue,
WAITARA, N.S.W. 2077
(02) 48 4116.

MELBOURNE
Zephyr Products
553 3266

BRISBANE
Delsound Pty. Ltd.,
229 6155

ADELAIDE
Gerard & Goodman
223 2222

FOR 15¢ PHONE YOUR ORDER TOLL FREE ON 008·999·007

We will immediately confirm stock availability. We will also confirm the very hour your order will be dispatched (over 95% of orders leave the same day). **With Jet Service Delivery we deliver next day to capital cities and suburbs** — Country areas please add 24 to 48 hours. **Available bankcard holders only** — sorry non-bankcard holders must post a cheque or money order — even so, we promise to deliver quicker than any other supplier in Australia.

PROFESSIONAL QUALITY
SOLDER SUCKERS

Not to be compared with inferior "Hobby types". Saves countless hours in fault finding and repair of complex PCB's.

SINGLE HANDED OPERATION
SELF CLEANING PLUNGER
LONG LIFE TEFLON TIP
DOUBLE DIAPHRAGM, DUAL O-RING SEAL
225mm x 20mm(d)
50mm STROKE
POWERFUL SUCTION

T1240. . only ~~$11.95~~

T1241. Replac tip. **$1.95**

SOLDER

200 gram reel. 1mm universal gauge. Suitable for all types of electronic soldering. Resin cored and includes bit saving additive.

T1200 **$4.95**

5 UP **$4.50 ea**

LOOK AT THIS

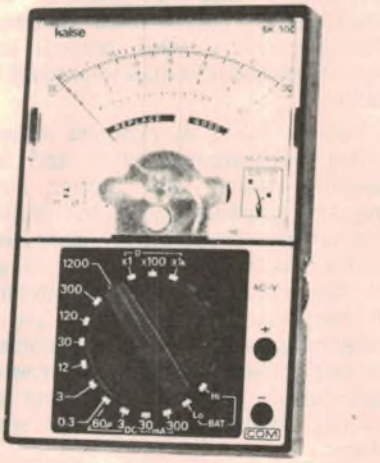
INCREDIBLE SAVINGS On our Super Popular National Semiconductor Data Books

SAVE A MASSIVE 40%

	Was	Now Only
B1010 LINEAR DATA VOL 1	$12.50	$6.50
B1011 LINEAR DATA VOL 2	$12.50	$6.50
B1015 LOGIC DATA	$ 9.95	$8.50
B1030 CMOS DATA	$11.50	$8.50

BUY THE SET FOR ONLY **$28**

DROP PROOF MULTIMETER
WITH OVERLOAD PROTECTION



• 20,000 ohms/Volt DC • 10,000 ohms/Volt AC • Taut band meter movement • Integral bench stand • Uses 1 x AA cell • Comes complete with battery, test leads and instructions.

• **RANGES DC Voltage** - 0.3,3,12,30,120,300,1200 **AC Voltage** -12,30,120,1200 **DC Current** - 60uA,3,30,300 mA **Resistance** 0-5 Meg in 3 ranges

• Battery test Lo: 50 mA (1.5V) Hi: 250 mA (1.5V)

• With temperature range (See right)

Q1030 . . . . Value at **$39.50**

Q1035 . . . . Carrycase **$12.50**

TEMPERATURE PROBE

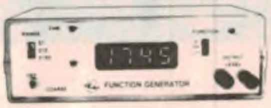
Use with our Q1030 multimeter to measure from -50°C to 250°C — that's right — a full 300°C range. Now you can check heatsink temperatures, transistor and IC cases — even how cold your beer is!

Great value

Q 1036 . . . . .only **$19.50**

THESE SUPERB TEST EQUIPMENT KITS ALL NOW INCLUDE OUR BRILLIANT H 0480 INSTRUMENT CASE.

FUNCTION GENERATOR



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

A truly versatile unit at a bargain price.

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

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

K2505 . . . . **$85.00**

DIGITAL CAPACITANCE METER

with Deluxe Instrument Case

NEW DELUXE FINISH

We are pleased to announce the release of the Digital Capacitance Kit housed in our Deluxe H0480 ABS Instrument Case.

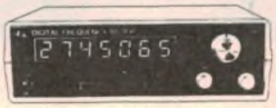
This superb Test Instrument Kit now compliments our top selling Digital Frequency Counter and Function Generator Project Kit. Electronics Australia Project. Measures capacitance of both polarized and non-polarized capacitors from 1 picofarad to 99.99 microfarads in 3 ranges. Check values of unmarked capacitors especially those little trimmers that are never coded. Select precise values for filters and timing networks within ease.

EXCLUSIVE TO ALTRONICS

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

K2521 . . . . **$55.00**

7 DIGIT FREQUENCY COUNTER



UNBELIEVABLE 0.005% ACCURACY

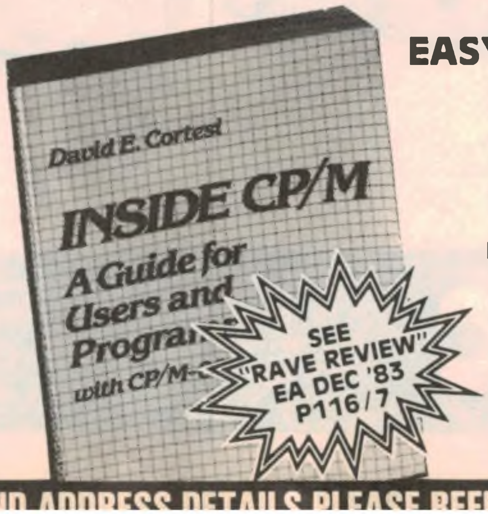
• **Frequency and Period measurement to 500 MHz (with optional prescaler) • High input sensitivity. Professional unit at a fraction of the cost of built up units.**

• IC sockets provided throughout • Low age rate 10.000 MHz XTAL • Quality ABS plastic case with deluxe Front panel • Specified LSI.

K2500 . . . . **$119.50**

PRESCALER
K2501 . . . . **$26.00**

DECIMAL POINT
K2502 . . . . **$7.50**



EASY READING GUIDE TO CP/M 2.2

As a learning tool —
IT'S INVALUABLE
As a Reference —
IT WILL TAKE PRIDE OF PLACE NEXT TO ANY CP/M SYSTEM

B9080. . ONLY **$41.95**

Devoted primarily to CP/M 2.2' this manual is equally applicable to most other CP/M systems. Cortesi divides the book in two sections, an **absorbing, explanative, tutorial** covering setup and operating procedures and a **comprehensive reference section.**

BANKCARD HOLDERS — PHONE ALTRONICS TOLL FREE 008·999·007 FOR NEXT DAY JETSERVICE DELIVERY

BANKCARD HOLDERS — PHONE ALTRONICS TOLL FREE 008·999·007 FOR NEXT DAY JETSERVICE DELIVERY

• FOR DESPATCH P&P CHARGES AND ADDRESS DETAILS PLEASE REFER TO OUR AD ON PAGE 131 •

PHONE YOUR ORDER — ALTRONICS TOLL FREE 008·999·007

OR FOR 30c POST AN ORDER TO ONE OF ALTRONICS COMPETITIORS

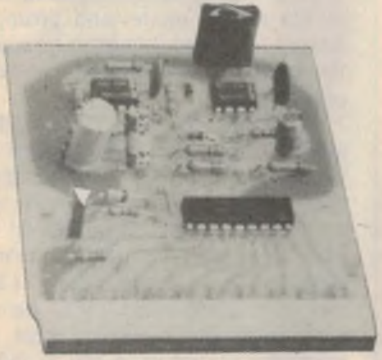
— naturally you won't have a clue as to whether they've got the items you need available. And of course, be prepared to wait, wait, patiently wait sometimes for weeks!

Why waste your valuable cash? Altronics staff are waiting for your call now (up to 6pm eastern standard time).

BANKCARD HOLDERS — PHONE ALTRONICS TOLL FREE 008·999·007 FOR NEXT DAY JETSERVICE DELIVERY

BANKCARD HOLDERS — PHONE ALTRONICS TOLL FREE 008·999·007 FOR NEXT DAY JETSERVICE DELIVERY

LED BARGRAPH PEAK DISPLAY



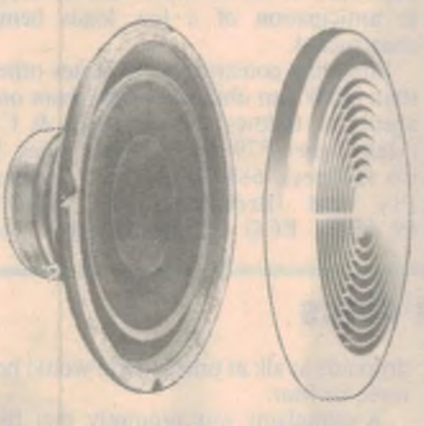
This easy to build level meter uses our exclusively imported LED bargraph module which gives it a very professional finish indeed. Indicates from −21dB to + 6dB using a logarithmic scale. **Great Value!**

K 5412 .... **$16.50**

8 INCH WIDE RANGE DUAL CONE SPEAKER

200mm (8 in.). 10 Watts Max. power input. Public Address, Background Music. Ideal Hi Fi extension speaker. Includes transformer holes at 51mm. Over 30,000 sold in Australia! Mounting holes 140 x 140mm.

C2000 .... **$9.50 ea**
10 Up **$8.70**



8 INCH CEILING SPEAKER GRILL

C0800 .... **$2.75**
10 Up **$2.00**

MICROWAVE OVEN LEAK DETECTOR

ETI PROJECT

Completely passive project receives microwaves via an antenna which develops a voltage across a detector diode driving the meter.
Monitor your microwave oven with this easy to build kit. All components mount on single PCB, including the meter.
Genuine Hewlett Packard Hot Carrier Diode supplied.

K1724 .... (still only) **$14.50**

THE DAZZLING MUSICOLOR IV PROJECT

Combination Colour Organ and Light Chaser. Four channel colour organ. Internal micro-phone or connect to speakers for colour organ operation. (The lights connected to each channel pulse in beat to the music proportional to portion of frequency spectrum concerned.) Four chaser modes forward and reverse. Output lamp load capacity a massive 2400 watts — that's 100 party globes. Full instructions and every last nut and bolt included. Great for parties, shop signs, display windows etc.

K5800 .... **$89.50**

ALCOHOL BREATH TESTER

GENUINE FIGARO GAS SENSOR

K1583
ONLY
$29.95
(SEE EA MAY 1983)

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

FAMOUS VOYAGER CAR COMPUTER

WAS $199 SAVE $74

AS REVIEWED
EA OCT '82 P26-28
ETI NOV '82 P26

ONLY $125

COMPLETELY BUILT AND TESTED

MADE IN ENGLAND! — QUALITY!

Contains equivalent of thousands of transistors — uses massive custom LSI Chip to achieve low price.
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.

DIL SWITCHES

GOLD PLATE SELF-WIPING CONTACTS.

LAST MONTH AT THIS PRICE

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

2N3055'S SLASHED

QUALITY "SGS"

Z1174 **$1 EA**

SUPER TYPE GLUE

HIGH BONDING STRENGTH STICKS IN SECONDS

T3010 **$1.95**

SAVE A DOLLAR

IC SOCKETS DIL

LOW PROFILE

SAVE A FORTUNE

		ea.	10+	25+
P 0550	8 Pin	.18	.15	.10
P 0560	14 Pin	.20	.18	.15
P 0565	16 Pin	.20	.18	.15
P 0567	18 Pin	.30	.25	.20
P 0568	20 Pin	.50	.45	.42
P 0569	22 Pin	.60	.50	.47
P 0570	24 Pin	.45	.40	.35
P 0575	40 Pin	.65	.55	.45

FOR DESPATCH P&P CHARGES AND ADDRESS DETAILS PLEASE REFER TO OUR AD ON PAGE 131

Letters to the editor

Circuit voltages

Having constructed many of your projects over the years I was intrigued to read your article in the April issue entitled "If Your Project Won't Work". I agree with your basic precept, that most faults will be due to reversed components or incorrect values, but I almost laughed out loud when I read your advice to check voltages.

When has *Electronics Australia* ever published a kit design that identified, on the circuit diagram, the voltages that might be expected at various points? Note that I disregard such blindingly basic voltage references as shown in the 1982 Function Generator schematic accompanying the article.

Lest I be accused of singling one magazine out, your competitor in Australia does not fare any better in this regard. And all this despite the fact that, given a working sample, such values could be established within 10 or so minutes, preferably with a cheap multimeter such as a hobbiest is likely to use.

B. Alison,
Mona Vale, NSW.

PS: Otherwise a great magazine.

Dummy load

Further to your article on the high power dummy load in the April issue, I would like to make the following points:

(1) Everest Electronics is the Australian agent and importer of Arcol metal clad wire wound power resistors.

(2) Mayer Krieg & Co (NSW) are our NSW agents and the resistors used in the dummy load were supplied through them. The NHS100 8R resistors are a stock line but the NHS100 4R units were specially ordered and supplied free for your use. We have a small stock on order in anticipation of a few loads being constructed.

Intending constructors in states other than NSW can obtain resistors from our agents as follows: Mayer Krieg & Co (Melbourne), 579 5722; Mayer Krieg & Co (Sydney), 684 1900; DGE Systems Pty Ltd (Broadmeadow, NSW), 69 1625; ECQ Electronics Pty Ltd (Brisbane), 376 5677; Prospec Distributors (Perth), 362 5011; Anelco Electronics Pty Ltd (Adelaide), 294 2600.

R. Sedunary,
Everest Electronics,
Seaford, SA.

Video fires

I am writing in regard to the letters I have seen in your magazine concerning fires in TV sets and video cassette recorders. We own a VHS video recorder which is kept in our loungeroom where it is out of the sun. On several occasions last summer the temperature reached 30°C and, in three instances the VCR switched itself on, placed itself in the record mode, and promptly started to record. On each occasion, the on/off switch was in the "off" position.

If it is possible that the switch is affected by heat enough to turn the unit on, or there is some other fault, then this type of machine may pose a major threat to the public. In the case of a short circuit, a fire may start or a shock could occur. At any rate, it is quite annoying to have a tape, with the record protect tab removed, erased by a faulty video. How about some projects for CB and amateur radio operators?

S. Lamshed,
Bairnsdale, Vic.

Problems with compact discs

In a recent editorial you defended, rather strongly, the compact disc system. Certainly, I have encountered the derogatory comments about compact discs which may well have been prompted by a vested interest in traditional LP disc equipment and the sale thereof.

However, contrary to your assertion, I am not convinced that all is yet as it should be with CD players. There may also be some problem with the discs themselves, although I am inclined to believe this is minor.

Late last year I bought a compact disc player. Although the sound quality and absence of background noise were all that I expected there were two problems. One was the dropping of the first few notes on a particular disc in rather more than 50% of starts. The other was random dropouts, probably averaging about one per disc but not necessarily on any one disc or on every play. Sometimes there would be no dropouts at all; at others there would be three or four.

A complaint was promptly met by the manufacturer with an offer of a replacement unit which was accepted. The first problem mentioned above no longer occurred; no dropped notes after many, many starts. On the other hand, the incidence of dropouts (albeit of shorter duration) was increased about tenfold. While there was some variation in the average number of dropouts between discs, not one disc (of about 12) would ever play through without at least 3 or 4 dropouts while the highest number recorded for one disc was 27.

In the light of the comment in *Electronics Australia* about a year ago to the effect that one dropout in about 5000 years of normal playing was all that could be anticipated I felt satisfied that there was still a problem. Incidentally, I am more inclined to blame the player than the discs because, although there is a variation between discs, the dropouts never occur twice in the same place and there was a very large difference in performance between the first and second players.

A further complaint to the manufacturer resulted in a visit to my home by the Service Manager to verify my complaint. Having satisfied himself on that score, a third unit was installed while the problem was referred back to Japan. This unit is perhaps the best so far although it has a few funny tricks of its own. Ultimately I expect I will end up with a unit which performs properly.

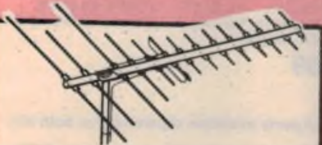
The whole thing is puzzling. I have not been aware of dropouts when CDs have been played on ABC FM. On the other hand I find it hard to believe that I am the only person to experience three faulty players.

Any comments you might care to make would be much appreciated.

A. Marsh,
South Turramurra, NSW.

Is your reception in peak condition?

Get ready for the Games!



Combined UHF/VHF antenna

For good VHF/UHF TV signals you need a good antenna. This one has both in one. Latest 14 element design needs just one feed line, suits 300 ohm includes mast clamp.

Cat L-4020 **$59.95**

Metropolitan High Gain

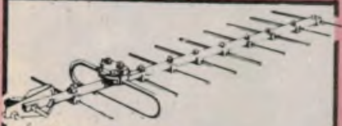
Our biggest seller! **$49.95**

Very popular in metropolitan & near fringe areas. Designed to give maximum gain on channels 0, 2, 7, 9, &10. Complete with mastclamp. Cat L-4022

Metropolitan Ghost Killer

Ideal for all channel reception in the most difficult areas. Features high gain and high front-to-back ratio.

Cat L-4030 **$74.95**



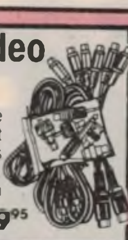
High Gain UHF TV Antenna

Designed to cover the entire Aust. UHF TV band. Provides high gain and very high front-to-back ratio. Features variable mounting clamp.

Cat L-4028 **$22.50**

Now is the time to get your TV antenna system in tip-top condition . . . the Games start in just a few weeks. Wouldn't you be popular if . . .

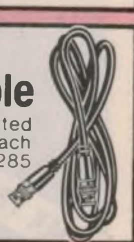
Video to Video Cable Set



2m audio/video cable with phono plugs at each end. Adaptors to suit UHF (PL259), BNC, 6.5mm, 5 pin DIN & 6pin DIN.

Cat W-1287 **$19.95**

BNC Video Cable



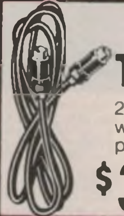
2m 75ohm coax fitted with BNC plugs each end. Cat W-1285

$6.95

Deluxe Video Processor

You won't believe the difference an enhancer makes to your video tape copies. Restores fine detail, lifts signal above noise level has inbuilt RF modulator so you can use with standard TV set.

Cat Y-8510 **$129.95**



75 ohm TV Cable

2m 75ohm coax fitted with standard TV coax plugs. Cat L-4506

$3.25

Mast Head Amplifier

Ideal for fringe areas. Designed to suit Australian TV & FM characteristics.

Cat L-4200 **$49.95**

PLUS . . .

a gigantic range of splitters, baluns, cables, plugs and sockets to improve reception!

Antenna Mountings

Wallmount

$5.95

28cm long, complete with saddle clamp assembly.

Cat L-4152

Bargeboard Mount

Mount any TV antenna from vertical surface. 139 cm long.

$9.00 Cat L-4150

TV Mast Pipe

2.44m mast section galvanised and rust-proof. 27.5mm dia.

Cat L-4156

$7.50

350 stores and resellers throughout Australasia

bankcard welcome here

HFC

DICK SMITH ELECTRONICS

For address details see page 108.

A 767/KT

SERIES 5000

SPECIAL PRICES THIS MONTH

As designed by ETI

INDIVIDUAL COMPONENTS TO MAKE UP A SUPERB HI-FI SYSTEM. DIRECT IMPORT AND A MORE TECHNICALLY ORIENTED ORGANISATION BRING THESE PRODUCTS TO YOU AT LOWER PRICES THAN OUR COMPETITORS.

EXTRA FEATURES OF OUR KITS
POWER AMPLIFIER
KIT PRICE $319 P&P $12.00

A + T Only $449

• 1% Metal Film Resistors are used where possible • Prewound Coils are supplied • Aluminium case as per the original article • All components are top quality • Over 400 Kits now sold • We have built this unit and so know what needs to go into every kit • SUPER FINISH Front panel supplied with every kit at no extra cost to you. • We are so confident of this kit that we can now offer it assembled and tested so that people who do not have the time can appreciate the sound that this amplifier puts out. This is done on a per order basis delivery approx. four weeks after placement.

PREAMPLIFIER
KIT PRICE $289 P&P $12.00

A + T Only $449

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

PREAMPLIFIER

Kit Price $289, P&P $12.00

SPECIFICATIONS

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

On Special at $259
Normally $289

**All parts available separately for both kits.*

POWER AMPLIFIER

On special this month $289

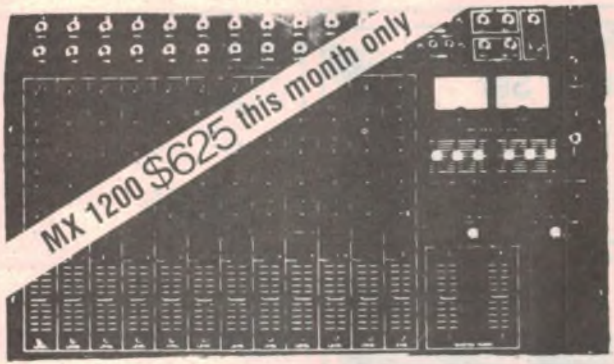
SPECIFICATIONS 150W RMS into 40hms

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

Please note that the "Superb Quality" Heatsink for the power amp was designed and developed by Rod Irving Electronics and is being supplied to other kit suppliers. This product cost $1,200 to develop so that your amplifier kit would have a professional finish as well as sound.

