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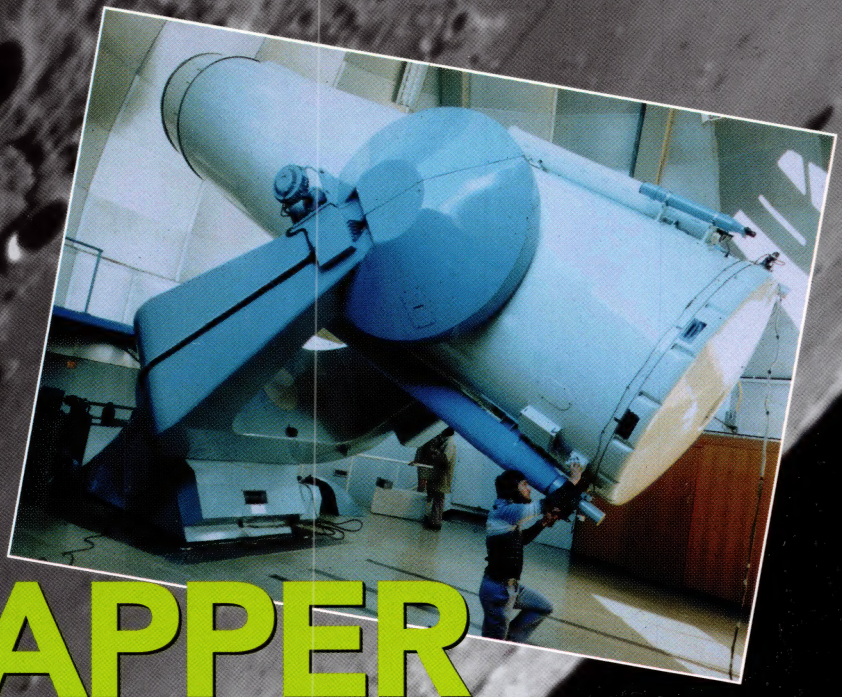
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REVIEWED INSIDE
Hitachi's new projector ■ 301-CD player

BUILD The Little Jim, 8-Channel IR Remote

PLUS: Green LEDs, an Urgent Alert, Tektronix's new scope, 300mm wafers, worms, more worms and Java beans.

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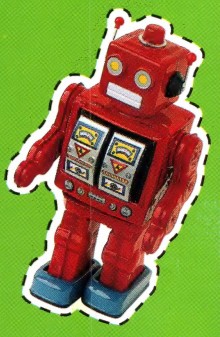


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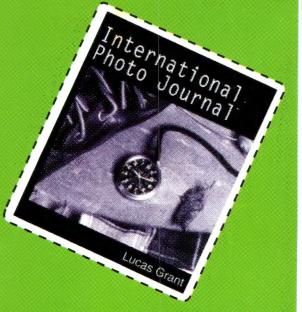












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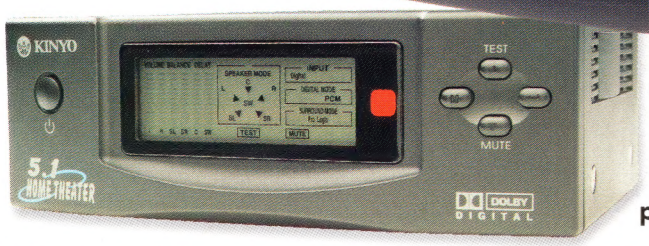
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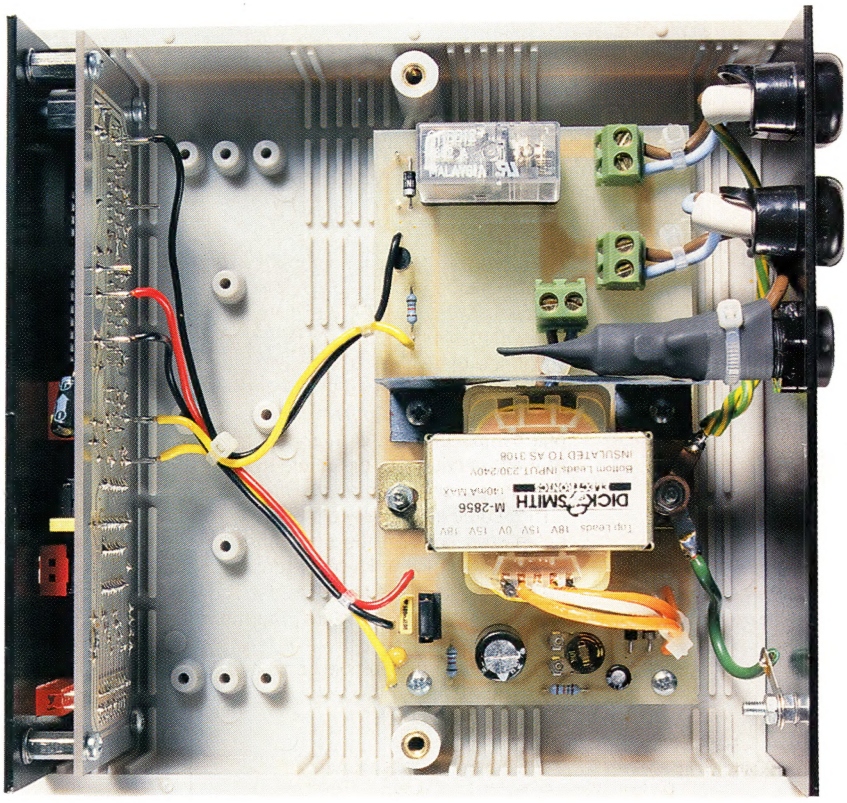
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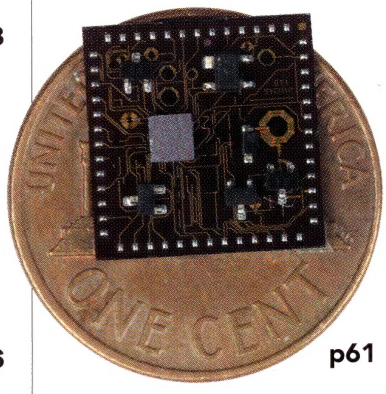
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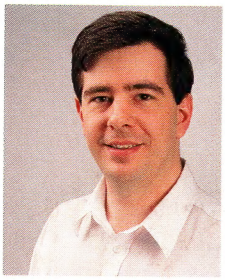
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Stay connected!

PULL THE LID OFF your computer sometime, and take a look inside. You'll see a motherboard with CPU, various I/O cards, RAM, hard and floppy drives, as well as a CD-ROM and power supply. Look more closely, and you'll see the various ICs, discrete components, wires and PCBs that make up the system.

There's one thing you won't have noticed though. It's one component that outnumbers all others; every one of them is critical to the whole system, and yet I'll bet you just passed them all over...

They come in a variety of physical shapes and forms, but always perform the same function. An inordinate amount of time and effort goes into designing and manufacturing these components, and in some cases, they are the deciding factors in terms of speed, size or performance.

Give up? It's the humble connector.

A quick count came up with over 2000 of these in my computer system, and every single one of them was functioning perfectly. Just think about it: you pop in a new PCI card, and 188 connections are made instantly. Install 32MB of RAM and that's another 168 connections. Lock in a socket-7 CPU, and a further 321 gold plated contacts come in to play.

Yes, the connector may not be the most glamorous component in a system, but it is certainly a very necessary part of our technological existence. Spare a thought for it next time you plug something in — and then think if there is something better we can do with the world's limited gold resources...



Graham Cattley, Editor

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Bulletin Board	(02) 9353 0627			

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ON THE COVER



The Moon. East of Sinus Iridium, to be exact, as seen through the eyes of the European Southern Observatory with help from the Wide Field Imaging project detailed on page 20. (Image courtesy ESR).

ELECTRONICS AUSTRALIA is published by FPC Magazines, a division of Eastern Suburbs Newspapers Partnership, which is owned by: General Newspapers Pty Ltd. ACN 000117322; Double Bay Newspapers Pty Ltd. ACN 000237598; and Brehmer Fairfax Pty Ltd. ACN 008629767, at 180 Bourke Road, Alexandria, NSW 2015.
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Printed by Hannan Print Dubbo, 51 - 59 Wheelers Lane, Dubbo 2830. Phone (02) 68 843 444. Distributed by Newsagents Direct Distribution Pty Ltd, Level 2, Rear 170 Bourke Rd., Alexandria, NSW 2015; phone (02) 9353 9911.

*Recommended & maximum Australian retail price. **ISSN 1328-6218**

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WHAT'S NEW

IN THE EVER CHANGING WORLD OF ELECTRONICS

THIS MONTH

Panasonic NV-DS55A Super Compact DV Camera

Denon CDR-1000 CD-R/ CD-RW Audio Recorder

Dick Smith Electronics Xenon Handheld Strobe

Neltronics Night Owl Night vision system

Neltronics All Compatible MP3 Player

Panasonic SC-AK28 Mini Sound Sytem

Jamo 7 Series Loudspeakers

Casio WMP-1V MP3 Watch

JVC HM-DR10000 Digital Vider Recorder

Dick Smith Electronics Spirit Set-top Surfer

Fuji FinePix 4700 Zoom Digital Camera

5D Products UsbBug & AudioBug

Panasonic PT-L758E Projector

Vestax 2000 Vinyl cutter

Hiteker AD-600A DVD/MP3/CD Player

JVC XV-M555B 3-disk DVD changer



Super-compact DV camera

PANASONIC'S new super-compact palm-style digital video camera, the NV-DS55A, is the world's smallest palm-style DV camera with LCD monitor. The NV-DS55A offers a new feature — MultiMedia Card recording capability — that allows it to operate as two cameras in one. It offers users a digital video camera with DV cassette recording; as well as a versatile digital still camera. A powerful 15x optical zoom is also available.

The MultiMedia Card slot allows recording of up to 100 still pictures on the supplied 4MB MultiMedia Card. Three image resolution modes are available — fine, normal and economy. Copying still images from the Card to a DV cassette is also possible. To import recorded pictures to a PC, send images attached to e-mail or print them out, the postage stamp-sized MultiMedia Card can be inserted into an optional PC Card Adapter, and plugged directly into a computer without the need for any cable connections. An optional MultiMedia Card external drive is available, which can be attached to a desktop PC's parallel port.

Camera body width has been reduced to just 47mm, the world's thinnest among palm-style digital video cameras, enhancing portability and holding comfort. The NV-DS55A has a 15x optical zoom lens (3.7-55.5mm focal length) and 150x digital zoom. Other features include Jet Zoom and super-quick recording start that commences recording within 3.5 seconds from power on. The NV-DS55A measures 47 x 94 x 129mm and weighs 490g (without battery and tape). It is priced at $3199, and is available from leading electrical retailers.

■ *For more information on this word's smallest camera, contact Panasonic Customer Care on 132 600.*





Denon CD recorder handles CD-RW

THE CDR-1000 offers high-resolution recording on both CD-R (record once) and CD-RW (rewritable) discs. Denon's CDR-1000 is a high-quality player that will record the same high-quality digital sound onto either CD-R or CD-RW discs from virtually any digital or analogue source.

It's this versatility to play normal CDs, record on CD-R (once-only recordable CDs) or CD-RW (many times rewritable/recordable) discs in such high-resolution 2-channel stereo that makes the CDR-1000 so special.

Despite its extremely attractive price ($1299 recommended retail), the CDR-1000 uses a 24-bit D/A converter in order to reproduce faithfully the high-quality sound recorded on CD-R discs. The sampling rate converter in the CDR-1000 supports a wide range of sampling frequencies according to the digital sound source, and it automatically detects such frequencies as 44.1kHz (the standard for CD), 32kHz (MiniDisc), and 48kHz (DAT) in normal mode.

The CDR-l000's specification includes one optical and two coaxial digital inputs, one optical and one coaxial digital output, and a set of analog stereo inputs and outputs. The Denon CDR-1000 CD recorder/player is covered by a nationwide two-year warranty, has an RRP of $1299 and is available at selected Denon dealers throughout Australia.

■ *For further information on this or any other Denon product call AWA Audio Products Pty Ltd on (02) 9669 3477 or email info@audioproducts.com.au.*

Xenon Handheld Strobe



THIS XENON STROBE Light is ideal for emergency situations and signalling applications. It provides a flashing bright light and is perfect for the car, boat, caravan or anywhere that emergency situations are likely to arise.

The lightweight and portable Strobe Light is shaped like a wand for easy use, and features two speed settings, fast and slow and is operated by two AA batteries (not supplied). The Xenon Hand Strobe Light is available from Dick Smith Electronics and Powerhouse stores for $9.80.

■ *It is also available via mail order by calling Dick Smith Electronics Direct Link on 1300 366 644 or by visiting their website at www.dse.com.au.*

Night owl



NEED TO SEE in the dark? Night Owl Optics allows you to see in complete darkness with its complete range of innovative and affordable optic range, exclusive to Neltronics.

The Night Owl Features a powerful integrated infrared illuminator, a 12° field of view and powerful 3.1x image magnification, giving over a 100 metres range of view. They weigh under 425g and are powered by 2 AA batteries.

Night Owl Optics are leaders in night vision and after extensive testing, Neltronics are thrilled to offer Australia the technology that lets you see in complete darkness.

■ *No, really they are. Contact Neltronics on 1800 633 930 and they'll tell you all about it, or visit their website at www.radarradar.com.au.*



Mp3 or tape?

IS IT A TAPE CASSETTE or is it an MP3 player? Actually, it's both! Download music from the Internet or your private CD collection into the Rome 'all compatible' MP3 player, and you can listen to up to six hours of your favourite music through the supplied headphones.

As the player is the same shape and size as an ordinary audio cassette, you can slip it into your car's cassette player and enjoy your digital music through your car's sound system.

Light and compact, with all software provided, the Rome MP3 player comes with 32MB built-in RAM, and accepts standard memory cards.