ON SPECIAL THIS MONTH $289

(MX-1200 MICROPHONE/AUDIO MIXER



NB — THIS UNIT IS BUILT AND TESTED NOT A KITSET

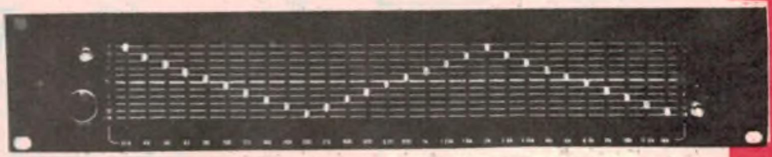
NORMALLY $799

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

SPECIFICATIONS:
INPUTS
Level Impedance Mic 48 db 1K
Line 22 db 16K x 12
Phono 52 db 50K STEREO x 2 (2mv) at 1KHz
Effect Return (Aux) 20 db 50K x 1
OUTPUTS
Level Impedance L & R 0 db 2K
Effect Send 0 db 2K F B Out 0 db 2K
Head phone Stereo + 10 db 600 (100 1K)
EQUALISATION
Channel
Bass ± 15db
Treble ± 15db
Master
Bass ± 12db
Treble ± 10db
Middle ± 12db

FADER & CONTROLLERS
12 channel fader, Slide 60m/m LOG 25%
2 Master fader, Slide 60m/m, LOG 15%
12 F B Volume 300 LIN
1 F B Master level 300 LIN
12 Effect Send 300 LIN
1 Effect Return 300 LOG 15%
2 Phono 300 LOG 15%
1 Head Phone 300 LOG 15%
S/N 58DB
FREQUENCY RESPONSE 20-20 KHz
TOTAL HARMONIC DISTORTION Less than 0.1%
METER 2 illuminated VU Meters 0db = 0.775V
PEAK INDICATOR 12 LED Peak Indicators
VOLTAGE 240 VAL 50Hz
POWER CONSUMPTION 7.2 watts
DIMENSIONS 820 (W) x 388 (D) x 108 (H) mm
(supplied complete with carrying case)

THIRD OCTAVE GRAPHIC EQUALIZER



SPECIFICATIONS E.T.I. Dec. 1982

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

1 unit **$189**

2 units **$359**

SERIES 4000 SPEAKERS

• 8 speakers with crossovers	$499
• Speaker boxes (assembled with grill and speaker cutout)	$299
• Crossover kits	$199
• Complete kit of parts (speakers, crossovers, screws, innerband, boxes)	$799
• Assembled, tested, ready to be hooked up to your system	$849

WE BELIEVE THAT WE ARE NOW THE ONLY ONES TO SUPPLY COMPLETE SPEAKER KITS ASSEMBLED AND TESTED FOR THOSE WHO HAVEN'T GOT TIME $849 EX STOCK.

PLEASE WRITE FOR CONSTRUCTION NOTES, THESE COMPLIMENT THE SERIES 5000 AMP RANGE AND ADD THE FINAL TOUCH.

ROD IRVING ELECTRONICS
425 High St., Northcote, Vic. 48-50 A'Beckett St., Melb., Vic.
Phone (03) 489 8866, (03) 489 8131, Mail Order Hotline (03) 481 1436
Mail orders to P.O. Box 235 Northcote 3070 Vic.
Minimum P & P $3.00. Errors & omissions excepted.

Please address tax exempt, school, wholesale, and dealer enquiries to:
RITRONICS WHOLESALE
1st floor 425 High St. Northcote 3070 (03) 489 7099 (03) 481 1923
Telex AA 38897

ON DISPLAY

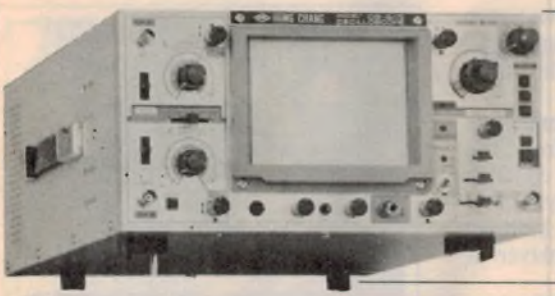
EX STOCK

ROD IRVING ELECTRONICS PRESENTS

"RITRON"

★ LOW PRICE ★ HIGH QUALITY ★ 12 MONTHS WARRANTY ★

DUAL TRACE OSCILLOSCOPES



MODEL
OS-645
15KV
45 MHz
&
1mV/div

- ★ **WIDE FREQUENCY BANDWIDTH (70MHz-6dB)**
- ★ **OPTIMAL SENSITIVITY**
  All the steps of vertical deflection factors are multiplied 5 times for the highest sensitivity of 1 mV/div; 10MHz.
- ★ **DELAYED TRIGGERING SWEEP**
  Any point of the waveform is addressed as a triggering start. So, any waveforms can be substantially and brightly magnified, thanks to the 15KV bright CRT.
- ★ **EXTREMELY BRIGHT DISPLAY**
  The metal-back CRT (PDA) provides brightest trace display.
- ★ **DELAY LINE (for BS-625)**
  Approximately 20 nsec before triggering point is displayed for real analysis of rise times.
- ★ **SCALE ILLUMINATION**
- ★ **SINGLE SWEEP**
  A triggered sweep of a single waveform can be displayed.
- ★ **TV-SYNC**
  TV composite signals can be easily synchronized.
- ★ **MAGNIFIERS**
  Both vertical and sweep time are simply magnified to 5 times (1mV/div, 40nsec/div).
- ★ **X-Y, or X-Y-Z OPERATION**
  Simply by turning the SWEEP TIME/DIV knob to CH-B, this functions as a very high sensitivity X-Y oscilloscope (1 mV/div) with intensity modulation.
- ★ **HF REJ**
  High frequency noises can be rejected for the stayble triggering by use of the low pass filter built in the triggering circuit.

COMPLETE MODEL RANGE SPECIFICATION CHART:

MODEL	SCREEN	SENS	SIG DEL	TRIG DEL	B'WIDTH	T'BASE	WITHOUT PROBES	TAX EXEMPT	WITH PROBES	CAT No.	COMMENTS
645	150mm	1mV	Y	Y	45MHz	0 2uS 0 5Sdiv	$995.00	$895.00	$1055	Q12110	(70MHz-6dB)
620	150mm	5mV	N	N	20MHz	0 5uS 0 5Sdiv	$495.00	$425.00	$549.00	Q12105	(45MHz-6dB)
615S	95mm	5mV	N	N	15MHz	0 5uS 0 5Sdiv	$695.00	$615.00	$759.00	Q12100	AC-DC Operation

POINTS TO REMEMBER:
Ex Stock
12 Month Warranty
High Quality Components
Direct Import
Flat Face Internal Graticule Screen
On View at our 2 Stores
Our Eighth Year Of Business

CAR COMPUTER—PRICE SLASHED!

— HUGE SCOOP PURCHASE —

BELOW MANUFACTURER'S COST!!

ONLY
$125
COMPLETE
MASSIVE SAVING OF $74

AS REVIEWED
OCT '82
EA (p.26-28)
ETI NOV '82 (p.26)

CAT. XC2010

NEW IMPROVED MODEL!

Mail Order By
BANKCARD
Via Your Phone

FULL 90 DAY WARRANTY

or by mail order to
Jaycar
Box 185
Concord 2137

At $199 the Voyager Car Computer represented absolutely outstanding value for money. No one else had such a low priced **FULL FUNCTION** car computer. The Voyager is the only low-cost unit that will give you full consumption (the most important feature in a car computer) in both metric litres 100km **AND** good old **MILES PER GALLON**!

At $199 many, many hundreds have been sold. **NOW** you can grab one **absolutely complete** for only $125 — a saving of 37% or $74!

The Voyager comes absolutely complete with all fitting hardware — even down to a roll of insulation tape! Installation generally takes between 4 and 6 hours depending on vehicle.

The Voyager is available from the following dealers at your convenience

Jaycar Sydney (City)	264 6688/267 1614
Jaycar Concord	745 3077
Jaycar Carlingford	872 4444
Jaycar Hurstville	570 7000
Zap Electronics	Parramatta Hornsby
Rod Irving	
Melb A'Becket St	(03) 347 9257
Northcote	(03) 489 8131
Altronics Perth	(09) 328 1599

Spare Flow Sensors: Jaycar will be supporting this product for many years to come. To avoid problems changing cars, why not buy a spare fuel flow sensor? They are about the only things that wear out!

Cat. XC2036

ONLY **$29.50**

VOYAGER OPERATING FEATURES

ROD IRVING ELECTRONICS, 425 High St, Northcote, Vic; 48-50 A'Beckett St, Melb, Vic. Phone (03) 489 8866, (03) 489 8131. Mail Order Hotline (03) 481 1436.
Mail Orders to P.O. Box 235, Northcote 3070, Vic. Minimum P&P $3.00. Errors and omissions excepted.
Please address tax exempt, school, wholesale and dealer enquiries **RITRONICS WHOLESALE,** 1st Floor, 425 High St, Northcote 3070, (03) 489 7099, (03) 481 1923, Telex AA38897.

REVIEWS OF RECENT
Records & Tapes
CLASSICAL • POPULAR • SPECIAL INTEREST

SHOSTAKOVICH — Concerto No. 1. KABALEVSKY — Cello Concerto No. 1.

Yo-Yo Ma (cello) with the Philadelphia Orchestra, Conducted by Eugene Ormandy.
CBS Masterworks Digital Disc D37840.

Two very different kinds of cello concertos are offered on this very well produced digital disc. The Shostakovich is a very serious work that needs knowing to be fully appreciated. Yo-Yo Ma, a 28 year old Paris born Chinese, starts the first movement with a typically cheeky Shostakovich tune, cello and orchestra beautifully mated.

The soloist and conductor both show the hands of masters and the digital processing is very clear and sharply recorded. The result is almost like a close-up of the music.

It is taken in the strictest time and I often found myself in my mind's eye marching to it.

The second movement is very luscious though the Philadelphia's strings lose a little of their gloss under the close-up of digital scrutiny. Ormandy, who uses the same strict treatment as in the first movement, loses a little of its lyricism in consequence. The main theme, cold at first, grows on you more and more as the movement goes on.

But the missing lyricism enters when Yo-Yo's cello sings out. His playing is peerless and the brilliantly scored orchestra is always in perfect balance. They blend together in a process Brillat-Savarin might well have called osmosis. Towards the end the sound grows more compressed and the very high solo passages sound so far off key that they might be quarter tones.

But on the whole the movement is very lovely, different entirely from the jocose first one. There is a long cadenza treated with sensitive lyricism by Yo-Yo with a compelling crescendo built to fortissimo proportions by the player at speed.

Yo-Yo treats the daunting difficulties of the Finale with outstanding brilliance and at breathless speed. This has easily followed logic, and refers back cyclically to the first movement with here and there a hint of Stravinsky.

The Kabalevsky is much more accessible. Of lighter weight it sounds quite mellifluous after the Shostakovich. It starts with an easy swinging gait that makes great demands on the soloist. The engineering has the same close-up style of the reverse side with Yo-Yo's precision echoed everywhere in the orchestra. The second movement, marked largo, goes at much more like a moderato tempo. The composers' two styles couldn't be more different yet both are firmly Russian. Any sensuous sound is swept from the orchestra, leading to a long cadenza-like passage in meditative mood. The ending is full of charm.

The finale (allegretto) has the same easy-running style as a prelude to a faster strong Russian style that has the feet dancing. The movement runs along like a happy girl. Later, it is taken at a speed and clarity reminiscent of the old Heifetz finale to the Mendelssohn E. Minor. (J.R.)

CHOPIN

Waltzes No. 1 to 14. Claudio Arrau (piano). Philips stereo disc 9500 739.

One might be forgiven for thinking that a simple form like the waltz would have precluded any exercise of deep thought. Yet simple as it is, it has an astonishing number of different moods and styles. One has only to recall such variants as Liszt's Mephisto Waltzes, the Viennese Waltz, the serious and the flippant examples and finally this collection of Chopin.

One only has to hear the difference between the Rubinstein performances and these of Arrau to appreciate this. One thing they share in common is an aristocratic style. Otherwise their readings are very different indeed. And much of this is due to the nature of Chopin's inspired writing.

The differences are striking right from the very first waltz recorded (and incidentally the first Chopin published), Op.34. Here Rubinstein's style is characteristically elegant; Arrau's is slower and much broader with fuller tone.

In Op.34 No.2, Arrau's darker mood is sharply contrasted by Rubinstein's brisker treatment. So, right at the beginning of the record, there is a difference between Rubinstein's salon elegance and Arrau's considerable delving into the construction of the pieces which, under his magic fingers, differ bewilderingly while always remaining true waltzes.

I must apologise here for the different spelling used in naming these pieces. Chopin used the French version Valse, but it is customary when discussing the form in English to use the German form waltz. I have tried to rationalise the problem but quite without success.

Op.42 is probably the finest of all these pieces (14 in all) and Arrau interprets it on a wider scale than his competitor, though Rubinstein suffers in no way by comparison. Perhaps the best example of the two artists' idiosyncracies is to be found in the C Sharp Minor Valse in which we have Rubinstein in typical mood and Arrau at his most meditative. Either versions of these delicious waltzes should please everyone, but both would be better. (J.R.)

RACHMANINOFF

Symphony No. 1. Concertgebouw Orchestra conducted by Vladimir Ashkenazy. Decca digital disc SXDL 7603.

This symphony might be briefly described as a composer's love affair with the minor mode. But it is never lugubrious. At its first performance it suffered the fate of so many promising first pieces by a young composer — ridicule and condemnation.

Glazounov gave a disgracefully bad perforformance, not even taking the trouble to hide his dislike, so much so that the young (22) composer accused him of drunkenness. He had edited the symphony and made many alterations which it must be admitted were usually improvements. At any rate, young Rachmaninoff was so discouraged by its reception that he wrote nothing for some three years afterwards.

The recording is digital and some loss of lusciousness in the strings is compensated for by increased clarity of the scoring that otherwise tends to become congested. You won't hear any of the sensuous melodies you do in the piano concertos, though they are hinted at in plenty. After a rave introduction, the work continues very turbulently. The plainsong Dies Irae is featured — how often Rachmaninoff introduces it into its later works — and the splendid clarity of articulation at very fast speed in the cellos and basses is a joy. A very Russian-sounding second subject foreshadows the juicy tunes that will come later in the concertos and other works.

Next follows a fugato at great speed, faster than I have heard any other conductor take it — and none the worst for it. This leads to extended turbulence, played here with meaning and some pain. Ashkenazy has great panache and ease of manner in his handling of the very many abrupt changes of tempo. And the engineering provides a wide range of dynamics carefully not overdone. The second movement is scherzo-like but with some troubled Mendelssohnian speed. It is all enjoyable, the technique assured, with most of the movement so soft that loud bits bring with them some surprise.

The third movement is a larghetto which displays the promise of the composer's slow theme style with much reliance on the minor scale and some commonplace modulations from it and some decidedly not. The mood darkens and remain sceptical. Ashkenazy shows much passion in the long quiet stretches and makes the whole very easy to listen to.

The stirring opening of the finale goes with splendid control of the many changes of syncopated rhythms. This is stunning playing at an exciting speed with the conductor pushing it along exhuberantly. One can imagine his hair streaming in the wind he creates. But behind it all is exemplary refinement. Major struggles against minor in a stirring finish. Highly recommended. (J.R.)

HANDEL

Music for the Royal Fireworks. Water Music. The Academy of Ancient Music on authentic instruments conducted by Christopher Hogwood. Oiseau Lyre Stereo Disc DSLO 595.

The Royal Fireworks Music was written to celebrate the end of the War of the Austrian Succession. When it was arranged to hold the ceremony in the Green Park, and make a martial sounding outdoor affair of it, Handel first chose for his orchestration 16 trumpets and 16 French horns. George 2nd had also expresed the wish that there should be "no fiddles" and that oboes should be substituted. Handel disapproved of this, however, and later added "fiddles" and reduced the number of oboes and trumpets.

The Orchestration finally decided on consisted on 24 oboes, 12 bassoons, contra bassoons, nine horns, nine trumpets, side drums and three sets of timps. Serpents were also included but later removed from the score.

However, at the rehearsal everything went wrong. With 101 brass cannon, fireworks going off at the wrong time or failing to go off at all, rockets falling among the crowd, and a splendid pavilion that was to be the set piece catching fire, not much of the music could be heard.

The only conductor I know who tried to capture the original grand sound was Charles Mackerras many years ago on a Pye disc. He modified the first orchestration by using 26 oboes, 14 bassoons, four contrabassoons, two serpents, nine trumpets, nine horns, three timpanists and six side drums. And a grand row it all made.

The rehearsals took place in London after 11 o'clock at night, this being the only time that all the musicians needed would be free from engagements elsewhere. Anyway, they all loved it and made a joyous din and Mackerras told me last year that Pye were thinking of re-issuing it.

Hogwood makes a fine fist of it using the present day compromise orchestration. At any rate, his music has an "authentic" sound, something like characteristic Handel. The problems caused by the recreation of Handel's first thoughts are more closely resembled by the Mackerras version but, in the meantime, the present one under review will do nicely.

The Water Music receives an excellent performance too, and I can recommend this disc as an entirely worthy compromise. But if the Pye re-issue of the Mackerras performance eventuates don't hesitate to acquire one. (J.R.)

STRAUSS

Eine Alpensinfonie (An Alpine Symphony); Richard Strauss. Herbert von Karajan conducting the Berlin Symphony Orchestra. DG compact disc 400 039-2.

The Alpine Symphony was composed between the years 1911 and 1915, with most of the actual orchestration being completed within the final three months. According to the booklet, Strauss did not particularly enjoy the task, although he saw the work as something of a musical tour-de-force, requiring an orchestra of 135-odd players, an organ, a wind machine and other possible effects.

Essentially a symphonic poem with a single movement lasting for just on 51 minutes, the Alpine Symphony describes a mountain-top climb, probably of the Zuggspitze, which towered above the Strauss villa in the Bavarian Alps.

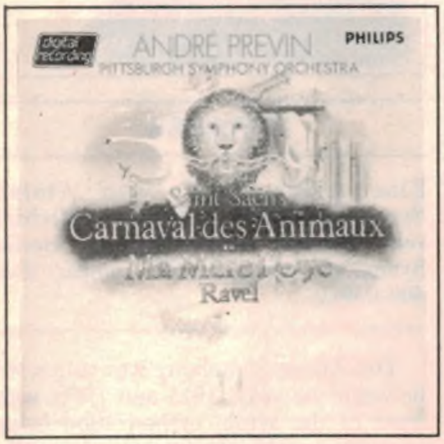
The work divides into 22 melodic episodes. It opens with the mountain shrouded in darkness ("Night) — barely audible strings; this is followed by "Sunrise", dramatic — and noisy! Then comes "The Ascent", followed by "Entering the Forest" . . . and so on to the complex emotions as the climbers reach the top: "Precarious Moments", "On the Summit" and "Vision".

The return journey is essentially the climb in reverse, except that it is interrupted by a fierce storm, complete with wind machine! But the storm subsides, the sun sinks from sight and an evening "Epilogue" ushers in another "Night".

The Berlin Philharmonic plays magnificently and Karajan's direction is equally notable. Some may feel that the climb has been scaled to epic proportions but this would be a quibble rather than a real criticism.

What I found really disappointing was the sound quality of the disc arising, I believe, from the difficulty of recording such a large group. Unless I miss my guess, DG engineers have relied too heavily on multi-miking and "spotting", leading to a confusion of sound, from which the violins in particular emerge in a quite strident fashion.

In short, the performance is fine but, by compact disc standards, I found the sound disappointing. (W.N.W.)



SAINT-SAENS, RAVEL

Carnaval des Animaux (Saint-Saens). Ma Mere l'Oye (Ravel). The Pittsburgh Symphony Orchestra conducted by Andre Previn. Philips compact disc 400 016 2.

Listening to Saint-Saens' Carnival of the Animals, I couldn't help but feel that this Philips release would be a worthwhile inclusion in any new domestic compact disc collection, where children (or grandchildren) are involved. To complement, say, Prokofiev's "Peter and the Wolf", Saint-Saens 14 miniatures depicting animals and what-nots would provide the basis for a diverting and meaningful exercise in identifying orchestral themes.

The booklet which comes with the disc lists the subjects in this "Grande fantaisie zoologique" and adds a few jottings about the orchestration, which are probably sufficient for this popular and very transparent item. It's a fun performance.

By contrast, and despite its name, Ravel's "Mother Goose" suite sounds quite formal and the playing possibly does err in that direction. But it's a very competent performance, nevertheless.

My real quarrel is that the booklet notes on this "beautifully orchestrated" half-hour suite are lamentably brief — a mere 10 lines of English-language text, plus a list of six related ballet scenes — in French! It underlines an obvious problem in relation to compact discs produced for the European market: if you have to accommodate three languages in the usual small booklet, you can't say much in any of them!

A further point is that, with its potential for tuition and its 20 distinct subjects (14 in "Carnival" and 6 in "Mother Goose") the disc is a natural subject for detailed index and/or time encoding but there is no hint in the booklet of any such provision having been made. As far as the CD player is concerned, it simply registers two tracks and that's that. A pity!

The recording itself is fine, however and if the contents appeal, you can buy with complete confidence. (W.N.W.)

DEVOTIONAL

Restoration. A Prayer in Music for the Church. As expressed by Evie and Pelle Karlsson. Stereo LP Word WSB-8906. [From Word Records Aust, 18-26 Canterbury Rd, Heathmont, Vic 3135. Phone (03) 729 3777].

The devotional songs on this new album, all but one composed by Evie and Pelle Karlsson, reflect a strong personal faith and a deep concern of the Authors for the Christian Church — not for bricks and mortar but for the congregation of worshippers. Instead of the usual jacket notes, there is "An open letter to Christians everywhere", explaining their convictions.

In a program that runs for almost 40 minutes, Evie and Pelle present 15 of their songs, interspersed with occasional scripture quotations: Restore Your Temple — Nehemiah's Prayer — Seek Me — Be Still and Hear — Sing to The Lord — Lord Most High — Your Glorious Throne — Rejoice and Sing — Touch Your People — Sanctify Yourselves — Let There Be Fellowship — Jesus' Prayer — Authority — We Are The Church — Sanctify Yourselves.

Featuring male and female vocal leads, Pelle and Evie Karlsson, chorus, organ and instrumental, the music should find wide acceptance — modern enough to appeal to a younger audience but not to the extent that would alienate the "oldies".

The lyrics appear in full on the liner and can be followed through from track to track. While the sound itself is good, the album should appeal to anyone whose interest goes beyond the mere music to the message which it carries. Have a look and a listen. (W.N.W.)

NOSTALGIA

All-time Favourites. Roger Whittaker. Stereo LP. RCA VPL1-6664. Cassette VPK1-6664.

Here's an album of silver-haired nostalgia, if ever there was one: 19 tracks and 50 minutes or more of all-time favourites, featuring soloist Roger

STOP CRIMS!

Install these quality alarm systems at do it yourself prices!

Amazing Security Centre

This is it! The most professional alarm system we've ever seen — and it's suitable for homes, offices, factories. . . you name it! With six individual sectors all full controllable for instant or delayed alarm, each able to isolate and each triggerable by a huge range of sensors: the type of alarm used by banks, etc where security is paramount.

- Resistive loop sensing suits both n/o & n/c alarm sensors. Bridging out cutting sensors will trigger the alarm.
- Suit most type of detection devices.

CAT L-5100

12V Rechargeable Battery to suit. Cat S-3442 $24.95

Only **$199**

Catch them electronically

Ultrasonic Sensor

Just **$65**

12V operated, works on doppler principle. Has provision for remote switching. Trigger any alarm unit. Cat L-5109

Microwave Sensor

Only **$95**

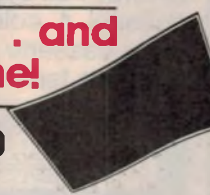
Works through plaster, fibro, etc. Very handy for complete concealment! 12V operated, both n/o & n/c contacts. Range up to 15 metres. Cat L-5000

Infra-Red Detector

It's a steal at **$99**

Ideal for doorways, halls etc. Operates when beam is cut (ie when someone walks through it!) Range from 0.8 to 15 metres. Cat L-5050

One step. . . and they're gone!



Only **$19.50**

Hide a pressure mat under the carpet, a rug - even the lightweight Bill Sykes can't get past this one! Put one in front of your safe! Normally open contacts. Cat L-5270

Protect against fire, too!

Only **$7.95**

The above Security Centre (and most alarms!) have provision for a fire sensor. Take advantage of it - and protect your home & property! Use any number of sensors in likely 'hot spots'. Cat L-5254

Blast 'em!

Know what a crook hates most? Noise! Scare the pants off them with this high efficiency horn speaker. Connects to alarm speaker output. Really loud Cat C-2705

Just **$10.25**

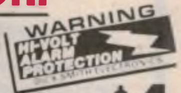
Give em the gong!

A real loud fire bell is great for scaring them off, too. This one is 12V operated, draws just 300mA and can be heard blocks away! Cat L-5280

Only **$34.95**

Scare em off!

Warning stickers are a great deterrent in themselves. The thief doesn't know which type of alarm you have - so tries someone else's place instead! Self-adhesive, brightly coloured. Cat L-5310



$1

STOP PRESS

Just arrived: Swiss made Passive Infra-Red detector-top quality, no false alarms! $119.00 Cat L-5010

EXCLUSIVE

Your Home is on the 'hit list' - your valuable property maybe the gleam in a crooks eye tomorrow! You need help!!! Here it is: our specially written guide to installing a fully professional alarm system - and it's free with any purchase of $1.00 or more for June only! That's right: every home now needs protection - and we'll show you how to install an alarm that will deter even the most persistant pest . . .

FREE!

Ask for your copy when you're in a Dick Smith Electronics store - or with your next mail order.

DICK SMITH ELECTRONICS

See page 108 for full adress details

bankcard welcome here

A765/JL

Telephones:
211 0744
211 0816

Radio Despatch Service

Est 1934

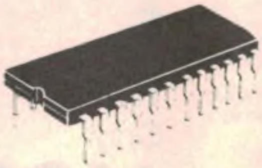
869 GEORGE STREET, SYDNEY 2000

WE STOCK A LARGE RANGE OF SEMICONDUCTORS

DIGITAL

2102
2112
2114
2708
2716
2732
2764
4116
5203
5204
6800
6522
6116
4164
6802
6821
6850
Z80

INTERSIL



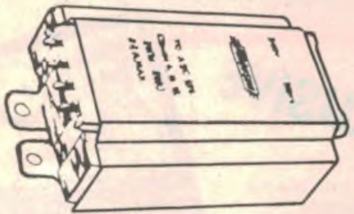
4000 SERIES
7400 SERIES
74LS SERIES
74C SERIES
74S SERIES
74F SERIES

LINEAR

1488
1489
TEA 1002
IIC90
"XR" RANGE
LM334Z
LM394
8T28
LM1812
6875
LM1889
PAC 0800
ADC 0800
TL490CN
5303 (UART)
6402 (UART)
7106
7107
7224
7660
8038
7664
7226
7216
7207
LM396K
LF398H
687S
8013
7555
75107
75110

TOO MANY TO LIST

FERGUSON TRANSFORMERS



PL-/2-5VA SERIES	9.30
PL-/5VA SERIES	9.90
PL-/20VA SERIES	17.70
PL-/40VA SERIES	19.50
PL-/60VA SERIES	25.50
TS115/30VA	48.00
TS115/60VA	48.00
TS115/200VA	50.40
TS115/300VA	72.00

PLEASE NOTE NEW TELEPHONE NUMBERS

TRADING HOURS:

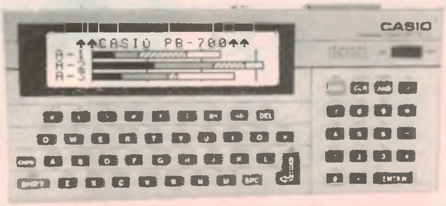
MON TO FRI 8.30am to 5.30pm

THURS NIGHT 6.30pm

SATURDAY 8.30am to 12pm

CASIO PB700 COMPUTER

Display 20 characters x 4 lines — 160 x 32 dot matrix graphic display. RAM capacity — 4K bytes, expandable to 16K. Uses BASIC. Full system expansion — optional 4 colour plotter printer with cassette interface, micro cassette tape recorder.



CALCULATORS

CASIO

FX 550	33.73
FX 82	24.95
FX 910	39.95
FX 990	49.95
FX 450	58.12
PB 100	79.95
FX 602P	109.95
FX 702P	169.16
FX 700	124.95
FX 802P	189.95
FX 3600P	49.95

TEXAS INSTRUMENTS

TI 30-ii	22.00
TI 35	26.00
TI 54	48.00
TI 55 ii	67.00
TI LCD Prog	76.00
BA ii	55.00
BA 55	76.00

HEWLETT-PACKARD

HP 10 C	109.86
HP 11 C	141.25
HP 12 C	188.34
HP 15 C	188.34
HP 16 C	188.34
HP 41 C	306.06
HP 41 CV	431.63
HP 41 CX	486.56

HITACHI 20MHZ OSCILLOSCOPE

DUAL TRACE LATEST MODEL **WHY PAY MORE?**

ALL PRICES INCLUDE SALES TAX.

ONLY **$679.00**

Records & Tapes

Whittaker and an oh-so-gentle orchestral accompaniment arranged by Chet Atkins.

My first reaction to the opening track was that Roger W is not as young as he used to be and that he was finding it just that much more difficult to match the flowing melody of the accompaniment. But the impression soon passes and a mood of relaxation takes over, which is obviously what Whittaker and Atkins had in mind.

In short, if you're a candidate for the greying generation, this is music to read by or knit by.

There are eight tracks on side one: Lara's Theme — Unchained Melody — Making Believe — Scarlet Ribbons — Red Sails in the Sunset — Red Roses for a Blue Lady — Red River Valley — Vaya Con Dios. Side two has 11 more but, without trying to list them all, they finish up with: "Eternally", "Tenderly" and "Stranger on the Shore".

Quality is no problem, if only because the even (who said "wallpaper"?) sound obviates any worries with dynamic range. As I said: pure nostalgia! (W.N.W.)

POPULAR/CLASSICAL

Posh. Stereo LP. From Arika Records, PO Box 2, Pymble, NSW 2073.

The unlikely group name "Posh" is said to be short for "People of Sydney Harbour" but I'd take some convincing that it isn't a colloquialism to describe a trio who, in part anyway, have their feet in the world of jazz, pop and rock, and their heads in the Conservatorium and the Opera House.

The basic group comprises:

Jane Rutter — flute, graduate of the Sydney Conservatorium High School, soloist with the Sydney Youth Orchestra, Sydney Symphony Orchestra, associate of the Australian Chamber Orchestra and lecturer at the Conservatorium.

John Huie — guitar and vocals, trained at Conservatorium High School, active composer, founder of two rock bands, studying overseas.

Hugh Fraser — double bass. Studied piano and clarinet at the Conservatorium High School, but became addicted to bass, studying and playing here and overseas, in the context both of classical and jazz.

Associated with them on this album are four other named players, playing cello, violin and congas.

The program is a mix, if ever there was one: "Lazy", humorous comment; "Can You Imagine", a tribute to John Lennon; "Blackbird", adapted from Lennon-McCartney; "Terpsichore", "Go To Your Room" and "Gay Paris", classical/jazz fusion; "Telemann Vivace F Minor" and "Bach Bourrees", clasically inspired; and others.

John Huie provides the novelty and variety with vocals and guitar but the whole program is tied together by the magnificent flute (and Piccolo) of Jane Rutter, and Hugh Fraser's no less magnificent bass. This is not loud music, because they rely on clarity and intimacy rather than amplification.

Posh has immediate and universal appeal and it is of no wonder that they are in such demand locally; or that they were invited to repesent Australia in New York, at the International Off Broadway Festival, with other US engagements to follow.

Recorded at the Alberta St Studios and mixed at Sun Studios, the quality is first rate, with a very clean sound in the top and middle register and enough energy from the double bass to make your woofers wonder what hit them! Don't pass this one up because of the odd name! (W.N.W.)

When you need them fast
the connector specialists
are ready to roll.

ACME

PROUDLY AUSTRALIAN

ACME ELECTRONICS
- 2-18 Canterbury Road, Kilsyth 3137
(03) 729 8999 AA 35786
- 120 Beaconsfield Street, Auburn 2144
(02) 648 2255 AA 79004
- 355 Montague Road, West End 4101
(07) 44 4131 AA 42130
- J.G. THOMAS & ASSOCIATES
5 Durham Road, Bayswater 6053
(09) 272 7122 AA 94423
- NEIL MULLER P/L
74 Mary Street, Unley 5061
(08) 272 8011 AA 88508
- W.P. MARTIN P/L
202 Argyle Street, Hobart 7000
(002) 34 2811 AA 58219
- ELECTRONIC COMPONENTS
29 Wollongong Street Fyshwick 2609
(062) 80 4654 AA 62468

A Division of James Hardie Electrical
Hardie Trading Ltd Inc in Vic

PHONE YOUR ORDER — ALTRONICS TOLL FREE 008·999·007

FOR 15¢ PHONE YOUR ORDER TOLL FREE ON 008·999·007

We will immediately confirm stock availability. We will also confirm the very hour your order will be dispatched (over 95% of orders leave the same day). **With Jet Service Delivery we deliver next day to capital cities and suburbs** — Country areas please add 24 to 48 hours. **Available bankcard holders only** — sorry non-bankcard holders must post a cheque or money order — even so, we promise to deliver quicker than any other supplier in Australia.

NEW HITACHI F SERIES
SQUARE SCREEN DUAL BEAM CRO

V-212 DC to 20 MHz, 1 mV/dlv, DUAL-TRACE

We are proud to include Hitachi's latest oscilloscope in our range of test equipment.

It features: • Thin, light and compact design (310W x 130H x 370D mm, 6 kg) • Large 6 inch rectangular, internal graticule CRT • Vertical mode triggering selection to provide stable triggering of each channel • High accuracy ± 3% • High sensitivity 1mV/dlv • Stable, low drift design • TV sync separation circuit builtin • Convenient X-Y mode for phase difference measurements • Tilting bail supplied.

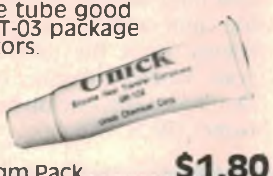
FREE FREIGHT ANYWHERE IN AUSTRALIA

Q0152............ **$699.00**

HEATSINK COMPOUND

BUY THE BULK 150g PACK — IT'S 378% MORE ECONOMICAL!

Heat conducting paste facilitates heat transfer from semi to Heatsink. One tube good for up to 30 T-03 package semiconductors.



Fantastic Value

H1600	7.5gm Pack	**$1.80**
H1610	150gm Pack	**$9.50**

MASSIVE 30 AMP RATED PANEL MOUNT FUSE HOLDER

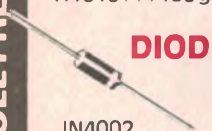
Remember the hassle in providing high current circuit protection? The options are few — expensive industrial fuse assemblies costing $10 or more or circuit breakers (costing an arm and a leg). Well here is the answer — our nifty new panel mount fuse holder. **It's like a big, big brother to the 3AG Style.** The 10mm x 38mm fuses are an industry standard of course — naturally though, **ours cost somewhat less than industry standard prices.**

Panel hole size 15/16 inch is perfect although 1 inch or 25mm is OK.

Simple One Hole mounting — no more expensive panel cutouts, brackets.

	each	10 +
S6030 Fuse Holder	**$4.50**	**$4.10**
S5975 Fuse 20 AMP	**$1.95**	**$1.85**
S5976 Fuse 25 AMP	**$1.95**	**$1.85**
S5977 Fuse 30 AMP	**$1.95**	**$1.85**

OEM's — Please contact our Wholesale Dept for wholesale prices.



DIODES SLASHED

	Were	This Month	100 +
IN4002	**8c**	**6c**	**5c**
IN4004	**10c**	**8c**	**7c**
IN4007	**14c**	**10c**	**9c**

SCOOP

SUPER BRIGHT HIGH INTENSITY

SEIMENS 5mm RED LEDS

WERE 50c

SAVE A FORTUNE!

CAT	1-9	10-99	100 UP
Z0155	**22c**	**19c**	**15c**

MINI BUZZER 1.5-5V DC

SENSATIONAL LOW PRICE

Handy little solid-state audio "Buzzer" or signalling device. Just the shot for communicator panels, or for timer alarms or in the car. Polarity conscious.

S5062 **$1.95** 10 Up **$1.75**

200 MW 8 OHM

Large Ferrite Magnet. Ideal replacement speaker. Great for hobby projects.

C 0610	**$1.95**
10 Up	**$1.50**

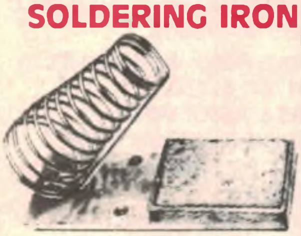
Dual Z 4/8 OHM
3 Watt RMS
Mounting hole centres at 82mm.

C 0616	**$5.25**
10 Up	**$4.75**

SOLDERING IRON STAND

UNIVERSAL TYPE

T1302



$5.95

INCREDIBLE VALUE

BULK PACKS

ALL COMPUTER SELECTED

SUPER PRICE

$5 each

R3501............25W Resistor Pack
Av. contents 300.
R3510........Greencap Pack 100V
Av. contents 50.
R3515.........CERAMIC PACK 50V
Av. contents 100.
R3520. ELECTROLYTIC PK. PCB TYPE
Av. contents 40.

3 watt 8 OHM

Mounting Holes at 71mm centres.

C 0612	**$4.75**
10 Up	**$4.25**

VERO TYPE STRIP BOARD

Alpha numeric grid. Pre drilled .9mm, 2.5mm spacing. 95mm wide. 3 handy lengths.

H 0712 .... 95 x 152 **ONLY**

Dual Z 4/8 OHM
3 Watt RMS
Mounting holes at 112mm.

C 0620	**$7.95**
10 Up	**$7.25**

BANKCARD HOLDERS — PHONE ALTRONICS TOLL FREE 008·999·007 FOR NEXT DAY JETSERVICE DELIVERY

BANKCARD HOLDERS — PHONE ALTRONICS TOLL FREE 008·999·007 FOR NEXT DAY JETSERVICE DELIVERY

FOR DESPATCH P&P CHARGES AND ADDRESS DETAILS PLEASE REFER TO OUR AD ON PAGE 131

● **PHONE YOUR ORDER — ALTRONICS TOLL FREE 008-999-007** ●

BANKCARD HOLDERS — PHONE ALTRONICS TOLL FREE 008-999-007 FOR NEXT DAY JETSERVICE DELIVERY

OR FOR 30c POST AN ORDER TO ONE OF ALTRONICS COMPETITORS

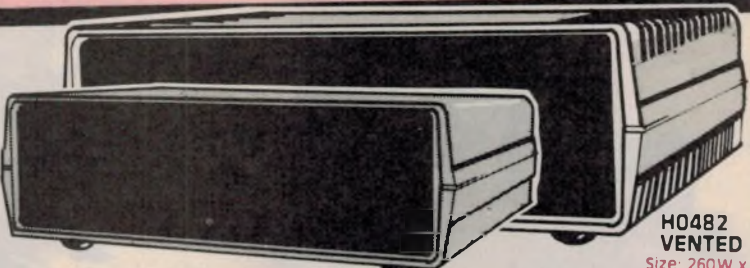
— naturally you won't have a clue as to whether they've got the items you need available. And of course, be prepared to wait, wait, patiently wait sometimes for weeks!
Why waste your valuable cash? Altronics staff are waiting for your call now (up to 6pm eastern standard time).

INSTRUMENT CASES

Our superb instrument cases will give your projects the professional appearance they deserve.

	WAS	NOW	10 +
H0480	$13.50	$11.50	$ 9.50
H0482	$17.50	$15.00	$12.25

OEM's — Manufacturers — Bulk Users. Your product will look like it's straight out of "Hewlett Packard's" factory with these brilliant low cost cases. Contact our Wholesale Department for Bulk Prices.



H0480
Size: 200W x 160D x 70H

H0482
VENTED
Size: 260W x 190D x 80H

- ★ Internal mounting posts enable a wide combination of PCB's, Transformers, etc. to be accommodated (screws supplied).
- ★ Removable front and rear panels. Attractive textured finish one side and plain the reverse side. (Enables direct engraving, silk screen printing etc. to plain side.)
- ★ Top and bottom split apart for ease of construction or service. Integral feet included.
- ★ Great for test instrument and other high grade projects.
- ★ PCB guide rails provided internally allow vertical PCB positioning to several locations.

KEY OPERATED SWITCH

HALF PRICE! BE QUICK

19.5mm mounting hole required. Supplied with two keys. Hundreds of applications for security type applications.

~~$2500~~ **$3.50**

LOGIC PROBE

Q1272
WAS $29.50

ONLY $19.50

★ Directly powered from circuit under test (5V) ★ Tested to 12.6 MHZ ★ DTL/TTL — CMOS Threshold selector ★ Circuit loading 30UA approx. ★ High-Low — pulse or memory led indication. Impulse mode pulse length is extended to enable visual observation. In memory mode any detected level is continuously displayed until reset.

ALTRONICS

105 STIRLING ST. PERTH — FOR INSTANT SERVICE

008 999 007 TOLL FREE

(09) 328 1599 PERTH METRO AREA & AFTER HOURS RECORDED SERVICE

All Mail Orders: Box 8280, Stirling St, Perth, WA 6000.

Phone toll free 6am-8pm — for personal service or take advantage of our 24 Hour 7 day p/week Bankcard phone order service. Give your **name address with postcode, phone number, bankcard number and expiry date then your order** — and presto your order will be processed and back to you in a flash. — Please nominate Jetservice if you want overnight delivery.

$2.50 DELIVERY AUSTRALIA WIDE. We process your order the day received and despatch via Australia Post. Allow approx. 7 days from day you post order to when you receive goods. Weight limited 10kgs.

$4.50 DELIVERY AUSTRALIA WIDE. We process your order the day received and despatch via Jetsetvice for delivery next day.

BANKCARD HOLDERS CAN PHONE ORDERS UP TO 8PM (EST) FOR NEXT DAY DELIVERY — SOUNDS INCREDIBLE DOESN'T IT? Alright you cynics just try us! Weight limit **3.3kgs.** Jetservice cannot delivr to P.O. box numbers (Australia Post would have a fit).

$10.00 HEAVY HEAVY SERVICE — AUSTRALIA WIDE All orders over 10kgs must travel on the heavy service, that is — road express. Delivery time 7 days average.

ALTRONICS RESELLERS

Please note that resellers may not have all the items advertised in stock, and as resellers have to bear the cost of freight, prices may be slightly higher than advertised. ALTRONICS resellers prices should however represent a considerable saving over our competitors' prices.