■ *It is powered by a single 1.2V rechargeable Ni-MH battery, and comes with charger, headphones and data cable. For more info, contact Neltronics on 1800 633 930, or visit their website at www.radar-radar.com.au.*

UFOs in your hifi



PANASONIC HAS RELEASED two new mini hi-fi systems — the SC-AK18 and the SC-AK28. These two new models offer powerful output, superior sound quality and excellent bass performance at a competitive price. The SC-AK18 is priced at $569, while the SC-AK28 is $679. Both models are available in stylish metallic silver.

System components are 5-CD changer, speaker system, 3-D acoustic image equaliser and manual equaliser with joystick and jog control, double auto-reverse tape deck, FM/AM digital tuner, and wireless full remote control.

The SC-AK28 offers an output of 140 watts RMS per channel, with a 3-way speaker system, bi-wired connection for enhanced bass response and 14cm super woofer. It incorporates Panasonic's Super Woofer Drive System for truly dynamic bass. The SC-AK18 has an output of 60W RMS per channel and a 2-way speaker system. Both systems incorporate Panasonic's graphic equaliser, which uses a Joystick and Jog-Dial to make sound heavier, lighter, softer or sharper.

■ *They also feature Panasonic's Double Space Spectrum Analyser, a display which features the image of a space ship... Yup, that's right, as the music changes, the display varies to provide a wide range of patterns, with the space ship flying and spinning in space. Find out more by contacting Panasonic's Customer Care on 132 600.*

Jamo's award-winning speakers hit Australia

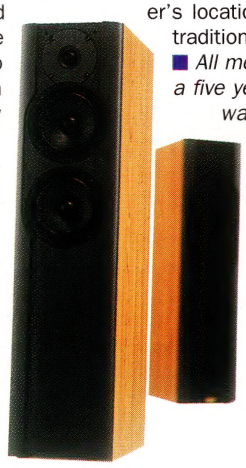
ONE OF EUROPE'S most highly awarded speaker manufacturers, Jamo, is introducing to Australia the latest development of one of Europe's most acclaimed speaker ranges, the Jamo 7 Series. With a reputation for outstanding performance and quality, the Danish designed and manufactured speakers offer a new dimension of choice for serious Australian home audio buffs. The wide range makes the 7 Series ideal contenders for both 2-channel hifi and home theatre applications.

The new Jamo 7 Series comprises the 7.7, 7.6, 7.5, 7.4, 7.3 and 7.2 models. The line-up is available in selected hand-rubbed finishes including Black Ash, Cherry, and Mahogany, with the 7.6 and 7.7 also available in American Cherry wood finish.

The floor-standing Jamo 7.6 (3-way, 150 watt) and 7.7 (3-way, 200 watt) models are equipped with two glass fibre cone midrange units mounted above and below the dome tweeter. This design gives a wide horizontal dispersion and a narrower listening window in the vertical plane than may be realised with one unit. As a result, more people can enjoy listening in the 'sweet spot' and the sound becomes less influenced by reflections from the floor and ceiling surfaces of the room.

Designed for serious hifi and home entertainment installations, the 7.6 and 7.7 speakers further incorporate a dedicated subwoofer mounted at the bottom of the cabinet, near the floor, and are augmented by a rear mounted reflex port. This construction delivers a deep, solid bass reproduction and is less influenced by the speaker's location in the room than traditional designs.

■ *All models are covered by a five year parts and labour warranty and prices start at $644 for the 7.2. For further information on this and any other Jamo product contact Jamo Australia on 1800 242 426, or visit their website at www.jamo speakers.com.*



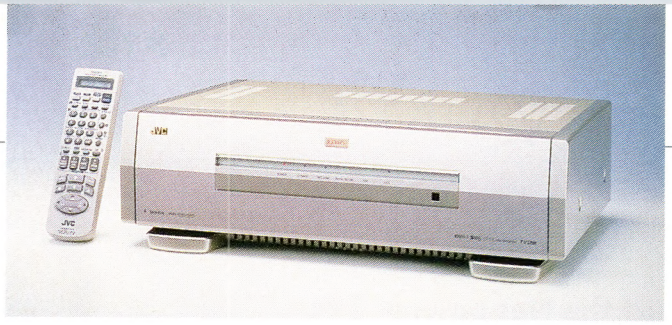
Watcha listenin' to?

NEW FROM CASIO is the WMP-1V Wrist Audio Player, the world's first wrist-type wearable MP3 format file player. You can use your computer to download MP3 files off the Internet (from authorised sites only, of course), or you can use commercially available MP3 file creation software to create MP3 files from your favourite music CDs. MP3 files can then be downloaded to the Wrist Audio Player for listening over the included stereo earphones.

The WMP-1V can play up to 33 minutes of music at CD quality, 44 minutes at near CD quality and 66 minutes of FM broadcast-level quality sound.

■ *The internal batteries last up to four hours, and take around four hours to re-charge. The watch has a USB interface to transfer files from your PC, and comes with a pair of stereo inner-ear headphones.*





VHS just went **digital!**

JUST IN TIME for the Olympic games, JVC has introduced the HM-DR10000 — the world's first D-VHS digital video recorder. It will record just about any video source as digital data, with a massive 21-hour capacity.

JVC invented VHS, the world's most popular video format, and is now taking VHS video into the 21st century with their new HM-DR10000 D-VHS digital recorder with MPEG2 CODEC (encoding/decoding) capability. Featuring the D-VHS digital recording format (which was also invented by JVC), this new home video deck will let people record from just about any source, whether it's analogue (such as regular PAL TV broadcasts) or digital (such as DV camcorder recordings) as an MPEG2 digital signal on D-VHS tape.

Since the MPEG2 digital signals used by the HM-DR10000 are becoming the industry standard for future digital broadcasts, and are the same signal format as used in DVD, the recordings made on the HM-DR10000 will be compatible with the future. You will be able to record your favourite TV shows today, as well as the new digital broadcasts of tomorrow (via separate receiver) in the same digital format.

Moreover, its DV input terminal (i.Link, IEEE 1394 compliant) will allow high-quality digital-to-digital dubbing straight from the growing number of digital video cameras that feature DV output. And for extra-long duration recording there is a special mode that allows up to 21 hours of recording on a single D-VHS cassette, which stores 44.4GB (10 times the capacity of a DVD disc), and is the same size and shape as the standard VHS cassette.

As if this weren't enough, the HM-DR10000 guarantees continued access to people's analogue VHS tape collections with its VHS/S-VHS recording and playback capability. With the HM-DR10000, people can get a taste of the future of video, while not having to sacrifice anything they need here and now.

■ *The HM-DR10000 has an RRP of $3999. For further information, call the JVC Customer Care Hotline on 1800 225 044.*

News from DSE
with Nicola Rutzou



A PRODUCT that is becoming more and more popular is the digital video camera. When they were first introduced a few years ago, everyone marvelled over the fantastic quality but were hesitant to jump in because of the high price.

The technology was first taken up by the professional market. People working in the television industry started using not just professional digital video equipment, but also smaller digital video cameras made for the consumer market because of the exceptional quality. It also gave many amateur video-makers the opportunity to produce broadcast quality footage, and saw the advent of programs like 'Race Around the World'.