WA

COUNTRY

ALBANY	
BP Electronics	41 2681
ESPERANCE	
Esperance Communications	71 3344
GERALDTON	
Geraldton TV and Radio	21 2777
KALGOORLIE	
Todays Electronics	21 5212
MANDURAH	
Kentronics	35 3227
WYALKATCHEM	
D & J Pease	81 1132

NT

DARWIN	
Ventronics	81 3491
ALICE SPRINGS	
Ascom Electronics	52 1713
Farmer Electronics	52 2967

ACT

CITY

Electronic Components	80 4654
Scientronics	54 8334
Australis	47 5172

VICTORIA

CITY

All Electronic Components	662 3506
Ellistronics	602 3499
MaGraths Electronics	347 1122

SUBURBAN

BENTLEIGH	
Absolute Electronics	557 3971
BOX HILL SOUTH	
Eastern Communications	288 3107
CHELTENHAM	
Talking Electronics	550 2386
FOOTSCRAY	
Acron Electronics	689 1911
SOUTH CROYDEN	
Truscott Electronics	723 3860

COUNTRY

BENDIGO	
Lindrea & Johnson	41 1411
MILDURA	
Electronic and Digital Services	23 3380
SHEPPARTON	
GV Electronics	21 8866

QUEENSLAND

CITY

Delsound P/L	229 6155

SUBURBAN

FORTITUDE VALLEY	
St. Lucia Electronics	52 3547
PADDINGTON	
ECQ Technics	369 1474
SALISBURY	
Colourview Wholesale	275 3188
SLACKS CREEK	
David Hall Electronics	208 8808

COUNTRY

CAIRNS	
Thompson Instrument Services	51 2404
GLADSTONE	
Purley Electronics	72 4321
NAMBOUR	
Nambour Electronics	41 1604
PALM BEACH	
The Electronics Centre	34 1248
ROCKHAMPTON	
Purley Electronics	2 1058
TOOWOOMBA	
Hunts Electronics	32 9677
TOWNSVILLE	
Solex	72 2015

SA

CITY

Protronics	212 3111
Gerard & Goodman	223 2222

SUBURBAN

BRIGHTON	
Brighton Electronics	296 3531
CHRISTIES BEACH	
Force Electronics	382 3366
KESWICK	
Freeway Electric Wholesalers	297 2033
PROSPECT	
Jensen Electronics	269 4744
REYNELLA	
Force Electronics	381 2824

TASMANIA

CITY

D & I Agencies	23 2842
GEORGE HARVEY	
Hobart	34 2233
Launceston	31 6533

NSW

CITY

Avtek Electronics	267 8777
David Reid Electronics	267 1385
Jaycar	264 6688
Radio Despatch	211 0191

SUBURBAN

CARLINGFORD	
Jaycar	872 4444
CONCORD	
Jaycar	745 3077
DEE WHY	
David Ryall Electronics	982 7500
ENFIELD	
Avtek	745 2122
HURSTVILLE	
Jaycar	570 7000
LEWISHAM	
PrePak Electronics	569 9770
MATTRAVILLE	
Creative Electronics	666 4000

COUNTRY

ALBURY	
Webb's Electronics	25 4066
BATHURST	
Sound of Music	31 4421
BROKEN HILL	
Crystal TV	4803
COFFS HARBOUR	
Coffs Harbour Electronics	52 5684
GOSFORD	
Tomorrows Electronics	24 7246
KURRI KURRI	
Kurri Electronics	37 2141
NEWCASTLE	
D.G.E. Systems	69 1625
George Brown & Co.	69 6399
NOWRA	
Vimcom Electronics	21 4011
PENRITH	
Acorn Electronics	21 2409
PORT MACQUARIE	
Hall of Electronics	83 7440
RAYMOND TERRACE	
Alback Electronics	87 3419
RICHMOND	
Vector Electronics	78 4277
TAMWORTH	
Landlink Communications	65 4622
TOUKLEY	
TES Electronics	96 4144
WINDANG	
Madjenk Electronics	96 5066
WINDSOR	
M & E Electronic Communications	77 5935

RESELLERS WANTED IN ALL AREAS (including WA).
Phone: STEVE WROBLEWSKI (09) 381 7233 for details.

BANKCARD HOLDERS — PHONE ALTRONICS TOLL FREE 008-999-007 FOR NEXT DAY JETSERVICE DELIVERY

● **PHONE YOUR ORDER — ALTRONICS TOLL FREE 008-999-007** ●

Micronews

Apple IIc portable released

Apple Computer has released its second new product of the year, the Apple IIc portable, launched at the end of April. The IIc is a miniaturised, portable addition to the Apple family and is compatible with most of the vast range of software for the Apple II machines.

The basic unit consists of a 3.5kg keyboard console with a single built-in 13cm mini floppy disk drive, an external power supply pack and an RF modulator to enable the system to be used with a domestic TV receiver A specially designed video monitor is also available, and a flat panel, 80 column by 24 line liquid crystal display (LCD) will be introduced for the IIc later this year, according to Apple.

Other features of the system include the use of the 65CO2 CMOS version of the 6502 microprocessor, 128K bytes of RAM as standard, selectable 40 or 80 column text display (with video monitor) and three colour graphics modes (40 x 48 in 16 colours, 280 x 192 in 6 colours and 560 × 192 in 6 colours). A built-in sound generator and loudspeaker allows sound effects and music over a range of five octaves.

A range of new peripherals and software for the Apple IIc has also been announced, including a plain paper thermal printer, a "mouse" cursor positioning device, a modem, an external disk drive and a carrying case. The existing Apple joystick, hand controllers, Imagewriter printers and Colour Plotter can also be used with the IIc.

To enable the new user to quickly learn how to use the IIc, Apple is including 20 hours of disk-based training in the form of an "interactive user's manual/computer literacy course" with each computer. "It's everything you need to get started in one box", says David Strong, managing director of Apple Computer Australia. "This allows consumers to buy, set up and use the system right away. The miniaturisation of the IIc architecture has resulted in a serious small computer that people can easily take from the home to the office or school and back again."

The Apple IIc will run most software written for the Apple II and IIe. The Apple programs that are incompatible are those which use non-standard copy protection and memory allocation schemes, and those which require the use of the CP/M operating system.

In fact, the "all-in-one" design of the IIc provides two RS-232C serial ports and a port for an external disk drive but no general-purpose expansion slots. There is no provision for a battery power supply making the IIc a "transportable" version of the Apple II rather than a challenger to "knee-top" computers such as the TRS-80 Model 100.

Price of the basic Apple IIc with one disk drive is $1,775 including sales tax and an RF modulator.

Computer work-station from Meyertronix

Meyertronix has introduced a three tier computer work station called the "Computable" which is supplied as an easy to assemble kit. Features of the unit include three large shelves on an aluminium frame (available in a range of colours) and castor legs for moving the table about. Recommended retail price is $199 (including sales tax).

Further information is available from Meyertronix, PO Box 65, Riverstone, NSW, 2765. Phone (02) 627 2510.

Software support for TI-99/4A

Imagic Australasia has joined forces with Texas Instruments to provide ongoing support for the TI-99/4A home computer. Since April, Imagic has been providing Australia-wide marketing and distribution services for TI software and peripherals for the 99/4A.

"Texas Instruments' policy is to provide long term support for the TI-99/4A" says Imagic's managing director Chris Milner. "We will have available the entire TI software range and will be carrying sufficient stock to support the system for over three years."

For further information contact Mr Don Dennis, Imagic Australasia Pty Ltd, PO Box 234, Dee Why, NSW, 2099. Phone (02) 981 2744.

1984 - *BIG BROTHER MIGHT BE LISTENING. . . BUT WOULD YOU LIKE TO TALK BACK!*

NEW

AVTEK MINI MODEM

Possibly Australia's smallest Telecom approved (pending) MODEM
The **MINI MODEM** comes complete with a phone so that all you have to do is remove your standard phone and plug-in the **MINI MODEM**.
It is so small that you can mount the **MINI MODEM** on the skirting board next to the phone socket and use the Modem phone all the time as your standard phone.

SPECIFICATIONS: ★ 300 Baud CCITT V.21 answer or originate full duplex ★ Power indicator LED ★ Carrier detect LED ★ Answer/originate switch ★ Modem/phone switch ★ Plug pack power supply ★ Size approximately 65x130x40mm overall - SIMPLE AND SMALL!!

AVAILABLE SOON ONLY $189.00

THERMISTOR SPECIAL *56R Philips type 2232-660-91009 - refer to Philips Catalogue for specs.*

10 FOR $1.00

SPECIAL - 1793 DISC CONTROLLER
WAS $45.00 THIS MONTH ONLY $25
SAVE $20.00

ATTENTION MAIL ORDER CUSTOMERS

Next month we are 1 year old and we will be doing a mailing list to send to all our customers. This will have a lot of specials, which we would not normally advertise plus lots of other goodies. If you would like to be on this mailing list just phone (02) 267 8777 and ask.

9" DISPLAY MONITOR FOR YOUR COMPUTER - GREEN (ORANGE) DISPLAY - ONLY $279.00

12 VOLT SUPER TOOL

Designed for sanding - grinding - polishing - cutting - engraving - drilling - milling - erasing. AC adaptor supplied.

$32.50

S-100 SOCKETS

Quality GOLD plated - pins suitable for 1 level wire wraps as well as mother board mounting.

ONLY $4.95 each

QUALITY NEUTRIK XLR CONNECTORS

We now stock a wide range of these quality Swiss made connectors - CHECK OUT OUR PRICES - Buy 10 or more units and pay less 10%

The AVTEK MULTI MODEM is a completely Australian Designed and Manufactured Multi Standard Modem. It has been designed to meet current Telecom specifications (approval pending) and will be available in 4 different styles.

KIT FORM

This is for the hobbyist and is not approved for connection to Telecom lines. It is ideal for private line use and for the Amateur Radio operator for Packet Radio (See review EA January 1984). Complete kit to the last nut and bolt including pre-punched and silk-screened front and back panels.

ONLY $249.00

MODEL MM2

This is a completely assembled and tested unit with a telephone hard wired into the Modem. It can be plugged legally into any phone socket to replace your standard phone.

INTRODUCTORY PRICE $329.00

MODEL MM3

This is basically the same model as MM2 but does not include the telephone but comes fitted with a data Telecom plug which means a dedicated socket must be installed by Telecom.

CONTACT AVTEK FOR PRICE

MODEL MM4

This unit is basically the same as model MM3 but does not have externally selectable Baud rate. The mode of operation is factory set. This is ideal for dedicated dial-up lines. This model also has hardware Auto Answer included.

CONTACT AVTEK FOR PRICE

SPECIFICATIONS FOR KIT, MM2, MM3 and MM4: ☐ **Data Standards** CCITT V.21 & V.23, Bell 103 & 202 ☐ **Data Rates** 300, 600 and 1200BPS ☐ **Backward Channel** 75BPS in conjunction with 1200BPS ☐ **Computer Interface** CCITT V.24 (RS232C) ☐ **Power Requirements** 240V AC 3 watts ☐ **Front Panel Controls** Mode Switch (12 position rotary - not MM4). Connect Switch (3 position toggle). Test Switch (3 position toggle) ☐ **Front Panel Indicators** Connect LED, DCD Data Carrier Detect, RXD Received Data, RTS Request to Send, CTS Clear to Send, TXD Transmit Data, RING Ring Detect, TEST Test Switch off normal, POWER.

NOTE: Models MM2, MM3, and MM4 will not be available until Telecom approval has been obtained.

DISKETTE STORAGE BOX
ONLY $39.95 - Holds 85 discs

MOTOROLA LINEAR INTERFACE IC HANDBOOK - Over 25mm thick. This books contains information on Bus, Memory, Computer, Terminal, Peripheral and Numeric display interface as well as information on voltage references, voltage comparator and communications interface IC's. Includes comprehensive selector guide. **DON'T PAY $11.50 JUNE ONLY $4.95 (p&p $1.00)**

MOTOROLA 6800 PROGRAMMING REFERENCE MANUAL - Over 150 pages - Contains information on ● 6800 program visible registers ● interupts and stack operations ● addressing modes ● instruction set ● commands for Motorola "Bugs" PLUS descriptions of the 6800 series MPU, ROM, RAM, DIA & ACIA **ONLY $3.95**

AVTEK

(ELECTRONICS) Pty. Ltd.

TWO GREAT LOCATIONS

FOR SYDNEY
AND A FAST MAIL ORDER SERVICE

bankcard

CITY

119 YORK STREET
SYDNEY 2000
PHONE: (02) 267 8777

BURWOOD

172 LIVERPOOL ROAD
(HUME HWY) ENFIELD
PHONE: (02) 745 2122

MAIL ORDER

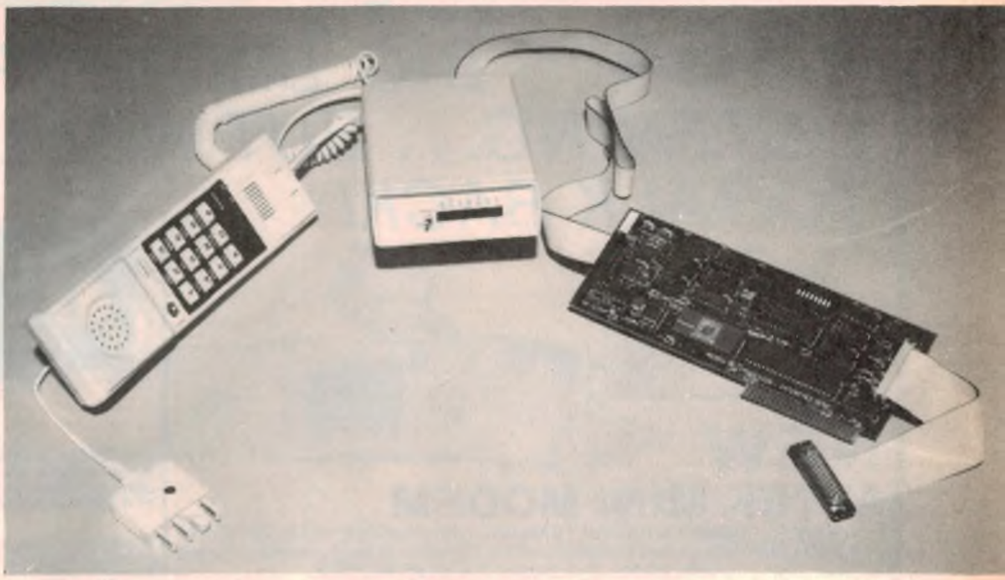
P.O. BOX Q302,
QUEEN VICTORIA BLDG
SYDNEY 2000

POST AND PACKING: Divide the value of your order by 20 (5%) to get post and packing value and then add $2.00 - it's that simple! All Bankcard orders can only be sent to a normal address (NOT a P.O. Box). All Bankcard orders will be sent by registered mail (add $3.00 to P&P charges).

All specials only for month of issue or while stocks last - all prices correct and stock expected to be available at time of going to press.

ENFIELD IS OPEN ON SUNDAYS.

Apple modem from NetComm Australia



NetComm (Australia) Pty Ltd has released a wholly Australian designed and built multi-function modem for Apple computers. The modem is the first in a range of modem communication products from the company and features Auto Dial, Auto Answer and Auto Disconnect facilities.

The unit can be preset with a series of hardware switches but can be re-configured under program control to provide either 300 baud asynchronous full duplex, 1200 baud synchronous half duplex or 1200/75 baud asynchronous Prestel formats. Thus the modem can be used to connect an Apple computer to virtually any remote computer service, including Prestel videotext, IBM 3270 systems, DEC, Prime and Wang minicomputer terminals, Dow Jones, The Source or CSIRONET.

Both CCITT (Australia) or Bell (USA) transmission standards can be supported, with the modem controlled by an on-board microprocessor with its own RAM and EPROM. A Telecom approved slim-line phone handset is supplied with the modem and can be used for voice conversations or manual dialling. Automatic re-dialling is built-in.

The Auto-dial facility allows user programs to automatically establish a connection with their chosen data dial-up service, and the modem can be left in "auto answer" mode and will automatically alert the Apple program of an incoming call.

NetComm will also supply their Apple software package under a "third party developers" licence to allow the modem routines to be integrated into applications packages. Demonstration programs are currently available.

For further information contact NetComm (Australia) Pty Ltd, 8/33 Ryde Rd, Pymble, NSW, 2073. Phone (02) 498 5577.

Computers assist small business award winner

Systems and support supplied by a Commodore dealer have been a "large contributing factor" in the success story of one of the winners of the prestigious National Small Business Awards.

Paul Wright is a retired ballet dancer turned cobbler whose Brisbane-based company is one of only two national award winners from Queensland.

His company — Paul Wright Pty Ltd — makes a full range of dance shoes, including ballet and ballroom, and casual footwear. What started off as a "back of the garage" hobby 16 years ago, has today become a thriving concern, employing 50 people and producing 550 pairs of shoes a day.

Paul went computerised in July 1982 choosing a Commodore computer, one megabyte disk drive and 132-column printer from the 8000 Series.

Hardware was supplied by Commodore dealer Austcomp which also supplied Paul with standard Commodore accounting systems plus a specially written job-costing program.

"Our needs at that time were considerable," says Paul, "we had no costing control up to then and this was reflected in our profits.

"But from obtaining the systems, the company did a real turnaround."

Paul began his business purely as a hobby while touring with the Australian Ballet Company. Today his ballet shoes are used by dancers of both the New Zealand and Norwegian Ballet Companies and he has made shoes for women in the Queensland, Victorian and ACT police forces.

"I have always been ambitious but I would never have believed we could grow to such a degree and win this award," he says.

When is 180 CPS faster than 200 CPS?

When you have this little beauty on hand. **Throughput speed** is what counts: C.Itoh's new low profile dot matrix printer is a high speed performer, prints out with a throughput of 100 LPM (draft mode with pica character).

You'd expect to lose visual quality? No way! C.Itoh's print resolution is sharp, defined, unbeatable — throughout the print head's 100 million-plus character life.

8510S is rugged, sturdy as it is fast, built to take the punishment with heavy duty castings and high quality metal parts throughout. Plastic parts are all high stress.

It's a colourful character: there's even a colour model which gives you up to seven colours, with high resolution graphics of 144 x 160 dots per square inch on all models.

And if you want to use all the features of your IBM personal computer, C.Itoh has two special versions designed just for the IBM PC.

So make sure you ask the **throughput** of your new printer. And take a close look at C.Itoh. It answers all the questions.

C.ITOH

For further information contact your Warburton Franki Data Products office.

WARBURTON FRANKI

A DIVISION OF THE ANI CORPORATION LTD (INCORPORATED IN N.S.W.)
• ADELAIDE (08) 356-7333 • BRISBANE (07) 52-7255 • HOBART (002) 28-0321
• MELBOURNE (03) 699-4999 • PERTH (09) 277-7000 • SYDNEY (02) 648-1711
• AUCKLAND N.Z. (09) 50-4458 • WELLINGTON N.Z. (04) 69-3016

WF

WF/RB1/84

MULTI SAVINGS!

NEW!

LCD Digital...
it's the one with the lot!

Everything you've ever wanted in a multimeter ...and then some!

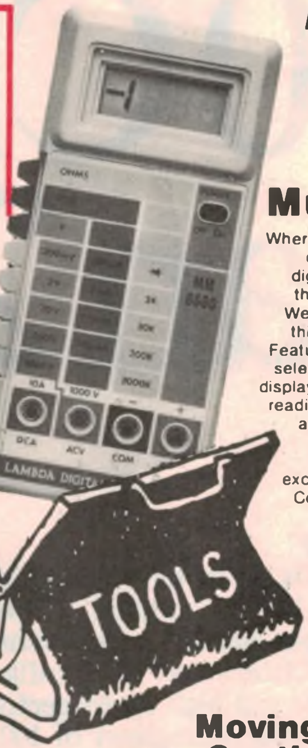
- ★ Semiconductor junction test
- ★ Hfe check for both NPN & PNP
- ★ Inbuilt buzzer for continuity
- ★ 5 capacitance check ranges
- ★ 10A AC & DC ranges
- ★ 30 ranges
- ★ 0.5% accuracy

PLUS huge LCD display with auto polarity, low battery indication...all for less than **$150!!** Isn't it time **YOU** updated your multimeter? Cat Q-1500

Includes a sturdy case for extra protection!

$149.95

Amazing low price!



No tool case is really equipped... without an

LCD Multimeter

Where else but Dick Smith's could you find a quality digital LCD multimeter at this incredibly low price? We've cut no corners with this precision instrument. Features push button range selection, large 13mm LCD display, bench stand for easy reading, diode check facility and overload protection. With its 10A DC range, the Q-1444 represents excellent value for money! Complete with test leads and full instructions. Cat Q-1444

$59.50

Budget Priced Moving Coil with Continuity Test!

A compact, reliable multimeter with an added bonus: a built-in buzzer for continuity testing! Also has a battery checker PLUS 10A DC range - not normally found on low-priced multimeters! On top of this, you get a high sensitivity (20,000 ohms per volt) meter mirrored scale and large banana plugs for sure contact. Cat Q-1022

$29.50

Our Biggest Seller!