But like all new technologies that take off , the price has come down and the number of models has increased.

This quality and range certainly make digital video cameras very attractive but they also have a great advantage over analogue video cameras, because footage can easily be downloaded and edited on a computer.

In our Dick Smith Electronics PowerHouse stores we sell a number of brands of digital video cameras including Panasonic, Sony, Sharp and JVC with many models now under $2,000. This pricing will all change on 1 July when the GST is introduced (digital video cameras currently have 22% wholesale sales tax applied to them). Each brand has a number of models including several palm-sized models that literally fit in a top pocket.

Also in our PowerHouse stores (currently located in Sydney and Melbourne only) we have a 'Digital Editing Centre'. There is a digital video camera set up with connections to a personal computer with editing software and colour printer. Our staff are on hand to demonstrate how easy it is to take a still shot or video footage, download it to the PC, edit it and then print it out in colour or watch it on an LCD screen also connected to the equipment.

Digital video cameras are an ideal add-on for Internet users who want to send footage or still shots to friends or relatives, or for business purposes like setting up an Internet site or developing multi-media presentations. The possibilities are really limitless with this compact accessible technology. ■

Surf the Net on your TV!

DICK SMITH ELECTRONICS has released the Spirit Set-top Surfer that allows users to access the Internet via a standard TV set for a lot less than the cost of a personal computer. The Spirit Set-top Surfer has a 56K modem and a cordless infra-red keyboard with a built-in mouse. The keyboard can control both the television and the set-top box controls.

The television and Internet can also be browsed simultaneously via the picture-in-picture feature that provides a smaller picture overlaying the television screen. This allows the user to browse the Internet while keeping an eye on their favourite TV show. A printer can also be connected to the Set-top Surfer via the parallel port for printing pages off the web. The Spirit Set-top Surfer will operate with any Internet Service Provider (ISP), however the machine is pre-configured to use Ozemail and comes with 200 hours of free access.

It is easy to set-up and easy to use to browse the Internet and send email. It plugs into either the RF socket on any standard television set or via S-video (Super VHS) output on a more advanced television for better definition.

■ *The Spirit Set-top Surfer is powered by an Intel processor and is ready for Internet e-commerce with Secure Sockets Layer (SSL) security and JavaScript support. It is available from selected Dick Smith Electronics stores Australia wide and Dick Smith Electronics PowerHouse stores for a retail price of $694.*





It's tiny! Fuji has announced that the the FinePix 4700 ZOOM, the latest addition to its widely acclaimed 700 series of digital cameras, is now available for an estimated street price of US$799. We can't wait to get our hands on it...

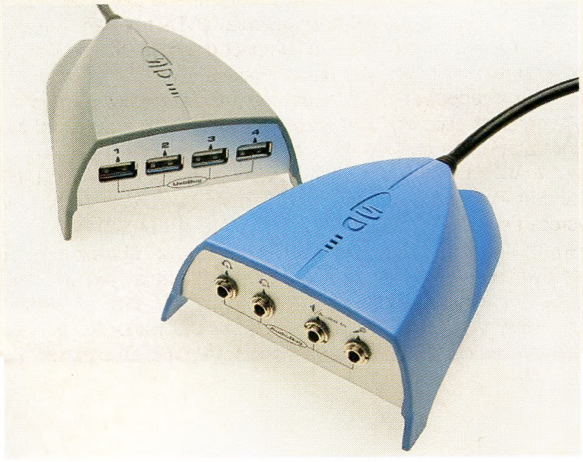
Australian Bug for your PC

5D PRODUCTS is a new Melbourne based computer peripheral manufacturer with an idea... Their products are dedicated to "Increase the functionality, and enhance the appearance of any standard PC." Their product line-up starts with the 'Bug' product family, which includes the AudioBug and the UsbBug.

The AudioBug is a 4-port connector terminal for PC. It makes your life easier by supplying all-important audio connectors within easy reach, yet occupying minimal desktop space. Ideal for sticking under the monitor, or on top or on the side panel of the PC or monitor. AudioBug retails at $39.90, and will "Permanently solve the problem of messy audio connectors at the back of the computer."

UsbBug is a 4-port USB Hub for the PC, iMac or iBook. It is bus powered and targeted to low powered and self powered USB devices. Like the AudioBug, it is ideal for placing under the monitor or on the PC. UsbBug retails at $49.90.

■ *There is also a MiniHub available, providing two USB ports for laptop users. For more info, contact 5D Products at www.5d-products.com, or email them at 5d@5d-products.com.*



Brightest portable projector yet

THE PANASONIC PT-L758E projector is designed for bright, portable presentations — offering an impressive 2500 ANSI lumens of output, combined with a compact design and a PC card slot for stand-alone operation.

The projector is compatible with popular third-party PC cards (such as SanDisk), allowing presentations to be made without a PC — ideal for 'travelling light' to trade shows and information displays. A Repeat function allows it to be programmed for unattended presentation.

With its 2500 ANSI lumens, the PT-L758E achieves a centre-to-corner uniformity ratio of 95%, and ensures crisp, clear, ultra-bright screen images in all room lighting conditions. It supports true XGA resolution at a full 1,024 x 768 pixels, with a maximum resolution of 1,280 x 1,024 SXGA. It is suitable for projecting detailed computer images, graphics and web pages.

When expanding or compressing images that have anything other than XGA resolution, the projector uses digital signal processing to deliver smooth outlines and superior on-screen definition. Intelligent Image Resizing removes annoying jagged edges when displaying expanded or compressed images.

The PT-L758E ensures full compatibility with VGA, SVGA, SXGA, Macintosh, video and even DTV signals from HDTV sources. The projector measures 263 x 124 x 336mm, and weighs 6.4kg. It is supplied with an all-in-one remote control that features a laser pointer, mouse control and projector operations.

■ *The PT-L758E is priced at around $19,995, and is available from specialist computer and audio-visual dealers. For more information contact Panasonic Customer Care on 132 600.*





THE VRX 2000 is a real time acetate cutting machine, allowing any audio source to be duplicated on to vinyl. Acetates allow DJ's to play exclusive tracks that are not available in commercial quantities, or to record original music from a mastered format on to one off records. Scratch DJ's can record breaks and loops from other sources and prepare their set on to one record. In DJ 'battles', this will enable quicker performance as the record will no longer need to be changed. Any audio source such as CD, MP3, tape or mini disc can be easily duplicated.

The most stunning feature of the VRX 2000 is the durability of the records. Unlike traditional acetates that have a very limited life span, the 'blanks' used with the machine will last 90% as long as standard vinyl. This is due to the fact that the VRX 2000 utilises a new plastic for the blanks called 'Harmodisk', which offers excellent reproduction quality and durability previously unheard of. Blanks will be available through Vestax VRX 2000 dealers, for around or under the price of an import 12" single. Up to 25 minutes can be recorded on each side.

Whereas in the past, the cost of cutting records in small quantities has been quite expensive, the Vestax VRX 2000 will offer a considerable reduction in price, as well as allowing a larger number of performers to cut one off records. Stores will offer the service of vinyl reproduction for the cost of the blank with a cutting charge, making it more accessible for artists everywhere.