Almost a complete test bench in one package - no wonder it's our best selling multimeter! With 100,000 ohms per volt sensitivity and ranges to cover every test set-up, this outstanding meter is all the average hobbyist will ever need - and it's just as much at home on the service bench or in the lab! Measures transistors Ico and Hfe for both NPN & PNP (also good for diode testing) and has an inbuilt transistor iscillator for capacitance measurement. Cat Q-1140

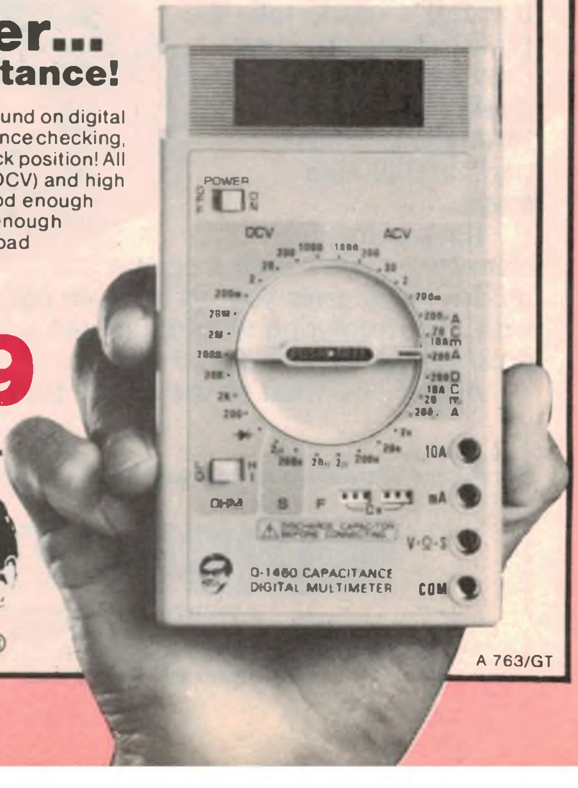
$76.50

LCD Multimeter...
that measures capacitance!

Yes! It not only features the normal ranges found on digital multimeters, it also has five ranges of capacitance checking, two ranges of conductance AND a diode check position! All this in a very accurate (less than 0.25% on DCV) and high impedance (10Mohm) instrument that is good enough for the designer's test bench, but has a low enough price for the hobbyist. All this plus overload protection, automatic polarity, 2.5cm LCD digits - and measurement to 10A AC & DC. Cat Q-1460

- ★ 32 ranges
- ★ Up to 1kV & 10A AC & DC
- ★ Capacitance, diode & conductance too!
- ★ Auto polarity

$99



DICK SMITH ELECTRONICS®

(See page 108 for address details)

A 763/GT

Micronews

RMIT launches computer clearinghouse

The Royal Melbourne Institute of Technology has attracted 16 local and internal international computer companies to its Australian Microcomputer Industry Clearinghouse (AMIC), launched in April.

The Clearinghouse offers microcomputer owners, operators and potential users a range of services including access to hardware and software for evaluation, staff assistance and a variety of short training courses. Mr Don Schauder, the general manager of the Clearinghouse, predicted that the centre would appeal to individuals and businesses looking for somewhere to try out computers and peripheral equipment without sales pressure.

"As we don't sell computers, people using AMIC can be assured of total impartiality" he said. "People can book time on any of our machines for $6 an hour. For students, the fee is $3. Where the assistance of one of our 30 demonstrators is required, the hourly rate is from $20".

AMIC already has an extensive range of hardware and software including the Tandy range of business computers, DEC Rainbow and Decmat and Hewlett-Packard's HP-150. Control Data has installed a CC638A microcomputer and ICL has three of its model 15 systems on display. Cromemco is represented by Insystems, and Futuretronics is expected to install six of its Atari computers at the centre.

Australian manufacturers, whose participation is sponsored by the Department of Science and Technology, are represented by Case Communications, Datacraft, Digital Electronics, Hartley, and SME. Other Australian firms will also be offered space.

AMIC occupies a suite of offices in Gateway Plaza, in Swanston Street, opposite the Royal Melbourne Institute of Technology and is open on weekdays and Sundays. Courses are conducted on most days, including 1½ hour breakfast sessions on specific products. Special programs on Sundays cater for family groups.

Pulsar Electronics expands

Pulsar Electronics Pty Ltd, the largest manufacturer of STD bus computer systems in Australia, has won status as a preferred supplier to the Victorian Education Department.

Pulsar Electronics manufactures a range of computer equipment, from single-user stand alone machines to Turbodos equipment designed for over 20 users. The company, which recently moved into larger premises at Tullamarine, also manufactures a range of ancillary STD boards to complement the Little Big Board which forms the heart of all Pulsar systems. These boards include a 256K RAM card, auto/dial auto answer modem board, hard disk interface, Turbodos slave processor boards, a six channel serial interface and four and 12-slot STD bus motherboards.

The company began trading in 1980 and developed various microcomputer products including display signs and a single board Z80 computer. In 1981 a project commenced to provide a high performance general-purpose computer, ultimately resulting in the Little Big Board.

All Pulsar products are 100% "open" with full details available on software and hardware. The flexibility and expansion possibilities of the Little Big Board in particular have made it a favourite with other computer manufacturers who base complete systems around Pulsar's board. Local support and manufacture means that products and assistance are readily available, without the problems of dealing with overseas suppliers.

Further information on Pulsar Electronics products is available from John Reardon at PO Box 10, Tullamarine Vic. 3043. Phone (03) 330 2555.

Commodore moves into IBM PC-compatible market

Commodore International Ltd, perhaps the most successful computer manufacturer in the home market, has made a significant move into the business area with the acquisition of an MS-DOS IBM PC-compatible portable computer. Previously the company has held off becoming involved with the IBM bandwagon, relying on sales of the VIC 20 and Commodore 64.

Commodore accomplished its bold shift of position with just two strokes of a pen, signing licenses to manufacture the Bytec Hyperion PC-compatible portable and to become a second source supplier of Intel's 8088 chip microprocessor, the heart of all IBM PCs and "workalikes".

The Hyperion, reviewed next month, is a substantially IBM compatible "transportable" computer with built-in screen and dual disk drives. Commodore's acquisition of manufacturing licences places it squarely in IBM's market area.

Nor will the company be bedevilled by the chip shortages which have affected all manufacturers of IBM PC compatibles. One of the reasons for Commodore's profitability is that it makes all components for its own computers, including the 6502 and 6510 8-bit microprocessors. The second-source agreement with Intel is a major coup for Commodore, allowing the company to move into the 16-bit area with the same assurance of supply of vital components.

It may be some time before we see Commodore IBM compatibles in Australia, however. The company is moving to meet the huge demand for compatibles in Europe where Commodore is well established and has a larger share of the market than IBM. Supplies of the IBM PC itself have been delayed by shortages of chips.

Micronews

RTTY software for radio amateurs

Radio amateurs who have a Commodore computer can expand their activities with a software package just released by the Melbourne firm High Technology Computer Systems.

The new software, called simply "RTTY", is the brain-child of Mike Hamilton (VK3HM) and is designed to handle radioteletype, Morse code, and slow scan television (SSTV). It provides translation facilities for the Commodore VIC 20, '64 and series 8000 microcomputers.

Using the program requires a shortwave receiver. The receiver is connected directly to the computer and the package allows the user to monitor teletype traffic, Morse code and slow scan television, and to answer back with "Mailbox", an automatic response mode.

For the capabilities provided, the price seems very reasonable at $59 on cassette or disk.

Further information is available from High Technology Computer Systems, 87 Swanston St, Richmond, Vic (03) 429 1966.

Sinclair launches 16-bit Quantum Leap computer

Clive Sinclair has definitely done it again with his QL computer. The first company to offer low-cost 8-bit systems, Sinclair has gone much further with the "Quantum Leap", a low-cost ($US499) system based on the Motorola 68008 microprocessor. The 68008 has a 32-bit internal architecture and an 8-bit data bus, and is compatible with the 68000 in the same way that the 8088 is related to the 8086.

The QL offers a 65-key full-size keyboard, two built-in "micro tape" drives and 128K of RAM, expandable to 640K with an external cartridge. Word processing, business graphics, a spreadsheet package and database management software are included with the standard machine. Graphics resolution is 512 × 256 pixels in eight colours, with the powerful 16-bit processor allowing extremely detailed pictures to be constructed in a very short time.

The QL has the ability to run several programs simultaneously (called multi-tasking). Output from the various programs is displayed in different "windows" or sections of the screen. Sinclair's own version of Basic, called SuperBasic, and a unique QDOS operating system are the keys to providing a powerful, easy to use system.

The tape cartridges used to store programs and data use narrow loops of video quality tape in plastic cartridges each the size of a book of matches. The tape is driven at around 50cm/second and each cartridge provides 100K bytes of storage, arranged in 50 data files.

In addition to the two tape drives built in, six others can be connected, for a total of 800K of storage. Average access time for a program on tape is 3.5 seconds.

At the rear of the console are connections for local area networking (allowing QLs to be connected together), colour and monochrome video monitors or a television set, a printer port, modem port and two joystick interfaces. Sinclair says that the add-on modem is still under development, as is a Winchester disk drive interface, a terminal emulator and other software. Up to 32K of ROM can also be plugged into the machine.

Barson Computers, who distribute Sinclair products in Australia, indicate that the QL will probably be available here later this year, at a price "under $1000".

Sales promotions rely on computers

Those cash refunds, competitions and bonus offers included with products of all types are collectively known as "sales promotions" and are generally handled by a specialist company contracted to the distributor or manufacturer. One of the largest companies in the field is Purchase Point Pty Ltd, who claim that Australians can expect to see even more special offers in the years to come.

"Dozens of new companies will emerge in every capital city and sales promotion will rapidly escalate its massive penetration in press, radio, and TV media and in direct mail and point of purchase", says Robert Wentworth-Sheilds, Chairman of Purchase Point.

Computers are a real aid to success in the sales promotion field, according to the company. Purchase Point installed its first computer last year, choosing a Panasonic JB 3001 with a 10MB hard disk supplied by Amicron Computers.

The company ran up to 20 promotions simultaneously last year, involving thousands of cash refunds, hundreds of thousands of competition entry forms and hundreds of trade bonuses.

"We quickly reached the point where a computer was a necessity to compile correct statistical information quickly and efficiently," Mr Wentworth-Sheilds says. "Amicron was called in and they came up with a solution that met all our requirements. Our staff spent a day at Amicron's training centre and were given a further two days of training on site."

"The computer system runs under the MS-DOS operating system and uses a dBase II program written by Amicron and tailored to our exact requirements in sales promotion work."

The computer provides complete printouts of the number of consumer and/or trade entries for each promotion per state, per city, per store on a daily basis. The company is able to provide a completely detailed statistical breakdown of any promotion within hours of it finishing.

"It can make the difference between a promotion being an outstanding success or a dismal failure," says Wentworth-Sheilds.

For further information contact Amicron Business Systems, Suite 6, 281 Pacific Highway, North Sydney, 2060

News from the Clubs

- The Southern Districts Commodore Users Group meets on the first and third Wednesdays of each month at the API Hall, Kurrajong Rd, Preston. The group publishes a monthly newsletter and describes itself as a "family group" with activities and information for people of all ages. There is a joining fee of $10 and an annual subscription of $24.

Further information is available from the secretary, Lex Toms, 3 Lucille Cres, Casula. Phone (02) 602 8691.

- The Melbourne TI-99/4A Users Group meets monthly at the Victoria College, Burwood. The group publishes a bi-monthly newsletter and six program tapes per year, runs demonstrations, tutorials and a special interest group in Assembly language.

Further information is available from Wayne Worladge, 123 Ashburn Grove, Ashburton, Vic. 3147. Phone (03) 25 1832.

‘how I wun a pryze in a short storey competishun fer gud Inglish.’

While it’s highly unlikely our **WordPlus** system ever would have to clean up a sentence such as the one above, it could without any trouble whatsoever.

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

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

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

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

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

Software Source Pty Ltd

P.O. Box 364, Edgecliff, N.S.W. 2027. Phone: 389 6388

Please send me full details of your **WordPlus** and **Punctuation and Style** systems.

Name

Company

Address

EA

SSI

Leave the kid's stuff to the kids...

YOU'RE READY FOR

FUN WAY 3

Now a whole new series of exciting projects - getting you into the fascinating world of **integrated circuits.**
No more kid's stuff: **Fun Way III** takes you straight into the big time. And while you're building, you're learning - what better way to understand what you're doing?

Look at the exciting range of projects to choose from...

There's something for everyone, from a mini amplifier and colour organ to games, binary electronics projects...even an electronic cricket (chirp!). And if you're building a school project, we even include glossy labels to make your project look a million dollars (top marks!).

Don't miss a single one of these...

Mini Stereo Amp.

$14^{95}

Just the shot for 'Walkie' stereo – now you can listen to it in your bedroom through speakers! Or make yourself a PA amplifier. Cat K-2667

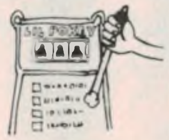
Binary Bingo

$19^{95}

A game of skill and reaction time – and a valuable teaching aid! It might sound pretty simple to play – but try it and see!
Cat K-2668

Light and Sound

Another multi-talented project. Sound effects, flashing lights – continuity tester, Morse code oscillator . . . it's got the lot!
Cat K-2665 $8^{95}



Lil Pokey

It's a barrel of fun to play. And you don't risk losing your shirt like the real thing.
Cat K-2662 $19^{95}

Two Up

Australia's national game – now done electronically because King George pennies are hard to get!
Cat K-2661 $9^{95}

Minder

A multipurpose project for the car 'Lights on' warning, 'door open' warning plus a pseudo burglar alarm.
Cat K-2660 $7^{95}

THE BOOK

Fun Way III is for the advanced hobbyist: those who have worked their way through the projects in Fun Way I and Fun Way II. There are ten projects in Fun Way III and each one is based on integrated circuits. Because the projects are more complex than the previous Fun Way projects, they are dealt with in rather more detail. More explanation, more construction. So you learn more with Fun Way III. Cat B-2610

And best of all...
it's only

$6^{95}

GET YOURS NOW!

Mini Colour Organ

Like a disco – but battery operated so it's safe! Connect to your radio, etc. for a LED lightshow
Cat K-2664 $12^{95}

Combination Time Lock Switch

Make it into a game . . . or use as a real alarm component. It's that good! Just try getting into this one!
Cat K-2666 $12^{95}

Cricket

Whaaa! Hide it in a dark room and it starts chirping. Turn the light on and it stops. It's infuriating!
Cat K-2663 $9^{95}

Mini Synth

Wow! A real musical synthesiser, with decay, frequency doubling & halving, tremolo . . . unique circuit uses YOU as the note generator!
Cat K-2669 $19^{95}

A 768/GT

DICK SMITH ELECTRONICS®

(See page 108 for address details)

50 and 25 years ago...

"Electronics Australia" is one of the longest running technical publications in the world. We started as "Wireless Weekly" in August 1922 and became "Radio and Hobbies in Australia" in April 1939. The title was changed to "Radio, Television and Hobbies" in February 1955 and finally, to "Electronics Australia" in April 1965. Below we feature some items from past issues.

Wireless Weekly 3d

June, 1934

New police radio: A complete new transmitting and receiving wireless station has been installed at the Redfern Police Barracks, for the purpose of keeping the police wireless patrol cars in constant communication with headquarters.

The equipment, which was designed and constructed by Amalgamated Wireless, is of the most modern pattern, and it will enable messages to be sent out both in the Morse code and by word of mouth.

The amplifier championship: This contest, announced several months previously and involving a good deal of preliminary judging to reduce the contestants to a short list, was finally held at the club rooms of the Royal Motor Yacht Club at Rose Bay.

Technical judges included Mr Len Schultz, Mr Keith Blackwell, and the technical editor Mr A. G. Hull. Musical Judges were Frank Hutchins and Howard Carr, both leading musicians of their day.

The Champion of Champions was Mr H. J. Carter, with Mr K. T. Boyle winning the technicians' choice.

Ratings system, 1934: Dr Nevil M. Hopkins, a lecturer in engineering at the New York University, has developed a device which he says "will revolutionise the radio broadcasting industry". Dr Hopkins calls it the "Televotes" and by use of this instrument a listener-in can, by pressing a button, immediately transmit to the station his reaction to the program.

The instrument, which would cost approximately one dollar, can utilise air waves or carrier current on an electric light or telephone wires.

Not bad for 30 lines: Television has advanced so far in England that a "looker-in" at Bradford was able to send the London transmitters an easily recognisable photograph of a televised artist. It is calculated that during the three seconds exposure necessary for the photograph, 37 pictures were formed on the television screen.

Most powerful transmitter: The new transmitter for WLW, WSAI, and W8XAL, the Crosley stations in the USA, will generate the most powerful radio signals ever broadcast. A 75 × 75 foot spray pond is part of the system which cools the tubes used in the transmitters.

RADIO TELEVISION AND HOBBIES 2/6

June, 1959

Before the space probes: Radar contact with Venus, first achieved February 10 and again February 12, 1958, extended the range of radar to 28-million miles, more than 100 times the previous record, giving man his greatest DX. The contact gave us more accurate information on the size of the solar system, and may give us information about the surface of the planet.

The contact was made by scientists of the Massachusetts Institute of Technology Lincoln Laboratory, using equipment never before employed for radio-astronomical purposes and introducing techniques hitherto quite foreign to radio communications.

Where are they Neil? Some scientists believe that whoever wins the race to the moon might be rewarded with a fortune in diamonds.

Moon craters shaped like huge ice-cream cones could be an indication of diamond deposits, they believe.

Dr G. P. Kuiper, of Yerkes Observatory, Williams Bay, Wisconsin, has said the craters appeared similar to the funnel-like craters topping the Kimberley "diamond pipes" in South Africa.

Dr Harold C. Urey, Nobel Prize-winning scientist of the University of California, said pressures inside the moon were sufficient to create diamonds.

When TV was still a novelty: During the month, Australia's TV plans moved forward in two important particulars.

Firstly, initial programs as such were telecast in Adelaide, where thousands of people gathered around shop windows to watch, just as they did in Sydney and in Melbourne in 1956.

If anything, enthusiasm was greater in Adelaide, whose citizens have been long tantalised by reports of TV doings in other states.

There is no doubt that Adelaide, Brisbane and Perth will absorb TV even more rapidly.

Secondly, the Postmaster-General announced plans for extending TV into 13 country areas in the Capital Territory, Victoria, Queensland and Tasmania.

In doing so he emphasised that priority would be given to applicants representing local interests rather than those of the commercial stations already established, and that local commercial licences shall not necessarily be limited to one.

Our first coaxial cable: The £1,200,000 contract for the coaxial cable equipment for the Sydney-Melbourne six-tube coaxial system, which has been awarded to the Telecommunication Co of Australia Pty Ltd, is part of a huge program of expansion of Australian trunk telephone routes, using coaxial cable and wide-band radio systems.

New Radio, Television & Hobbies TV receiver: Our laboratory is currently developing a completely new television receiver for home construction. It uses the latest 110-degree deflection tubes and will fit completely within a modern slim cabinet. The emphasis is on simplicity of design, layout and construction, and it is anticipated that the total cost will be considerably lower than earlier designs. The new set will take either a 17-inch or a 21-inch tube, as desired.

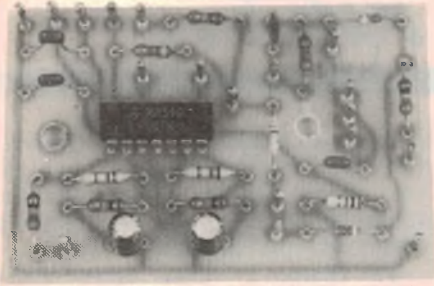
Watch for it in a forthcoming issue!

NEW KITS FOR THIS MONTH

FUNCTION GENERATOR ADAPTOR

$12

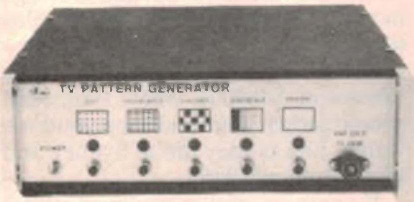
EA JUNE 83



Add this enhancement to your Function Generator which lets it operate as a frequency meter improving the linearity of the coarse frequency control.

TV PATTERN GENERATOR

$67.50



Anyone wishing to obtain the maximum performance from a colour TV receiver needs a pattern generator. Why not build this completely new design which provides five separate patterns: dot, crosshatch, checkerboard, grey scale and white raster.

ETI 477 MOSFET MODULE

$63.50

Remember the great ETI 5000 power amp. With this module as the hub of the ETI 5000 and a transformer you get an amazing power output of 150W RMS.

Plus Power Supply (No Trans)	$49.00
Plus Transformer	$39.50

TRANSISTOR ASSISTED IGNITION

EA November 79

$34.50

MUSICOLOR IV

$84.00

Add excitement to parties, card nights and discos with EAs new Musicolor IV light show. This is the latest in the famous line of Musicolors and it offers features such as four channel "Color Organ" plus four channel light chaser, front panel LED display, internal microphone, single sensitivity control plus opto-coupled switching for increased safety. EA August 81

CRUISE CONTROL

$70

EA JUNE 83

Commercial Cruise Controls available on some new cars and on the aftermarket cost around $200. This design can be built for less than half that figure. Price does not include windscreen wiper motor, brake cable or metal cases.

PROGRAMMABLE LIGHT CONTROLLER

$180

EA MAY 84

VCR SOUND PROCESSOR

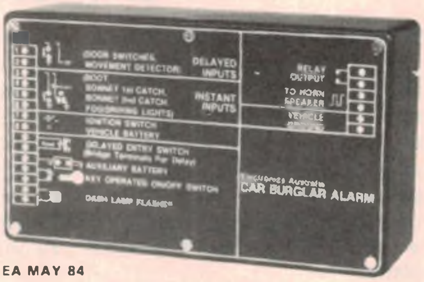
$69.00

EA APRIL 84

Give the sound from your VCR a lift with this new VCR Sound Processor. Main features include an effective stereo simulator circuit, a 5-band graphic equaliser, and noise filtering.

CAR BURGLAR ALARM

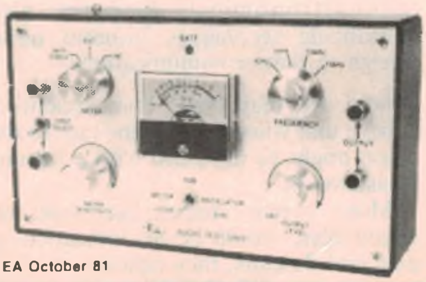
$70



EA MAY 84

AUDIO TEST UNIT FOR CASS DECKS

$47.50



EA October 81

NOISE SIMULATOR

$30

EA JUNE 83

This Noise Simulator will provide a soothing noise, like rain on the roof or waves on the beach, to mask out those sounds that irritate. Cost does not include plugpack.

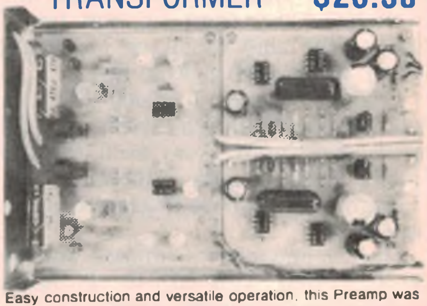
HEADPHONE AMPLIFIER

$28

EA MARCH 84

MIXER PREAMP TRANSFORMER

$26.50



Easy construction and versatile operation, this Preamp was for coupling with the 300W "Brute" Power Amp. ETI 467 July 80

CRYSTAL MARKER (INC 1MHZ X)

$34.50

PRE-STOCKTAKE SALE

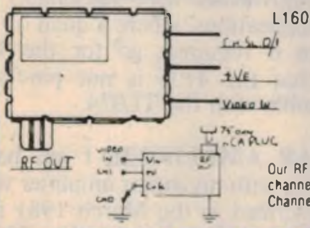
ENDS 15TH JULY 1984

PANEL MOUNTING RCA SOCKETS

		1-9	10+
P10232	2 way	35	30
P10234	4 way	.45	40
P10236	6 way	.60	.50

VIDEO RF MODULATOR

UNBELIEVABLE PRICE

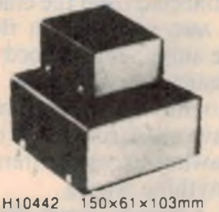


L16040

1-9	10+
$4.95	$3.95

Our RF Modulators are channel selectable either Channel 0 or Channel 1

DELUXE METAL CABINETS

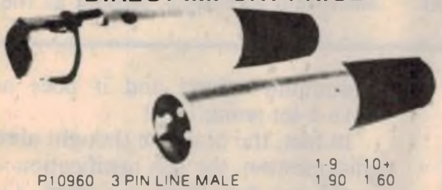


A "STEEL" AT THESE PRICES

		1-9	10+
H10442	150×61×103mm	3 95	2 95
H10444	184×70×160mm	4 95	3 95

CANNON TYPE CONNECTORS

DIRECT IMPORT PRICE



		1-9	10+
P10960	3 PIN LINE MALE	1 90	1 60
P10960	3 PIN CHASSIS MALE	1 90	1 60
P10964	3 PIN LINE FEMALE	2 50	2 10
P10966	3 PIN CHASSIS FEMALE	2 90	2 20

¼ WATT 5% RESISTORS E24 VALVES

CARBON FILM

S1 00 per hundred
S7 50 per thousand

That is 0 75 of a cent each
But Must Be The Same Value

34 WAY EDGE CONNECTORS FOR DISK DRIVES

SCOOP DIRECT IMPORT PURCHASE

1-9	10+
S5 95	S4 95

Errors & omissions excepted.

HIGH CLASS INSTRUMENT KNOBS

Half price this month

H10060	35mm	50
H10061	24mm	45
H10062	20mm	40
H10063	15mm	38

KEY SWITCHES

1-9	10+
S3 95	S3 75

MINIATURE PCB RELAYS

Massive 3A contacts at 24VDC or 100VAC Nominal 12V Coil but will work OK from 9–15V

SPECIFICATIONS	S.P.D.T. S14060	D.P.D.T. S14061
Nominal Coil Voltage	12V	12V
Contact Current (max)	3A	3A
Contact Voltage (max)	125VAC	60VAC
Coil Resistance	400 ohm	300 ohm
PRICE		
1–9	S1 20	S1 50
10–24	S1 00	S1 20
25–99	S0 80	S1 00

ECONOMY TOGGLE SWITCHES

		1-9	10+
S11010	SPDT	1 00	70
S11020	DPDT	1 20	80

HORN SPEAKER

WOW $6.95

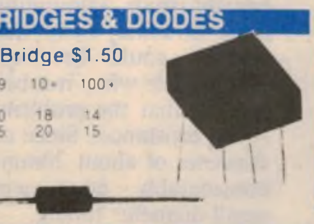
C12010

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

BRIDGES & DIODES

6A 400V Bridge $1.50

	1-9	10+	100+
IN5404	20	18	14
IN5408	25	20	15



DISCOUNTED PANEL METERS

BUT BE QUICK FOR THESE

PANEL METERS			NORMALLY	THIS MONTH
Q10500	MU45	0-1mA	9 75	6 95
Q10502	MU45	50-0-50uA	9 75	6 95
Q10504	MU45	0-100uA	9 75	6 95
Q10505	MU45	0-50uA	9 75	6 95
Q10518	MU45	0-1A	9 75	6 95
Q10510	MU45	0-5A	9 75	6 95
Q10515	MU45	0-10A	9 75	6 95
Q10520	MU45	0-20V	9 75	6 95
Q10525	MU45	0-30V	9 75	6 95
Q10535	MU45	VU	10 95	8 95
Q10530	MU52E	0-1mA	10 95	7 95
Q10533	MU52E	0-5A	10 95	7 95
Q10538	MU65	0-50uA	13 95	7 95
Q10540	MU65	0-1mA	13 95	7 95
Q10550	MU65	0-100uA	13 95	7 95
Q10560	MU65	0-20V	13 95	7 95

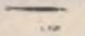
IC SOCKETS (LOW PROFILE)

HOW CHEAP CAN THEY GO

	1-9	10-99	100-999	1000+
8 Pin	15	14	12	9
14 Pin	16	15	14	10
16 Pin	17	16	15	11
18 Pin	18	17	16	13
20 Pin	29	28	27	26
24 Pin	35	33	32	28
40 Pin	45	40	35	30

5 WATT RESISTORS

WE ARE OVERSTOCKED YOU REAP THE SAVINGS



1-9	10-99	100+
25	22	20

½ PRICE

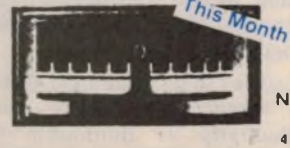
MORE PANEL METER BARGAINS

This Month $2.95

Normally

1-9	10+
4 50	3 95

Q10400
250 ua Sensitivity Panel cut-out 36mm x 16mm Mounting hole centres at 49mm



This Month $2.95

Normally

1-9	10+
4 95	4 50

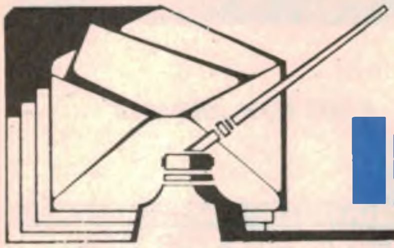
Q10405
250 ua Sensitivity centre O very useful for balanced circuit and applications needing a centre O or null indication

2¼" Speaker Only $1.00

welcome here

ROD IRVING ELECTRONICS
425 High St., Northcote, Vic. 48-50 A Beckett St., Melb., Vic
Phone (03) 489 8866, (03) 489 8131. Mail Order Hotline (03) 481 1436
Mail orders to P.O. Box 235 Northcote 3070 Vic. Minimum P & P $3 00

Please address tax exempt, school, wholesale, and dealer enquiries to: **RITRONICS WHOLESALE**
1st floor 425 High St. Northcote 3070 (03) 489 7099
(03) 481 1923 Telex AA 38897



Information centre

VCR SOUND PROCESSOR: I would like your help if possible in using the VCR Sound Processor (described in the April 1984 issue) as a graphic equaliser. I would appreciate it if you could give the formulas for changing the frequencies from those originally specified to 60Hz, 80Hz, 1kHz, 3.5kHz and 12kHz.

Would the same formulas be applicable to the graphic equaliser described in your May 1979 issue?

Also, what is the difference between the TL074, LF347 op amps and the uA4136 op amps used in the earlier graphic equaliser project? (MG., Woodbine, NSW).

● If you have a look at the capacitor values for the 500Hz, 1kHz and 2kHz gyrators (IC1d, 2c and 2, respectively), you will see that there is an inverse relationship between the size of the capacitors and the centre frequency. Essentially, you can shift the centre-frequency of the gyrators merely by scaling the size of the capacitors in inverse proportion to frequency value.

In simple language then, if you want to double the centre frequency, you halve the respective capacitor values and vice versa.

Unfortunately that is not the whole story for it is evident that you also wish to change the spacing between the centre frequencies. This means that you have to adjust the Q value of the gyrators. We don't have the space to go into this subject here but there is a good outline in the National Semiconductor handbook in the section on Octave Analysers.

Note that having the centre-frequencies closely spaced at 60Hz and 80Hz requires a very high Q value for the gyrators otherwise there will be substantial overlap and hence, interaction between the two controls. It would be more practical to select more widely spaced frequencies.

The TL074 is a quad Fet-input op amp package. For convenience, it can be regarded as a considerably upgraded version of the old workhorse, the 741. Compared to the 741, the TL071, 072 and 074 family are much quieter, have superior bandwidth and better slew rate, meaning that they can deliver a higher voltage swing at high frequencies.

Apart from that, the TL07- series have Fet inputs. This means that they draw negligible input bias current. This has two advantages. First, it is easier to design this op amp into high impedance circuits and, second, noise due to input currents is negligible.

The uA4136 is a quad low noise bipolar input op amp package. In fact, with the exception of the Signetics NE5533/34 family, the 4136 is the lowest-noise op amp package readily available.

For most general purpose circuits, it is difficult to go past the TL07- family and their equivalents. For reasonably low noise applications, where a quad op amp package is required, go for the 4136. Note that the 4136 is not pin-for-pin compatible with the TL074.

GUITAR AMPLIFIER: I am having problems with my guitar amplifier which was described in the March 1981 issue. The first point concerns the .0022μF capacitor connected from the collector of Q10 to the zero volt rail. In the Twin Twenty Five amplifier described in April '76, the same capacitor is shown connected to the equivalent transistor. Does this have an effect on the circuitry as I am drawing excess current and I can't find anything wrong.

Secondly, I cannot grasp the reason for the capacitors between the OV rail at the output and the tremolo cable sheathing to chassis ground as they are

TV antennas and steel conduit:

ANTENNA DESIGN: I was interested in your article on TV antenna design (How to Obtain Better TV Reception Pt 6). Would it be possible to use steel conduit, as used to encase wiring in old houses, as elements in the antenna?

It seems to be quite rigid and strong and would have nearly as good conductivity as aluminium tubing. More care would be needed to prevent corrosion, but are there any electrical problems with using steel conduit? (J.B., Oak Flats, NSW).

● You are right in suspecting that conductivity is not really important for receiving antennas although for transmitting antennas it is another matter.

Even so, there are several practical objections to the use of steel conduit for antenna construction. The first you have already recognised as corrosion. Don't underestimate this problem. While it may be relatively easy to protect the surface of the conduit from rusting, the connections will probably be always prone to corrosion.

Second, there is the problem of weight. Steel conduit is considerably heavier than aluminium tubing. A large antenna array made of steel conduit could be well nigh unmanageable when it is being installed. Add to that the problem of windage (wind resistance). Since conduit has a diameter of about 20mm it will have considerably more windage than small diameter tubing.

All this means that you will need a considerably stronger mast to support your antenna. Add to that the fact that conduit is not as easy to cut as aluminium tubing and it does not have a lot going for it.

In fact, the more we thought about this question, the less justification we could see for using the stuff. One justification could be having a pile of the stuff just waiting to be used but then it might be better to use it for tomato stakes.

Even as tomato stakes, conduit wouldn't be much good as it would rust out quickly. In fact, when you come to think about it, steel conduit isn't even any good for electrical conduit.

Since we have been so negative about the subject, we thought we should announce a competition for the best use for old steel conduit. Of course, in this case, the best use may not be the most obvious but it might be the funniest.

All right then, what would you do with steel conduit. The prize for the best answer will be $15. Go to it.

already directly earthed at the inputs via the cable sheathing.

I could not procure a VPC14 choke so I wound one on a 100 ohm 1 watt resistor, winding as many turns of 22 B&S as I could get on it. If this is not satisfactory could you inform me as to the correct construction for this choke?

I have just about built everything myself including rewinding a C-core transformer secondary and the PC board etc.

I used a phenolic board to make my printed circuit and left as much copper as possible, so the tracks are very close. Could my problem be possible tracking through the phenolic? I am going to let my head go and splash out on a manufactured fibreglass board, hoping that this will cure the problem. (L.M., Tuncurry, NSW).

- It is highly unlikely that the .0022µF capacitor would be the cause of the fault. This capacitor rolls off the open loop gain of the power amplifier, as a stability measure. Of course if the capacitor was omitted or was open-circuit, it is quite likely that the amplifier would be unstable and would draw heavy current.

You have not quoted any DC voltage conditions nor have you mentioned whether you have tried to adjust the quiescent current so it is not possible for us to say whether you have a dc fault or not.

On the other hand, you have not used the correct 14µH choke in the output of the amplifier and you have made your own PC board, and probably varied the layout in the process, so it is quite likely the amplifier is unstable and oscillating supersonically.

The 14µH choke is wound on a special grade of ferrite rod, 30mm long and 10mm in diameter. It is available from the mail order department of Dick Smith Electronics for 60 cents (cat. no K-6036). The choke is wound using 15 turns of 18 B&S enamelled copper wire. Ordinary ferrite rod used for ferrite rod antennas is not suitable.

The capacitor connected between the chassis and the tremolo jack shield is to reduce hum which is otherwise picked up by the isolated socket.

VK POWERMASTER: I have constructed the VK powermaster supply described in March 1984 for the purpose of powering my Yaesu FT-77. The supply has one major drawback — no over-voltage protection. In the event of a collector-emitter short on one or more of the pass transistors, excess voltage is applied to the load, possibly doing untold damage.

By the simple addition of a 15V zener diode wired between the negative output rail and the base of Q7 (cathode to base) full over-voltage protection is provided. I hope this information may be of use to readers. (M.B., Mt Warrigal, NSW).

- It is true that a faulty series pass transistor or other component failure could apply the full unregulated output of the Powermaster to the load. However, protecting against this condition is not an easy task. Your addition of a zener diode may activate Q7 and cause the undamaged series pass transistors to turn off but that is of little use if one series pass transistor is short-circuit.

In fact, if the regulator circuit is working at all, a short-circuit series pass transistor will immediately cause the other series pass transistors to turn off, as the circuit attempts to regulate.

In lower rated power supplies, such as our VK Powermate described in December 1983, it is possible to provide over-voltage protection fairly simply. We just connected at 15V 5W zener diode

Electronics Australia Reader Service

"Electronics Australia" provides the following services:

PHOTOSTAT COPIES: $3 per project, or $6 where a project spreads over multiple issues (price includes postage). Requests can be handled more speedily if projects are positively identified, and if not accompanied by technical queries. We reserve the right to supply complete back issues instead of photostats, where these are available.

CHASSIS DIAGRAMS: For the few projects which require a custom metal chassis (as distinct from standard cases) dyeline plans showing dimensions are normally available. $3 including postage.

PC BOARD PATTERNS: High contrast, actual size transparencies: $3, including postage. Please specify positive or negative.

PROJECT QUERIES: Members of our technical staff are not normally available to discuss individual projects, either in person at our office, or by telephone.

REPLIES BY POST: Limited to advice concerning projects published within the last three years. Charge $3. We cannot provide lengthy answers, undertake special research, or discuss design changes. Nor can we provide any information on commercial equipment.

OTHER QUERIES: Technical queries outside the scope of "Replies by Post" or submitted without fee may be answered in the "Information Centre" pages, at the discretion of the Editor.

COMPONENTS: We do not sell electronic components. Prices and specifications should be sought from advertisers or agents.

BACK ISSUES: Available only until our stocks are exhausted. Within six months of publication, face value plus 90c for post and packing for each issue. Seven months and older, $3 (includes post and packing and storage fee).

REMITTANCES: Must be negotiable in Australia and made payable to "Electronics Australia". Where the exact charge may be in doubt, we recommend submitting an open cheque endorsed with a suitable limitation.

ADDRESS: All requests to the Assistant Editor, "Electronics Australia", Box 163, Chippendale, 2008.

Forum — continued from p43

preamplifier is judged to be "remarkably quiet for a tube design" — surely a somewhat left-handed compliment!

I was intrigued, too, with the subjective evaluation of the sound:

> **". . . I found myself enjoying a preamp that fitted nicely in between the lush 'tubiness' of the Concordant and the more analytical sound of the Beard."**

Perhaps I am a member of the old school of audiophiles, a Luddite questioning the sanity of the New Wave of reviewers (not my words) but I have the old-fashioned idea that a preamplifier should be neutral; should not have or impart a sound of its own. Simple logic seems to suggest that, if you have three supposedly prestige preamplifiers which all sound subjectively different, then at least two of them must be suspect in terms of colouration. Maybe all three!

One more thing, and I promise to shut up:

When evaluating the Croft preamplifier, Ken Kessel says that he "switched it on and gave it a couple of hours to settle down" before proceeding to the listening tests.

In a previous article relating to the Audio Research D-70 power amplifier he explained how he had "let the D-70 warm up for four or five hours before spending any serious time with it".

Why, on earth?

If a preamplifier needs to "settle down" or a power amplifier needs to "warm up" for some hours before it can give of its best, the owner faces a double problem:

- The valves need to re-absorb the occluded internal gas, electrolytic capacitors need to re-form, or the circuitry is thermally unstable for some other reason; and
- The extra switch-on time is likely to halve the practical service life of the valves.

It is true that rating procedures for the US market require that amplifiers be driven in a specified fashion for a specified time before readings are taken but this is intended, not to coax the best out of the amplifier, but to force it into thermal aberration, if it is prone to such.

Methinks that the "New Wave" of reviewers have a few things to sort out!

directly across the supply output. In the event of a failure the rising supply voltage will cause the zener to conduct heavily and blow the fuse. In the process the zener may be destroyed but provided the protection has worked and saved the equipment this is no great problem.

Such a simple method is not likely to be effective with the 25-amp VK Powermaster. Even a high-power zener is likely to be blown to pieces before the fuse blows. The solution is to use a more complicated "crow-bar" protection circuit. Such a circuit was published with our 5V/10A Minibrute power supply described in November 1977.

Briefly, the crow-bar circuit uses a zener diode to monitor the power supply output for over-voltage. If an over-voltage condition occurs, the zener conducts and uses a transistor to turn on an SCR. In turn this uses a heavy duty automotive relay to short out the unregulated supply rail and blow the fuse.

The beauty of this circuit is that it activates again if the fuse is replaced and no repair has taken place. The circuit could be easily modified to suit the VK Powermaster.

MOTOR-CYCLE INTERCOM: I have built the motor-cycle intercom that was published in your February 1984 issue but have a problem. Could you please help? The intercom works well when the bike (the same model as in your article) is in the garage and engine running at 1,200rpm. With engine revs raised to say 1,500rpm slight interference occurs, but on the road conversation is impossible, with interference and voice distortion. When engine revs go back to tick-over it is possible to hear or just about.

All the cables used for the unit are the shielded type, have checked 7805 regular which is giving 9 volts. The only variation from your article is the case which you state plastic. I have used metal. (J.E., Campbelltown, NSW).

● We assume that you have connected the metal case to the chassis of the bike and thereby to the negative side of the battery supply. If so, we would expect the unit to give less trouble rather than more, as you have experienced.

We can only assume that the bike's electrical system is radiating interference which is being induced into the intercom wiring. With this theory in mind, it might be worth trying the effect of passing the supply leads several times through a fair-sized ferrite toroid. The same process could be tried on the two helmet leads, to try and reduce the common mode interference.

DREAM 6800: I am interested in building the Dream 6800 which was described in May 1979 and following issues.

At the moment I have some of the appropriate chips including 6802 of which I wish to make the best possible use. Can you kindly supply me with the following information: Where can I purchase two 6802 compatible PC boards? If these are unavailable could you please supply me with the details of modification? Where can I get a complete list of the components and price list? Is there any additional documentation regarding software and hardware which may be necessary or useful for the development of the project?

M. A. Sallehpour,
1d/105 Cook Road,
Centennial Park, NSW 2021.

● Unfortunately we know of no supplier of Dream 6802 boards. It would also be quite a fiddly job to adapt the 6802 chip to the original 6800 board since the pinouts for the two devices are different. Perhaps one of our readers can help. We have published your name and address in full to that purpose.