So, how much does a machine that allows you to cut records from the comfort of your armchair cost? We are expecting a RRP of around $13,000 including tax, a fraction of the cost of a record pressing plant! Needless to say, this new invention is causing a huge stir in the dance music industry and will revolutionise the way DJs perform, however the VRX 2000 may also be the catalyst in seeing vinyl re-emerging as a preferred medium for many recording artists.

■ *Further details regarding the Vestax VRX 2000 vinyl recorder can be obtained from Sean Humphries, DJ Product Manager at Moore Music. Contact him on (03) 9419 0344, or email dj@mooremusic.com.au.*

Region free DVD player handles mp3 too

PLAY YOUR DVDS on the Hiteker AD-600A, and then use it to play your mp3s! The Hiteker AD-600A will play DVDs from any region, as well as video CDs, karaoke and compact discs. It will also play mp3 music files stored on CD-R discs, making it one of the most flexible (and cheapest!) players on the market today. Record your favourite mp3 files on CD-R and have over 12 hours of continuous music playing, or change discs and watch a movie!

The AD-600A offers surround sound outputs (Dolby Digital/AC-3 and ProLogic), full remote control, parental control locks, colour system conversion (NTSC to PAL and PAL to NTSC) and is DTS ready. S-Video and ColorStream Outputs (Y, Cr, Cb) are provided, along with standard analogue video, and all cables are supplied.

■ *The Hiteker AD-600A is available now from freNETic for only $499 including tax and a 12 month warranty. For more information, visit their web site at www.frenetic.com.au, or phone (02) 9660 3388.*



NEWS HIGHLIGHTS



PHOTO BY BUSINESS WIRE

World's Highest Capacity Hard Drive

IBM HAS ANNOUNCED two new products that reportedly set world records for data storage — the highest capacity hard drive and the greatest areal density of any hard disk drive product.

The 7,200 rpm Deskstar 75GXP for desktop computers holds a whopping 75-gigabytes (GB) of data, more than 10 times the capacity of drives found in the average home PC. A single drive can now store the equivalent of up to 18 DVD movies in MPEG3 format, 159 music CDs or the data contained in a stack of documents 20 times taller than the Washington Monument.

"e-Business is fueling unprecedented demand for increased storage capacity on personal computers," said Shiv Shivaji, IBM's marketing director for desktop hard drives. "We're seeing increasing use of the Internet by people to download data-intensive software programs and applications, films, music, high-resolution photos and other multimedia content. Dramatic improvements in storage capacity, performance and reliability are helping enable this new economy."

IBM also announced the Deskstar 40GV, which runs at 5,400 rpm, holds 40GB of data and sets a new areal density record of 14.3 billion bits per square inch. Greater areal density allows more information to be stored in less space, producing a drive that is more reliable, quieter and more cost effective to manufacture.

These are the first IBM desktop drives to use glass disk platters instead of aluminum. The smoother and more rigid glass disks allow the recording head to read smaller bits of information that are packed more closely together. In addition, glass disks are more stable at higher speeds.

The new products are also the first IBM desktop drives to use load/unload technology. This feature parks the recording heads off the disk surface when not in use, dramatically increasing the amount of shock the drive can handle when not in use.

The Deskstar 75GXP sets a new standard in disk drive performance with a maximum media data rate of 444 megabits per second (Mb/s) and 8.5 milliseconds (ms) average seek time, while other technologies that enhance the drives' performance include a faster processor, more advanced LSI chips and better hardware caching. They are the first drives compatible with fast ATA interfaces, allowing burst transfers up to 100 megabytes per second (MB/sec).

Through improved mechanical design, IBM has made both drive families quieter by several decibels. The 40GV drive includes a new Silent Seek mode to further reduce acoustics to near solid state levels. This makes them ideal for use in television set-top boxes and other new consumer devices that require quiet access to stored data. For more information visit **www.ibm.com/harddrive.**

Dingo training

SPECIALISING IN Xilinx Field Programmable Gate Arrays (FPGA), Complex Programmable Logic Devices (CPLD) and VHDL, Dingo Electronics is a new Australian business providing professional training services to the digital electronic design industry.

Based in Melbourne, Dingo Electronics are offering interactive seminars on theory and workshop training, while events are conducted on-site or at a serviced training venue.

The seminar is an interactive presentation of current technologies. "It's a good means for many people to appreciate the possibilities of programmable logic", said Terry McNiff, training manager at Dingo Electronics. "If held on-site it is a very convenient event to organise. The workshop training is up to date and intensive. Dingo Electronics has a good established relationship with the Xilinx products supplier ACD." said Mr. McNiff.

Dingo Electronics conducts start-up training for the Xilinx tools suite, advanced schematic based design using VHDL and complete VHDL training for Xilinx FPGAs and CPLDs. The Dingo Electronics web site is at **www.dingo-electronics.com.au**.

Creative hobby show and fair

"THERE'S MORE TO LIFE than Video Games, TV and Cyber-Fun" says the Australian Creative Trends Association, who are organising a wide-ranging Creative Hobby Fair to be held on Saturday 24th June in Melbourne's inner city area.

The fair caters for an extremely diverse range of hobbies and interests, with the common theme being creative input. So whether it's music, screen printing, robotics, astronomy or just about any pastime (or passion) that needs active human input, you should be able to find it at 8 Chapel Street St.Kilda from 10AM to 5PM on 24/6/00.

Information and bookings details for the 'Huge Combined Hobby Bonanza' are available at **www.skyboom.com/original/hbbyshow.html**.

Australian road safety with Seagate drives



MELBOURNE-BASED export success story Redflex Traffic Systems rely on Seagate hard drives in their red light and speed cameras, which are producing images in sites in Australia, the USA, Canada and Bahrain.

Redflex cameras produce high-resolution, full-colour images at up to 7.5 frames per second across up to four lanes of traffic. The cameras then store the images on their hard drives before exporting the data for processing via ISDN, PSTN, fibre optic cable or modem for notice printing. The cameras are often required to function in temperature extremes, under constant vibration and have to process, store and transfer images quickly. Seagate drives are installed in Redflex traffic enforcement devices because of their transfer speed, robustness and reliability.

"Our digital cameras are operating in temperature extremes. In Arizona, for example, overnight temperatures can drop to zero degrees and daily temperatures can go higher than 40 degrees. We only install hard drives that can handle this sort of environment," said Bronwen Coulstock, Redflex' Business Communications and Public Affairs Manager.

To meet these demands, Redflex uses Seagate's U-series disk drives in its traffic enforcement devices. U-series drives are able to operate in a temperature range of between zero degrees and 60 degrees Celsius. Redflex also selected Seagate drives for their ability to manage the constant vibrations that its cameras can experience, since Seagate's U-Series hard drives can withstand up to 350Gs of shock per millisecond.

The third issue for Redflex was the system's ability to store images quickly to the hard drive to accommodate the enforcement requirements of heavy traffic.

Seagate's U-Series 5,400-rpm drives are able transfer data at a rate of 286 megabytes per second. They also offer 8.9-millisecond average seeks, a 256KB integrated cache buffer, and an internal transfer rate up to 206 megabits per second. This speed helps ensure that Redflex's critical enforcement timeframes are met.

The high-resolution images are quickly transferred from camera to processing centre for rapid processing and notice printing. "In Bahrain, for example, offences have to be notified to border authorities within 20 minutes of their occurrence. We require a storage medium that enables us to meet this deadline," said Ms Coulstock.

Wireless point-of-sale is now practical

HYPERCOM CORPORATION has recently announced the ICE(TM) 4000CE, the first wireless, Internet-enabled point-of-sale (POS) payment terminal using the Microsoft Windows CE operating system. The unit is suitable for merchants and service providers, including car rental companies, stadiums, medical facilities and restaurants that want to bring the payment system directly to the consumer.

When used with Hypercom's ePicPortz(TM) software, the secure, handheld payment terminal and web appliance supports a range of value-packed, browser-based services including: e-mail, on-screen advertising, interactive electronic coupons, electronic receipt capture (ECR), access to DDA account information, merchant e-commerce function, and cash management reporting through a standard browser — in addition to traditional card payment functions.

Additionally, the integrated web browser supports easy application downloading and expanded networking for merchants looking to access and/or process data from multiple locations from a single office.

"Hypercom(R) is moving electronic payment processing to the next level with secure web appliances that offer the flexibility of the Windows standard and the scalability to accommodate new value-added programs as they emerge," said George Wallner, president and CEO, Hypercom Corporation. "Merchants and service providers can now integrate customized programs onto the Hypercom payment platform to address a specific business need, such as loyalty programs or streamlined order entry, and they can use the value-added functions afforded by the Internet. That spells increased revenues for merchants and service providers."

With a near-palm-size footprint, the ePic ICE 4000CE can be worn or carried by service providers. The ePic offers a choice of communications options, with models supporting a variety of WAN technologies (GSM, CDPD), wireless technologies (900MHz), and a wireline modem that incorporates Hypercom 9600 bps FastPOS(TM) modern technology. With its built-in, high-speed RISC processor, the ICE 4000CE offers speed, power and expanded functionality in a platform that can be easily incorporated into an existing Windows NT-based network.

The ePic ICE 4000CE device is compatible with Hypercom's ePicPortz 1.0, a suite of security and gateway server software that enables browser-equipped ePic terminals to securely interface with the Internet and access an array of revenue generating web-based applications including email, on-screen advertising, interactive electronic coupons, interactive loyalty, electronic receipt capture, branding programs, e-commerce and traditional secure payment processing functions. Optional components and add-ons include a smart card reader, and memory options of 16 MB to 32 MB.



PHOTO BY BUSINESS WIRE



Data packing with Hewlett Packard

HEWLETT-PACKARD Company researchers at HP Labs in Palo Alto, California have created the company logo in a space 30 micrometers wide — about the diameter of a human hair — to demonstrate a technology called Atomic Resolution Storage (ARS).

An electron beam was used to write and read the image on a specially created material similar to that used in rewritable CDs. When used with other technologies, this technique will enable huge increases in storage density, making it possible to carry as much as 10GB of storage — enough to store 5,000 novels or 10,000 high-quality photographs — on a device the size of a credit card.

Intel launches wireless home networking

INTEL'S FAST GROWING networking products group has launched a new line of wireless networking products for the home computer market. The 'AnyPoint' Wireless Home Network systems will start at US$120.

Similar to Apple Computer's 'AirPort' wireless network system, the AnyPoint system is built around a wireless switch that plugs into a computer with Internet access. Each additional PC is equipped with a $129 radio receiver/transmitter Anypoint card. Data is transmitted from one device to another by way of the central switch using radio waves.

Intel said IBM would offer the AnyPoint wireless products with its new NetVista PC starting in May.

Sales of wireless-networking products for the home are projected to reach US$350 million in 2003 from $12.5 million last year, according to researchers at the Yankee Group.

New service puts your message into orbit

AUSTRALIANS CAN NOW 'speak to the sky' through a telephone service to record messages that will fly into space on FedSat, Australia's newest satellite.

The 'SpaceGram' service on 1902 974 001 costs $3.95 per minute and allows Australian callers to leave a spoken message to be included on the first compact disk (CD) in orbit. The disk will fly on FedSat, Australia's scientific microsatellite set to be launched from Japan next year as part of the Centenary of Federation celebrations.

The CD will also carry what may be the first Australian song in space: "From little things big things grow" (Kelly/Carmody), performed by Paul Kelly.

"Paul Kelly's song is the perfect theme for our satellite and we are grateful to the writers and publishers for their permission to use it," says CD project manager Jeff Kingwell.

"Our satellite is a small one but we hope it will be the beginning of bigger and better things for space exploration by Australia. This project means that any Australian can get into space, virtually speaking," he says.

"The messages recorded through the SpaceGram service will circle the Earth for about a hundred years. Perhaps during that time space systems will advance so that the satellite and its time capsule can be recovered. Just to be on the safe side, we are leaving a copy of the CD - and a compact disk player - at the National Museum of Australia that will open about the time our satellite is launched next year. The disk will form a record of what Australians thought at the turn of the new century. "

FedSat is the first major project of the Cooperative Research Centre for Satellite Systems, a joint venture by thirteen companies, universities and government agencies.

"Australia is back in space, make no mistake" says the Centre's Executive Director Dr Brian Embleton.

"It may have been a long time between drinks, but the pace of local space development is increasing. The cooperative approach adopted by the Centre means that our partners can get experience or space data more quickly and at lower cost. The new SpaceGram service makes it possible for all Australians to take part in this exciting journey," he says.

Funds raised by the SpaceGram service project will support Australian space research and education.

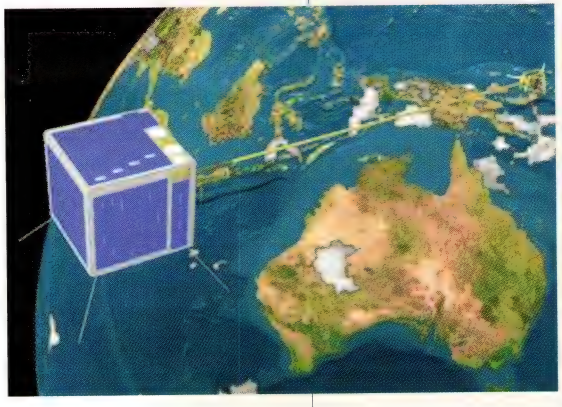
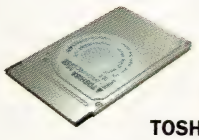


PHOTO BY BUSINESS WIRE



...and World's Highest Capacity 1.8" hard drive

TOSHIBA CORPORATION has extended the scope of its hard drive business with the introduction of its first 1.8-inch drive, and at the same time, reinforced its line-up of 2.5-inch HDD for portable computers with new drives offering one of the highest areal densities on the market.

With its established lineup of super slim 2.5-inch drives for portable PCs, Toshiba has now introduced a new generation of 6-, 10- and 20-gigabyte 2.5-inch drives, plus the 2-gigabyte 1.8-inch drive in order to satisfy a much wider range of portable equipment.