Notes & Errata

SWEEP GENERATOR: (April '84, Circuit and Design Ideas): pins 2 and 3 of IC8 should be transposed while the wiper of S2 should go to −5V instead of ground. Note also that the auto and manual positions on S2 are shown transposed.

MODEL 175 AUTORANGING
BENCH/PORTABLE DMM

KEITHLEY INSTRUMENTS

The new Model 175 Autoranging Bench Digital Multimeter, from Keithley Instruments, Inc., combines the measurement capabilities of much higher-priced system DMMs with several new features to extend its utility, yet retain simplicity of use. Ideal for use as a bench meter in production or lab work, this 4-½ digit autoranging DMM also has a field-installable battery option, making it fully portable. Fast autoranging (up to 200ms per range change on DCV) enables the user to concentrate on getting the reading without worrying about choosing the appropriate range.

The Model 175 features digital calibration for reduced cost of ownership, as many users can now calibrate the meter in-house. With the Model 1753 IEEE-488 (GPIB) option, the 175 is the lowest-priced IEEE-interfaceable DMM available.
Model 175's 100-point data logger monitors drifts, determines rates of change, and collects response curve data without a printer, output cables, or complicated hook-ups. The data logger has six different store rates from one reading/400ms to one reading/hour, and data recall is "push-button" easy.

Other features of the Model 175 include:
- 4-½ digit LCD display with annunciators for function, range, and feature indication
- 10μV/10mΩ/10nA sensitivity
- 0.03% basic DCV accuracy
- True RMS AC
- 10A capability
- 100kHz bandwidth in AC
- dBm/relative function
- Relative reference
- Max/Min reading hold
- Safety input jacks
- Front panel accessible amps fuse

For more information on the Model 175 Autoranging DMM, or on a variety of other industrial electronic testing and measurement equipment, contact:

SCIENTIFIC DEVICES AUSTRALIA PTY. LTD.
VIC. 2 JACKS RD., SOUTH OAKLEIGH. 3167
PHONE (03) 579 3622 TELEX AA 32742
N.S.W. 559A WILLOUGHBY ROAD, WILLOUGHBY, 2068
PHONE (02) 95 2064 TELEX AA22978.
S.A. 31 HALSEY RD., ELIZABETH EAST. 5112
PHONE (08) 255 6575 TELEX AA 88125

Next month in * Electronics Australia

Heat controllers

Save power this winter with one or both of these heat controllers. Use them for radiators in small rooms or for electric blankets. Zero voltage switching circuits are used for low electromagnetic interference.

Transceiver Power Supply

If you have built the UHF transceiver or want to build this month's VHF transceiver you'll also want a power supply housed in a matching cabinet. We publish an easy to build circuit.

Marantz CD-54 review

We check out the lowest cost CD player from Marantz, the CD-54. This compact machine stacks up well against the mounting competition from other low cost models.

Plus:

Our series on op amps continues; Hyperion computer review; and an antique SW receiver.

On Sale: July 2nd

*Although these articles have been prepared for publication, circumstances may change the final content. However, we will make every attempt to include the articles featured here.

AR2001 WORLD'S FIRST

- CONTINUOUS COVERAGE
- THREE MODE SCANNER
- COMMUNICATIONS RECEIVER

ONLY $599 INCL. TAX

FEATURES:

- 25-550 MHz continuous
- NBFM — for communication
- WBFM — for BC & TV monitoring
- AM — for Air band monitoring
- 20 CH memory
- Priority Channel
- Clock

SPECIFICATIONS:

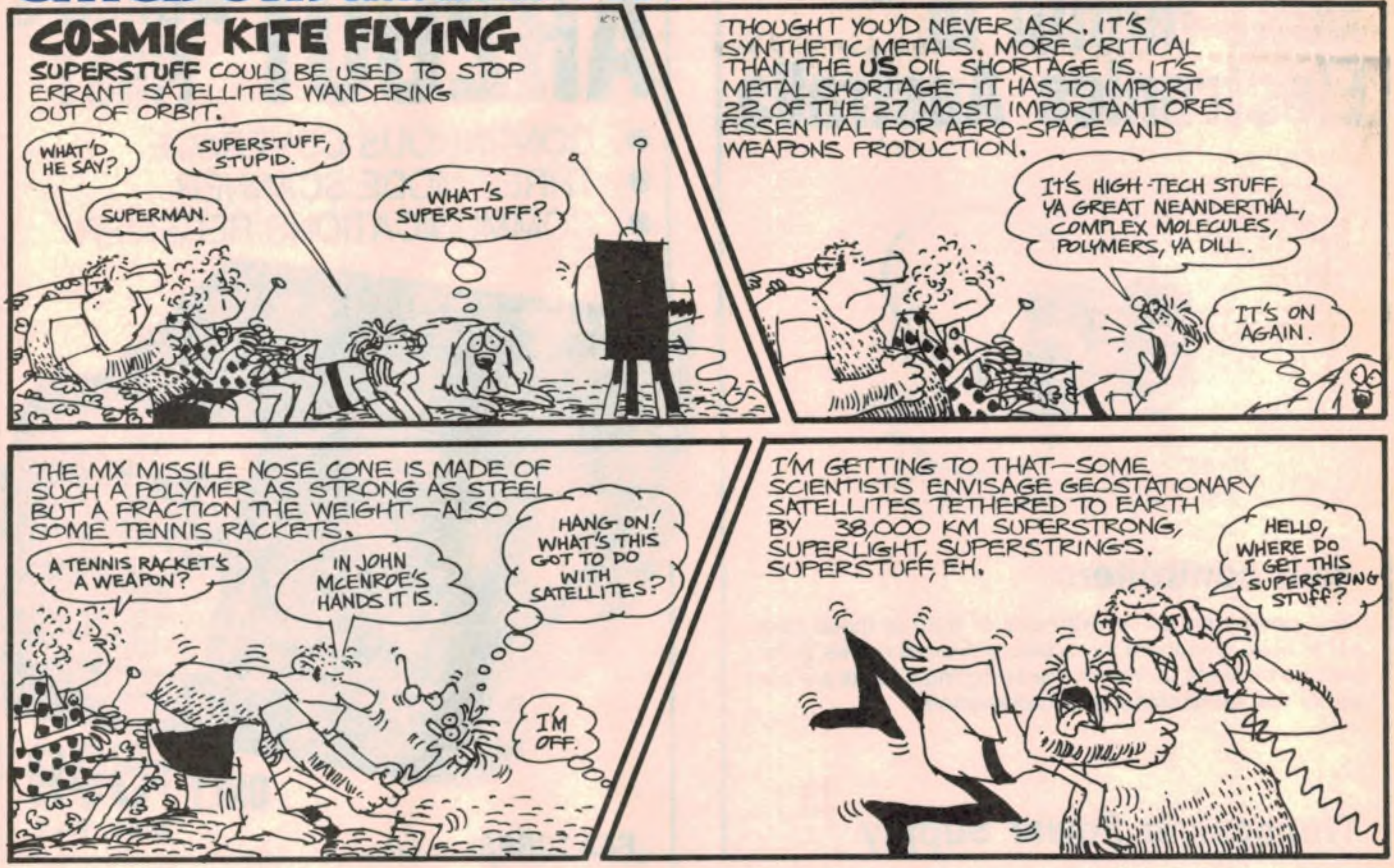
Frequency Range:	25MHz-550MHz Continuous			
Search Frequency Increments:	5KHz. 12.5KHz. 25KHz			
Mode:	Narrow band FM Wide Band AM			
Number of Memory	20 including			
Sensitivity	Narrow FM	0.3uV	12DB SINAD	
	Wide FM	1.0uV	12DB SINAD	
	AM	0.5uV	10DB S N	
Selectivity:	NFM	7.5KHz @6DB	20KHz @70DB	
	WFM	50.0KHz @6DB	250KHz @60DB	
	AM	5.0KHz @6DB	10KHz @70DB	
Spurious and Image rejection	50DB			
Modulation Acceptance:	NFM	7.5KHz		
	WFM	50KHz	AM	100%
IF Frequencies:	1st IF 750MHz	SAW Filter	3rd IF 455KHz	Ceramic Filter
	2nd IF 45.0275MHZ	Crystal Filter	(WFM) 5.5 MHz	Ceramic Filter
Reference Oscillator	(Synthesiser) Crystal Controlled			
Scanning Rate	Approx 5 Channels per Second			
Search Scanning Rate	Approx 6 Seconds per mega Hertz			
Scan Delay:	Normal.	Approx. 1 second		
	With Delay Option	Approx. 2.5 seconds		
Search Delay	Approx. 2.5 seconds			
Priority Sampling Rate	Approx. 2 seconds			
Audio Output:	1W @10% or less Distortion			
Speaker (Internal):	8 Ohms			
Power Requirements	12V-14V DC			
Frequency and Message Readout	LCD Type			
Size:	138mm Wide × 80mm High × 200mm Deep			
Weight:	1.1 kgs			

DEALER ENQUIRIES WELCOME

EMONA electronics P/L

All Mail to: P.O. Box K21, Haymarket, N.S.W. 2000.
Ph: (02) 211 0531 92-94 Wentworth Ave, SYDNEY, 2000
MELBOURNE: GFS ELECTRONIC IMPORTS Ph: (03) 873 3777

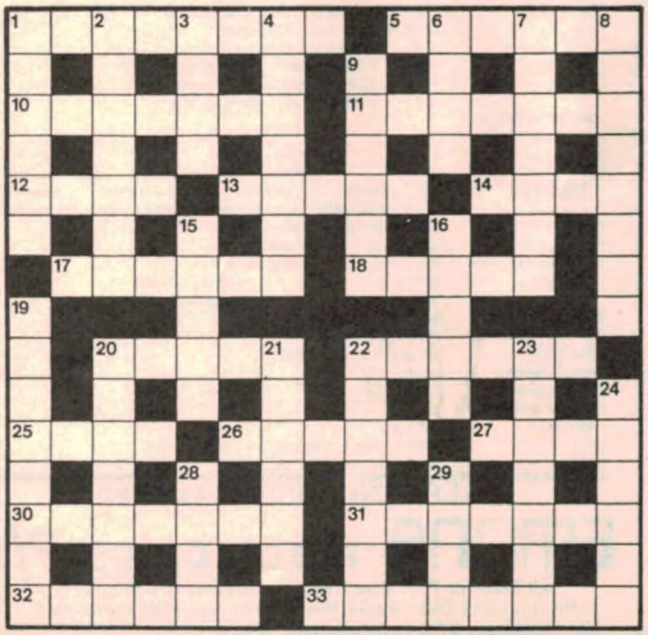
emerson's out of this world



JUNE CROSSWORD

ACROSS

1. Computer storage capacity unit. (8)
5. Electronic device which enables you to make contact! (6)
10. This is found in a tilt version of 5 across. (7)
11. Type of key which is another version of 5 across. (7)
12. Sets up an antenna. (4)

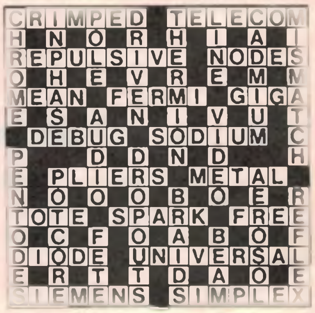


13. What a badly adjusted tonearm tends to do. (5)
14. The Crocodilian Connection? (4)
17. Electronics Australia's output. (6)
18. Ranging system. (5)
20. Another ranging system. (5)
22. Peaks. (6)
25. Type of aerial. (4)
26. Checks by 18 across. (5)
27. Prefix meaning "eight". (4)
30. Type of valve. (7)
31. Basic rule in electronics. (4,3)
32. Group of interconnected units. (6)
33. Electron accelerator. (8)

DOWN

1. Computer store. (6)
2. Openings for auto drivers. (7)
3. Component colour code for 6. (4)
4. Television coil structures. (1,1,5)
6. Erase a taped recording. (4)
7. Frequency multiplier. (7)
8. Type of filter. (4-4)
9. Part of an AC motor. (6)
15. Feature of a transformer. (5)
16. A circuit within a calculator. (5)
19. What 5 across possibly does to a circuit, etc. (8)
20. Removes ripple. (7)
21. Another type of 5 across. (6)
22. Electronic control panel. (7)
23. Kind of radio coil. (7)
24. Location with the call sign 8DN. (6)
28. Charge carrier. (4)
29. Colloquial radio operator's term, ack ———. (4)

SOLUTION FOR MAY



C	R	I	M	P	E	D		T	E	L	E	C	O	M
H		N		O		R		H		I		A		I
R	E	P	U	L	S	I	V	E		N	O	D	E	S
O		H		E		V		R		E		M		M
M	E	A	N		F	E	R	M	I		G	I	G	A
E		S		A		N		I		V		U		T
	D	E	B	U	G		S	O	D	I	U	M		C
P				D		D		N		D				H
E		P	L	I	E	R	S		M	E	T	A	L	
N		O		O		O		B		O		E		R
T	O	T	E		S	P	A	R	K		F	R	E	E
O		C		F		O		A		B		O		F
D	I	O	D	E		U	N	I	V	E	R	S	A	L
E		R		T		T		D		A		O		E
S	I	E	M	E	N	S		S	I	M	P	L	E	X

L. E. CHAPMAN

122 PITT ROAD, NTH CURL CURL.
MAIL ORDERS: BOX 156, DEE WHY, NSW. 2099.
TELEPHONE 93-1848.

SUPER SPECIAL
GRAMO MOTOR AND PICKUP 240V

3 speed 33-45-78 includes cartridge and stylus turnover

$12

P&P NSW $2.75
INTERSTATE $4.20
WA NT $5.20

SUPER SPECIAL
FM STEREO KITS

Sets of 3 modules includes FM tuner decoder and if detector. Circuit diagram supplied.

ONLY $22 PP $1.40

Send stamped envelope for copy of Electronics Australia magazine review of the units.

VU & BALANCE METERS

$2

PP 70 cents

12K 100μA $2.00 STEREO VU $3.00

VALVE SOCKETS

9 pin 25c — 7 pin 25c — octal 25c.

DUAL VU METER $3

PP 70 cents

ICs

74LS76N	50c	SAA5050	$2.50
74SL74N	50c	747S08N	50c
74LS00N	50c	74L392N	50c
14011UB	50c	74LS174N	50c
S041P	$1.00	SN29848N	50c
2612N	50c	MC14011UB	50c
74LS157N	50c	NES560N	50c
53114N	50c	74LS90N	$1.50
MM53114N	50c	74LS93N	$1.50
HEF4024BP	$1.50	SC87024P	$2.50
MM57186N	$2.50	S7646211B	$1.00
HEF4024BP		74LS90N	50c
74LS76N	50c	HEF4011BP	50c
MC1306P	50c	74LS10N	50c
2112B	50c	SN29862N	50c
2112N	50c	HEF4019BP	75c
SC87024P	$2.50	NE566N	50c

SPEAKER

2-way crossover networks

$2

CRYSTALS for colour TV $1 each

SPEAKER TRANSFORMERS
for valve radios
7000 to 15 ohm **$4.50**
7000 to 3.5 **$3.50**

455KC IF Trans for valve radios
$1 each
Aerial OS coils
75c each

VORTEX TAPE DECK MOTORS
$10

CAR RADIO
Suppressors
5 for $1

SPECIAL
Chrome ¼ shaft push-on knobs. **10 for $1.**
Usual price 60c to 80c each

IC SOCKETS

24 pin	35c
28 pin	40c
18 pin	25c

TRANSISTORS AD161-162 **$1** pair
100 mixed Capacitors, fresh stock, all handy values **$2**
AD149 **$2** pair
100 mixed resistors, handy values **$2**

STICK RECTIFIERS

For colour TV **75c** each

SUPER SPECIAL JVC CD FULL 4 CHANNEL MODEL 4VR 1006 AM/FM TUNER AMPLIFIER 40 WATTS RMS

Normal price over $600
our price only
$195 each
instruction
manual included

PP NSW: $2.75
Interstate: $3.80
TAS: $4.50 WA/NT: $7.00

POTS ROTARY

½ Meg	50c
1 Meg	50c
100K	30c
100K Switch	50c
50K Double Pole Switch	50c
7.500	30c
10K Switch	50c
250K	30c
50K	30c
20K	30c
10K Min Pots	25c
50/ohm	50c
½ or 1 Meg Switch	50c
½ 1 meg dual Concentric tapped at 100K	$1
2 meg ganged double pole switch	$1
1.5 meg dual ganged	50c
2 meg ganged log	$1
1 meg dual ganged	$1
½ meg dual ganged LIN	75c
25K 50K dual ganged Concentric double switch	$1
200K single line	30c
20K wire wound	75c
dual log 10K	75c
100K dual ganged linear pots	75c
10K sub min log pots	50c
250K ganged pots	75c
25K in ganged pots	75c

SPECIAL

500 metres single strand shielded cable

$25

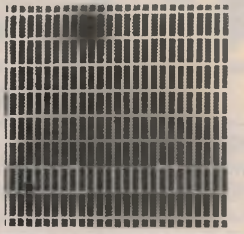
PP NSW	*$3.50*	*TAS*	*$ 7.45*
VIC	*$7.00*	*WA*	*$10.70*
QLD	*$7.00*	*NT*	*$11.70*

SLIDE POTS

½ meg dual	$1
1 meg dual	$1
2 meg dual	$1
25K dual	$1
250K dual	$1
1K dual	$1
50K single	50c
250K single	50c
10K single	50c
2 meg single	50c

SPECIAL SPEAKER SYSTEM KIT

Includes front Grill and Solid Timber Baffle. Dual Purpose woofer and Mid Range 12 inch. 5 inch Dual Cone Tweeter. 2 way cross over network 30 watts RMS.



$75 *A PAIR*

PP	*NSW*	*$4.50*	*SA*	*$ 7.00*
	VIC	*$6.50*	*TAS*	*$ 7.50*
	Qld	*$7.00*	*NT*	*$11.50*
			WA	*$10.50*

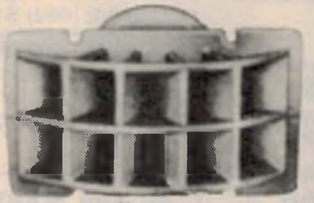
DECORATE WITH SOUND ... THERE'S A PANEL SIZE TO SUIT ANY REQUIREMENT

Dimensions (m/m)

522 × 371 × 32	$25 ea
730 × 520 × 49	$35 ea

PP	NSW	$3.00	TAS	$5.40
	VIC	$4.20	WA	$7.00
	Qld	$4.20	NT	$8.00

CELLULAR HORN TWEETER



HT.3

Mounting Specification
12.5cm × 7.1cm

Frequency Range:
2000 — 20,000Hz
Sensitivity: 105 dB
Maximum Power:
30 Watts
Impedance: 8 Ohms

only **$12ea**

PP $1.40

SPECIAL

12 mixed switches **$4** PP $1.40 not a lucky dip, c wot u get!

AUDIO REFLEX

MODEL AR 850

2 × 50 WRMS ● A & B SPEAKERSWITCH LOW/HI FILTER ● AM/FM STEREO LOUDNESS ● TAPE NON. SW PLUS MANY MORE FEATURES

RRP **$369**

OUR PRICE ONLY **$199**

PP	NSW	$3.00
	VIC	$4.80
	Qld	$4.80
	TAS	$6.00
	WA	$7.00
	NT	$8.00

SAVE A BUNDLE

MODEL CE-431

RRP **$239**

ONLY **$75**

PP	NSW	$2.80
	VIC	$4.20
	Qld	$4.20
	TAS	$6.00
	WA	$7.00
	NT	$8.00

STEREO EXPANDOR COMPRESSOR

designed to give extra noise reduction capability and to extend the dynamic range of previously recorded material.

SPEAKER SPECIALS

Magnavox	10 inch	$8
MSP	8 inch dual cone	$5
MSP	9 × 7	$6
	5 × 7 8w 15/ohm	$4.50
	8 × 4 8w 15/ohm	$4.50
	6 × 4 15w 8/ohm	$3.50

6 inch dual cone	$6
5 inch dual cone 27/ohm	$5
4 inch 27/ohm	$4
4 inch 4/ohm	$4
5 inch 4/ohm	$4
5 × 4 4/ohm	$4

EA marketplace EA marketplace

FOR SALE

MODEMS: Direct connect modem based on Am 1910 chip. 300 baud full duplex (V. 21) and 1200/75 baud half duplex (V.23). Also includes auto answer/auto disconnect. Bare circuit board (plated through) plus Manual, $80. Partial kit includes board, line transformer, Am7910, switches crystal and relay, $165. Fully built unit (Telecom approval pending), $380. All prices include tax and P&P. Mail order to Computer Systems Eng Pty Ltd, PO Box 282, Croydon, Vic, 3136. (03) 725 7317.

TV AERIAL SALES: Boat — House — Caravan. Kamar Shop, 147 Victoria Rd, Drummoyne, Syd, 2047. Tel (02) 81 4196.

BACK COPIES: EA, RTVH, RM, near complete, 54-78, best offer. (09) 386 6504, 59 Riley Rd, Dalkeith, WA, 6009.

SEREAL PRINTER: Canon PW 80, 10¼ plus paper. New condition, $150. (02) 601 7481.

SUPER 80 USERS: Software on tape from $5. Now available, Super Expansion board, features Centronics printer interface, sound generator, Atari joystick interface, 2 paddles, 8 bit I/O port. Kit (parts, manual, PCB) + postage, $45. Send cheque to Matrix Software, PO Box 291 Kensington, 2033.