The company's first 1.8-inch HDD, the MK2001MPL, draws on the advanced technologies Toshiba has developed in its 2.5-inch HDD to achieve a world-leading 2-gigabyte capacity in a drive that stands only 5mm high, and is a feather-light 55 grams. The drive is compliant with the PC card Type II card standard, and can be used in current and future devices with PC card slots. In addition to portable personal computers, promising areas of application include hand-held mobile terminals, digital video cameras, digital still camera, and digital music players, car navigation systems, digital set-top boxes and digital VCRs. Portable applications are supported by a drive voltage as low as 3.3V and a resistance to shock of 1000G in non-operating status.

Toshiba's new line-up of 2.5-inch drives (20GB, 10GB and 6GB) are all 9.5mm high and the lightest high-capacity HDD available for portable applications — the heaviest weighing in at only 98 grams. The 20GB and 10GB variants boast a data capacity of 10GB on a single 2.5-inch disk, which translates to an areal density of 17.6 gigabits per square inch – said to be the highest data density of any HDD available in the market.

Japanese court throws out TI's IC patent

JAPAN'S SUPREME COURT has upheld a lower court's ruling that cancels Texas Instrument's 'Kilby XX275' transistor patent, a technology for making integrated transistors that is used in every integrated circuit in use today.

Fujitsu initiated the patent lawsuit in 1991, when it asked the Tokyo District Court to declare that its 1- and 4-megabit DRAM and 36K EPROM chips did not infringe on the Kilby '275 patent. The latter patent was awarded in the early 1990s, some 30 years after TI had originally applied for it. Fujitsu received a favorable ruling in 1994, which was upheld by the Tokyo High Court. Now the Supreme Court has dismissed TI's appeal to the 1994 court ruling.

TI officials said the ruling will not effect the company's ability to collect millions of dollars worth of royalty payments from various Japanese chip manufacturers who are using the patent and have signed licensing agreements with the American chipmaker. The Kilby patent is set to expire in 2001.

32GB drives for notebooks

IBM HAS ANNOUNCED development of a new line of notebook PC disk drives with storage capacity up to 32 gigabytes, five times the average amount of data stored on today's portable computers.

The 32GB disk drive holds enough data to run eight full-length movies, equivalent to a one mile high stack of type-written pages. IBM's laptop hard drives are used in machines from both IBM as well as from Compaq, Gateway and Dell Computer.

"Mobile users don't simply want the convenience of portability. They want a PC with desktop capabilities, able to store and process massive multimedia files", said Bill Healy, vice president of IBM's storage technology division in San Jose.

The new high-capacity drives will appear in notebook systems scheduled to hit the market later this summer. Five versions will be available: 5, 10, 15, 20, and 30 gigabytes.

HP launches wireless printing

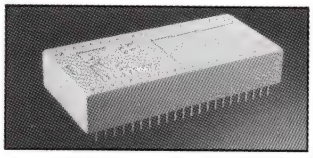
IN HER FIRST MAJOR product launch event, Hewlett-Packard CEO Carly Fiorina took the wraps of a series of new printers, imaging products and services that feature innovative Internet capabilities — including a document router that enables wireless printing.

"Future printers will have to go far beyond their traditional capabilities and offer new functions to meet the needs of the new Internet-based economy," Fiorina said. "Printers will be judged by the services they deliver, not just by how fast they print."

She added that today's US$40 billion printer market will become a $100 billion industry by 2004, including printers for new Web appliances and services. ■

THE TIGER COMES TO AUSTRALIA

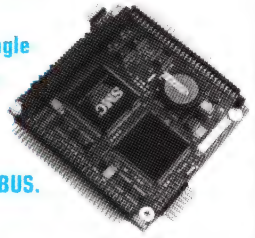
You've seen the BASIC Tiger and Tiny Tiger advertised in the US magazines: they are now available in Australia from JED.



Tigers are modules running true complied (not tokenised), Multitasking BASIC at 20 Mhz, but only draw 45mA. They have memory, 4 x 10-bit analog inputs, digital I/O, two serial ports, RTC, and are superb small controllers for scientific and industrial applications. **Tigers range in memory size from 32k Ram, 128k FLASH (less than $A100) to 6Mb.** A development system (W95/98/NT), with a proto board, is only $275. JED has a local board/controller with LCD/Kbd and industrial I/O.

See our www site or call for data sheets.

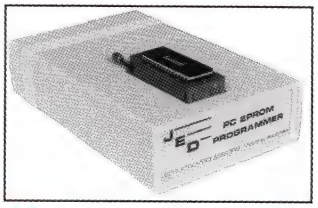
Three PC/104 single board computers based on X86, one with 5 UARTs, LPT & JBUS.



The **PC540** (at $350) uses an 80C188EB, with 40 I/O, 2 UARTs & timers uses $179 Pacific C.
The **PC541** is a V51 PC/XT DOS computer with 20 I/O, PC UARTs, LPT, FDC IDE disk. The new **PC543** uses an AMD ÉLAN (386) cpu at 33 Mhz with 4 MB DRAM, 16 MB FLASH, five RS232 (2 opt. RS485), LPT and JBUS. (All have JBUS, JED's 26-pin ribbon cable bus for industrial I/O. All boards are 3.6" by 3.8"on the PC/104 bus, and range from $350 to $500.)

$300 PC-PROM Programmer Also: Chiprase Eraser $225.

This programmer plugs into a PC printer port and reads, writes and edits any 28 - pin or 32 pin PROM without needing special plug-in cards.



JED Microprocessors Pty Ltd
www.jedmicro.com.au
173 Boronia Road, Boronia, 3155
Ph 03 9762 3588
Fax 03 9762 5499
(prices do not include freight,sales tax or gst.)

Letters to the Editor



Aircraft safety

I read with interest, and some trepidation, Tom Moffat's article on the Boeing 737-200 aircraft's handling problems in the May issue. I enjoy reading Tom's articles and his diversity of subjects.

However, this article is more disturbing. My first thought was, "Where is Ralph Nader when he is needed?" This is much more serious than his exposé of the cars that performed erratically, where he was successful in bringing those defects to the public notice.

Unfortunately, the Boeing consequences are far more disastrous than those of the cars. To train pilots to cope with these 'nuisance events' doesn't give me any comfort should I have to fly in one. One can only hope that Boeing does the right thing and re-design the servo-system and improve low-speed stability. Until this occurs the article's sub-title question is indeed worth considering.

Barry Ring (via email)

Lies, damn lies and...

Stewart Fist's comment in April's Letter to the Editor regarding the use of normalisation in statistics was completely unwarranted. He is either an opinionated fool or rather top heavy with grey matter. Statistics is simply a tool and normalisation can be misused like anything else. If he wants to extend that further, everyone of us normalises our image of the world to suit ourselves but that's waxing philosophical.

My point is, if you accept statistics (and politicians, salespersons, charities etc.) on blind faith then you're a fool. But then maybe that's our lot. I believe, statistically, that 20% of the population are smart enough to question everything.