ACETRONICS PCBs

MANUFACTURER OF QUALITY PRINTED CIRCUIT BOARDS — MODERN EQUIPMENT — FRIENDLY SERVICE — PLATED THROUGH HOLES — ROLL SOLDERING

PHONE NOW FOR PROMPT QUOTE

645 1241

112 ROBERTSON ROAD,
BASS HILL

RCS Radio Pty Ltd

Tel. (02) 587 3491

IS THE ONLY COMPANY
WHICH MANUFACTURES AND
SELLS EVERY PCB & FRONT PANEL
published in EA and ETI

651 Forest Road Bexley 2207
AUSTRALIA

RING FOR INSTANT PRICES
24 HOUR TURNAROUND SERVICE

SPECTRUM ANALYSERS: Solid state, 500MHz, $1250; 1000MHz, $1850. Perfect condition. Ph (08) 381 7419 AH.

VIDEO COLORIZER: B/cast Std, also Elect Test Pat Gen. Solid state, perfect condition, $950 each. Ph (08) 381 7419 AH.

WIRELESS GUITAR: Instrument FM Transmitter ex manufacture, only needs few connections to complete (refer page 4, Aug, 1982 EA), Main PC board is tested, potted in place and guaranteed. Complete with instructions, sold for $149.50. Limited quantity at only $39.50 including P&P. For further information send SAE to Oatley Electronics, PO Box 89, Oatley, NSW 2223.

BIG BOARD I: Double density disk controller kit. Board holds 1795 and support chips, replaces 1771. Selectable 5¼" & 8" use. Bios, complete software, documentation & 4MHz conv included. Kit $135, A & T $155, details $2. Tech Edge, PO Box 10, Aranda, ACT, 2614. (062) 51 5519 AH.

MICROBEE DISK SYSTEM: Runs CP/M 2.2 or 3.0 on 5¼" & 8" disks. Runs on an 8, 16, or 32K, 2.0 or 3.375MHz Microbee. Upgrade board holds up to 128K memory, 4K ROM, Disk controller, PIO, SIO, CTC. For details on Beeboard I send $1. Dealer enquiries welcome. Tech Edge, PO Box 10, Aranda, ACT, 2614. (062) 51 5519 AH.

SPECTRUM SOFTWARE: UK and Aust. Bargain prices. Also custom programming service. Send SAE for details. Softpac Enterprises, 109 Kennedy St, Sth Hedland, WA, 6722.

DO YOU WANT TO BE A RADIO AMATEUR?

The Wireless Institute of Australia, established in 1910 to further the interests of Amateur Radio, conducts a Correspondence Course for the A.O.C.P. and L.A.O.C.P. Examinations conducted by the Department of Communications. Throughout the Course, your papers are checked and commented upon to lead you to a successful conclusion.
For further information, write to:

THE COURSE SUPERVISOR
W.I.A. (N.S.W. DIVISION)
P.O. Box 1066
PARRAMATTA, N.S.W. 2150.

DISPLAY ADVERTS IN MARKETPLACE are available in sizes from a minimum of 2cm x 1 col rated at $15 for a col cm.

CLASSIFIED RATES $3.60 for 40 letters or part thereof per insertion payable in advance. Minimum 80 letters.

CLOSING DATE is six weeks prior to the on-sale date. Issues are on sale the first Wednesday of each month.

AMIDON FERROMAGNETIC CORES: Large range for all receiver and transmitter applications. For data and price list send 015 x 220 SASE to: R.J. & U.S. Imports, PO Box 157, Mortdale, NSW, 2223.

WANTED

AWA Teleradio; 3BZ Transmitter, Receiver, Speaker. Any replies appreciated. Also nu.11, 108, 109, army sets. M. Kelly, Olinda Rd, The Basin, 3154. (03) 762 3993.

RADIO & TV VALVES: Old/Modern, new in cartons, any qty. For quote send type Nos. to L. E. Chapman, PO Box 156, Dee Why, NSW, 2099.

FOR SYSTEM 80 & TRS 80 MODEL 1 COMPUTERS

DISK CONTROLLER KIT **$124** — DOUBLE DENSITY KIT **$135** — RS 232 ASSEMBLED BOARDS **$98** — FULLY ASSEMBLED EXPANSION UNITS/PRINTER INTERFACE 32K MEM DOUBLE DENSITY **$560.** P&P INCLUDED

AGRO DATA CONTROLLERS

P.O. BOX 344
GATTON QUEENSLAND 4343
TELEPHONE 075 62 2329

AN INTRODUCTION TO
DIGITAL ELECTRONICS

Electronic equipment now plays an important role in almost every field of human endeavour. And every day, more and more electronic equipment is "going digital". Even professional engineers and technicians find it hard to keep pace. In order to understand new developments, you need a good grounding in basic digital concepts, and An Introduction to Digital Electronics can give you that grounding. Tens of thousands of people — engineers, technicians, students and hobbyists — have used the previous editions of this book to find out what the digital revolution is all about. The fourth edition has been updated and expanded, to make it of even greater value.

Available from "Electronics Australia", 57 Regent St, Sydney. **PRICE $4.50 OR** by mail order from "Electronics Australia", PO Box 163, Chippendale, 2008. **PRICE $5.40**

Yamaha CD player — continued from P37

problem, it appears that the hum is due to radiation from the unshielded transformer. A copper strap around the transformer could probably fix this.

Of course at any normal setting of the volume control, noise from the CD-X1 is virtually inaudible.

Listening tests confirmed that the CD-X1 is right up to the standards which we have come to expect from compact disc players.

The conclusion must be that Yamaha is on a winner with the CD-X1. At $599 it is the lowest cost player available at the time of writing. We have raised a few quibbles but at this price they are just that — quibbles.

Further information can be obtained from hifi dealers or from the Australian distributors for Yamaha products, Rose Music Pty Ltd, 17-33 Market Street, South Melbourne, Victoria. (L.D.S.)

BARGAIN PRICES ● PERSONAL ATTENTION ● SLICK MAIL ORDER SERVICE ● SATISFACTION

A.C.E. RADIO

136 VICTORIA RD, MARRICKVILLE, NSW 2204
PHONE 51 3845

PROUD TO BE AUSTRALIAN

ELECTRONICS CENTRE

★ MONEY SAVER SUPER DUPA SPECIALS ★

IMPORTER FOLDS UP — BRAND NEW SPEAKERS

TOP QUALITY — MOSTLY PIONEER BRAND

10in
250mm 8 Ohms
20W 40-8000Hz
$9.95
P-P NSW $2.80
Interstate $3.80

8in
200mm 8 Ohms
15W 35-8000Hz
$5.75
P-P NSW $2.80
Interstate $3.80

5in
120mm 4 Ohms
25W 45-10,000Hz
$5.95
P-P NSW $2.80
Interstate $3.80

TWEETER
80mm 8 Ohms
Also 4 Ohms 20W
3000-18,000Hz
$2.50
P-P NSW $1.50
Interstate $2.00

6in
160mm 4 Ohms
8W
65-10,000 Ohms
$2.95

160mm 8 Ohms
15W
55-10,000 Ohms
$4.95
P-P NSW $1.85
Interstate $2.75

MID
100mm 8 Ohms
10W
1000-10,000Hz
$3.50

120mm 8 Ohms
30W 600-8000Hz
$4.50
P-P NSW $1.60
Interstate $2.60

8in PASSIVE RADIATOR.

FOAM SURROUND. BRUSHED ALUMINIUM ESCUTCHEON

$4.50 P-P NSW $2.50 INTERSTATE $3.50

C-CORE TRANSFORMERS

● LOW NOISE ● HIGH EFFICIENCY FOR THE COMPUTER ● POWER SUPPLY ● AND MANY MORE PROJECTS

MODEL	SEC.V.	AMPS
JT266	0-18V	8A
JT235	26-0-26V	2A
JT248	0-10V	10A
JT249	8.5-0-8.5V	4A
	& 15VCT	1A
JT274	0-9.5V	10A
	& 2X 0-12V	1A
JT320	36-0-36V	2A

ONE PRICE
$31.95 ea
ADD P-POST: NSW $3.50.
V, Q, SA, T $4.50.
WA, NT $5.50

50 MICRO-AMP PANEL METER

$6.50
P-P 90c

High Quality Kyoritsu.

48 × 42mm. Barrel dia. 38mm.

DIODE IN 4004. 50 FOR $2.50
P-P 80c

A1 QUALITY FIBREGLASS PRINTED CIRCUIT BOARD
350 x 81MM 4 FOR **$2.95**
P.P. NSW $1.50 INTERSTATE $2.50

A1 QUALITY TRANSISTORS

2N3055
10 FOR $6. P-P $1.50

● EX-COMPUTER FAN MOTORS ●

!KEEP IT COOL!

4" Sq. 110V 50/60 HZ

EXCELLENT WORKING ORDER GUARANTEED

Amps ● Power Supplies ● Electronic Equipment will operate far more efficiently ● Imp protected ●

$7.95 EA

P.P. NSW $2.50
INTERSTATE $3.50

240V 50Hz 5 AMP MAINS FILTER

Professional Quality.
Ex-computer.
Also ideal audio gear, receivers, etc.

$9.50 P-P $1.50

REGULATORS

7812. + 12V 1A
7805 + 5V. 7905 − 5V 1A
10 MIXED $6. P.P. $1.50

HI-POWER BRIDGE RECTIFIER

400 PIV 35 AMP
$3.75 P-P 75c

ETONE SPEAKER SPECIALS

GENUINE FACTORY PRICES

Rugged top quality Aust made brand new bargains — all with factory warranty

Model	Size	Cone Type	V/Coil	Reson Hz	Freq Hz	Watts Rms	Price Ea or	2 for
4310	38cm	Straight surround	8 or 15 Ohms	45	40-6000	60	**$74.00** or	**$141.00**
4510	38cm	Straight surround	8 or 15 Ohms	45	40-6000	100	**$94.00** or	**$179.00**
4350	38cm	Hi-Fi	8 or 15 Ohms	30	30-4000	120	**$74.00** or	**$141.00**

Pack — Postage add for one 25/30cm model NSW $3.50. Interstate $5. For two 25/30cm models NSW $5. Interstate $7. For one 38cm model NSW $4.00. Interstate $6.00. For two 38cm models NSW $7. Interstate $8.50.

2SD200 = BU205 TRANSISTOR

NPN VCBO 1500V ● VCEO 700V ● 2.5 AMPS

4 FOR **$3.75** P-P 75c

50 WATT RMS SPEAKERS

FOR **$39.95** PAIR OR $22.50 EA.

ETONE FACTORY SCOOP.

30cm 8 Ohm Hi-Fi Woofer. Rugged Top Quality with Warranty. Foam Surround. 3.5cm V.C. Hefty Ferrite Magnet. Freq. Response. 35–4500 Hz.

P-P NSW for one, $3.50. Interstate, $5.00. P-P NSW for two, $5.00. Interstate, $7.00.

TRANSISTORS

BD135 NPN. 45V, 1A, 8W
10 FOR $1.95 P-P $1

MJE 3055 TRANSISTORS

10 for $9. P-P $1.50

HIGH GRADE POTTER AND BRUMFIELD RELAY

P-P 95c **$3.50**

KU series ● 240 VAC 50Hz operation ● 3 sets of 240V 10 amp change over contacts ● perspex cover and mounting base included ● size 50mm x 37mm x 35mm ● ex-computer ● as new condition. At less than ⅓ of the normal price

MJE 2955 TRANSISTORS

P-P $1.50 **10 FOR $12**

LOW PROFILE FERGUSON TRANSFORMERS

12V.7.5VA ● 24V. 20VA ● 18-0-18V. 40VA. 10-0-10V ● 0-15V.5A 0-15V.5A 0-9V.3A 40VA.

$5.50 **$6.95** **$12.50** **$12.50**

INPUT 240V AC 50 HZ. P-P NSW $2 INTERSTATE $3.50

POWER TRANSISTORS

140V 20AMP
MJ15003 NPN
MJ15004 PNP
$7.90 PAIR P-P $1

EA Magazine Holders

The binders and magazine holders are available over the counter from Electronics Australia, 57 Regent Street, Sydney, NSW — Price $5.10 binders, $4.50 holders.

Mail orders should be sent to Electronics Australia, PO Box 163, Chippendale, NSW 2008.

Prices including postage are:

Holders: $5.50 NSW; $5.60 other states, or six for $29.00 NSW; $31.50 other states, $A33.00 NZ.

Binders: $7.00 NSW; $8.50 other states; or six for $33.00 NSW; $36.00 other states, $A37.00 NZ.

EA PC BOARDS AND FRONT PANELS

Some readers have problems obtaining PC boards and front panels for projects. Many of our advertisers sell these items and their advertisements should be checked in the first instance. Failing that, below is a list of firms which produce or sell PC boards and front panels.

NSW

Jaycar Electronics
117 York Street,
Sydney 2000.
Telephone 264 6688,
267 1614.

Cnr. Carlingford & Pennant Hills Road,
Carlingford 2118.
Telephone 872 4444.

115-117 Parramatta Road,
Concord, 2137.
Telephone 570 7000.

121 Forest Road,
Hurstville 2220.
Telephone 570 7000.

Radio Despatch Service,
869 George Street,
Sydney 2000.
Telephone 211 0816.

RCS Radio Pty Ltd,
651 Forest Road,
Bexley, NSW 2207.
Telephone 587 3491.

Acetronics Printed Circuit Boards,
112 Robertson Road,
Bass Hill, 2197.
Telephone 645 1241.

WA

Altronics,
105 Stirling Street,
Perth 6000.
Telephone 328 1599.

Jemal Products,
5 Forge Street,
Kewdale, 6105.
Telephone (09) 451 8726.

N.Z.

Marday Services,
PO Box 19 189,
Avondale, Auckland.

Mini Tech Manufacturing Co Ltd,
PO Box 9194,
Newmarket.

Printed Circuits Limited,
PO Box 4248,
Christchurch.

VIC.

Rod Irving Electronics,
425 High Street,
Northcote, 3070.
Telephone 489 8131.

48 A'Beckett Street,
Melbourne 3001.
Telephone 347 7917
347 9251.

Kalextronics,
101 Burgundy Street,
Heidelberg 3084.
Telephone 743 1011.

Shop 11,
Regional Shopping Centre,
Melton 3338.
Telephone 743 1011.

Sunbury Printed Circuits,
Lot 14, Factory 3,
MacDougal Road,
Sunbury 3429.
Telephone 744 2714.

SUBSCRIPTION SERVICE

ELECTRONICS Australia

Subscription Rates

$29.00 per year within Australia
$31.00 per year elsewhere

Make sure you receive every copy of the magazine by ordering it from your newsagent or the publisher. For publisher subscriptions post this coupon, with your remittance to Electronics Australia Subscription Dept, John Fairfax & Sons Ltd, GPO Box 506, Sydney 2001. Subscription will start with first available issue.

Name ....

Address ....

Postcode .... Enclosed is .... for .... years

ADVERTISING INDEX

When you're in the games you've got to be good.

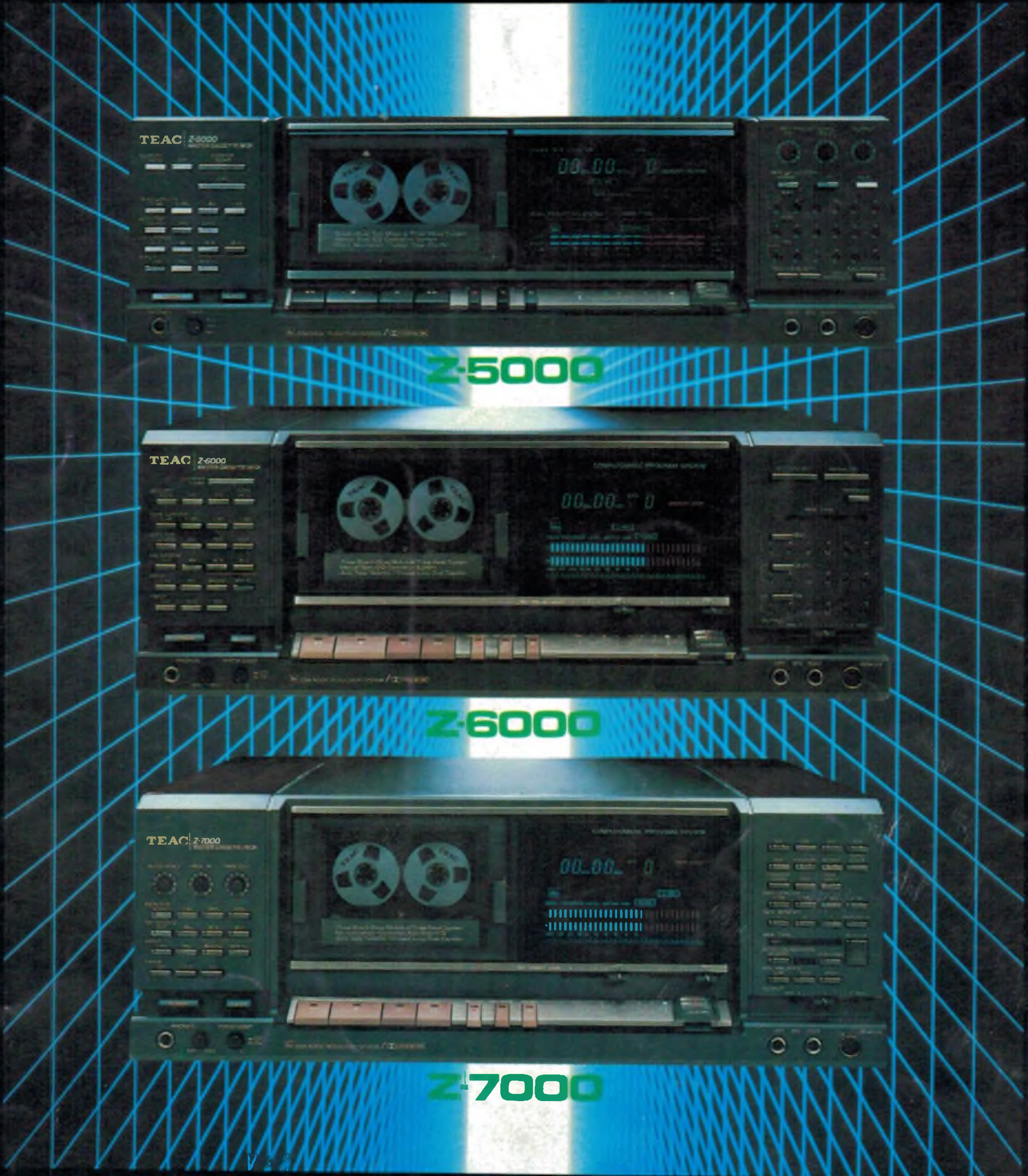
Two piece recorder/cameras just aren't in the race.
Right from the start, the Sanyo Betamovie Camera was designed to be a winner.
We began by taking a load off your back. Because with Sanyo Betamovie, the cassette is recorded in the camera.
So there's no bulky recorder, and no annoying over-the-shoulder cables.
Then we took another step forward. By allowing you to record up to 3 hours 40 minutes on one cassette.
That's 3 hours longer than any similar VHS camera.
And we made it lighter in weight. So if you record a morning's event with your Sanyo Betamovie, you won't feel like you've just taken part in it.
Add to all this Sanyo's simple one-handed operation and optional professional-style carrying case, and you'll see why the Sanyo Betamovie Camera is so far in front.
But with Sanyo that's life.

SANYO BETAMOVIE.

WHY DID WE CALL IT THE Z SERIES?

Because nothing can follow it.

The TEAC Z Series. Three cassette decks that are all the cassette deck anyone will ever need. Designed and built to provide absolutely the finest in cassette reproduction quality. In precision of performance. And in operational versatility. The transport and electronics are the pinnacle of TEAC technology, drawing on our know-how in producing superior open reel decks and professional equipment. Operational sophistication is unmatched. Any function worth having on a cassette deck is on the Z-7000. And the Z-6000 and Z-5000 are almost as impressive. In fact, you can tell just by looking that these decks are in a class by themselves. Bigger. Heavier. Without extraneous frills. Built for solid, stable, permanent excellence. The Z Series. Cassette deck performance from A to Z.



- Direct-drive capstan motor
- 3-head system
- dbx and Dolby B–C noise reduction
- Manual recording bias, level and EQ calibration system
- Heavy duty diecast chassis
- Electroload head loading system

- Direct-coupled playback EQ amplifier
- Real-time tape counter
- Memory repeat/play/stop
- CPS (Computomatic Program Search)
- Rec mute with auto spacer
- Standard remote control unit

- 3 direct-drive DC motors
- Direct-coupled playback EQ amplifier
- 3-head system
- dbx and Dolby B–C noise reduction
- dbx disc position
- Manual recording bias, level and EQ calibration system

- Dual-capstan closed-loop transport system
- Real time tape counter
- Automatic tape select
- 30-segment FL peak level meters
- Memory repeat/play/stop
- CPS (Computomatic Program Search)

- 3 direct-drive DC motors
- 3-head system
- dbx and Dolby B–C noise reduction
- dbx disc position
- Automatic recording bias, level and EQ calibration system
- Tape calibration memory
- Block Repeat

- Dual-capstan closed-loop transport system
- Real-time tape counter
- Automatic tape select
- Search To Cue, Search To Zero, Search To Record
- Spot Erase System
- CPS (Computomatic Program Search),

TEAC®

Where Art and Technology Meet

TEAC Australia Pty., Ltd.: 115 Whiteman Street South Melbourne, Victoria 3205 Phone: 699—6000