Glenn D'Abrera (via email)

Obviously it's optical...

On page 9 of the April edition, there's an article on an OTDR cable tester. Now, a long time ago, (RMIT, 1964 would you believe), I learnt about Time Domain Reflectometry, which uses a technique to find out how far down a coax line you'd have to go, to find an open or short circuit.

For the last 30 years this magazine has presented articles on TDR and shown products from companies making TD reflectometers, and I was rather amused with the comment.

Observation: an ...Optical... Time Domain Reflectometer.

I'm hoping it was a tongue-in-cheek comment, because if it's for real, then it's an insult to Anritsu. The times have well and truly changed if a technical magazine editor can't recognise the products he should know about, or is too lazy to research his own magazine!!!

'Argusy' (via email)

Usage and abuseage

Forum contributor Bryan de Pree should exercise caution in correcting the usage of the English language by others. They are likely to find another reader who will turn the tables on them.

He writes "... although the THEY's and the loose HE's and SHE's have to be hand done." I stand to be corrected in turn, but does Mr de Pree not mean THEYs, HEs and SHEs — i.e. the plural case rather then the possessive?

Peter van Schaik (via email)

A bouquet...

Well done, Graham on the new format of the magazine. I've been a reader since the 60's, a subscriber for the last 10 years or so and an occasional contributor.

I particularly like the new Generator section with the projects and technical articles grouped together.

Keith Gooley (via email)

...and a brickbat

After reading some of the readers letters in the last issue of Electronics Australia, I can't help but agree with the negative comments made re the 'new layout'.

Letters published in this column express the opinions of the correspondents concerned, and do not necessarily reflect the opinions or policies of the staff or publisher of Electronics Australia. We welcome contributions to this column, but reserve the right to edit letters which are very long or potentially defamatory.

All contributions to EA will be considered for publication in this column.

A remarkable man

I have been a very long time reader of your magazine (have a copy of Wireless Weekly Edition 2 from September 1922 in my collection). The other day I was going through some of my old copies looking for a circuit and I came across an article in December 1997 (page 88) on the passing of your short wave listening columnist the late Arthur Cushen.

I read the article and noted that Arthur had been sending in reports on Shortwave listening to you magazine for some 45 years.

About half an hour later, I picked up a bit tatted copy of Radio and Hobbies for February 1941 and on page 68 under Short Wave Reports was the following little gem:

Mr.A.T.Cushen (Invercargill, N.Z.). Your various letters and card arrived o.k. and pleased to hear reception is so good in your district. The Spanish speaking stations are now very weak in most districts in Australia... etc. etc.

After doing a quick mental calculation I worked out that Mr. Cushen had been sending you short wave reports for about 56 years, not the 45 years that had been quoted in your December 1997 edition. A truly remarkable man.

I also would like to thank you and past editors John Moyle, Neville Williams and Jim Rowe for a lifetime of reading and knowledge.

Michael Harley (via email)

While I can appreciate the difficulty in attempting to appeal to the widest possible readership, I think you need to keep in mind the historical reader base that has kept this magazine in circulation for so long. (i.e. doers/ builders/repairers rather than buyers, like the bumper sticker seen on some well presented customised cars; 'Built not bought')

While the latest and greatest (and horrendously priced) audio gear may appeal to some, others of us in the real world are still interested in picking up the iron and building gear. What percentage of your readers are in the position of spending $5000 on a single piece of audio gear? Certainly not this little black duck. (I have just spent a little over half this amount on a new (new to me anyway) family sedan.

Given your editorial in this month's issue, with which I totally agree, I don't understand the perceived direction the magazine is taking.

Anyhow, good luck with your precarious balancing act of trying to be some things to all rather than a good thing to a few. (I certainly don't have the answers, and wouldn't like to be in your shoes)

Alan Whitmore (via email)

Thumbs up

I am writing to express my approval of the new format of Electronics Australia. I think that the presentation is very professional and I particularly like the white paper that the constructional articles are printed on.

As a youth I began buying the magazine, (Radio and Hobbies) and I am very impressed with the way this magazine kept pace over the years, with the incredible changes in technology that have occurred. Always interesting and informative, and the constructional items were always stimulating to build.

Now that so many electronic devices are made by machine and contain so many microcircuits, one could be forgiven for thinking that the practical 'hands on' aspect of electronics has gone, but I think that new technology has expanded the possibilities for interesting constructional projects and I believe that EA is going in the right direction.

I remember some articles written by Calvin Walters that appeared in Radio and Hobbies. These were general science items and were most informative. Thank you for a great magazine.

Lionel Doolan, Newcastle, NSW

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You have PocketMail

The idea of instant access to your email any time, anywhere, is very appealing. This handheld 'email machine' gives you just that, however it is reasonably expensive to run, considering it doesn't do much else. Graham Cattley had a look at this new concept device, and came away slightly less than enthused...

"EMAIL ME" is a common enough phrase these days, with electronic mail providing a fast, efficient and cheap way of communicating anything from jokes to spreadsheets. If you don't want to be tied to your desktop computer to send and receive it though, you could well be interested in the PocketMail.

It's a small personal email device, looking not unlike a personal organiser with its 40 x 8 character LCD screen and miniature keyboard. Its only purpose in life is to send and receive email, and so all the software is burned into its internal ROM. This means that there's no way to install new software, and thus no chance of the device performing other tasks, such as scheduling or managing contact lists, and you don't get things like a diary or calendar. There's not even a calculator, just email. But because it is so specialised, the PocketMail is pretty good at what it does - it is easy to drive, with a number of quick buttons that take you directly to your Inbox, Outbox, Address book or the Compose screen.

Back to the Stone Age

Of course, once you've composed your message, you have to send it, and that's where some pretty basic communications technology comes in to play. You might expect to find a telephone jack somewhere on the device, to connect it to the phone line. Instead, you'll find something that I have never actually seen used before: an acoustic modem.

Yes, it's old-fashioned technology, but it makes sense if you think about it. Because the emails you are going to send and receive are going to be small - around 1K or so - a less-than-optimum connection is perfectly acceptable, and you can do away with the cables, plugs and adapters you would otherwise need. More importantly though, an acoustic link means that you can use the PocketMail with practically any mobile or public phone, which gives you truly portable email. To use it, you simply dial the 1300 number, hold the phone up to the flip-up acoustic coupler integrated into the back of the PocketMail and press the large silver button on the lid of the unit.

Sending and receiving mail isn't the quietest of operations, but after around 10-30 seconds of beeps and squawks the mail is transferred, and you can open up the case and read any new messages on the display.

Some limitations

Smooth, effortless and simple, PocketMail gives you a completely non-technical approach to email, however there are a couple of disadvantages.

First and foremost is the fact that you can't access

SUMMARY

■ A personal email device that acoustically links to just about any phone, giving you email on the run.

KEY FEATURES

■ Connects to any phone
■ Compose, send and receive emails anywhere in Australia
■ 'Too easy' to use — no technical knowledge needed

RRP

$149, plus $19.95/month

AVAILABLE

■ Call freecall 1800 625 296 for your nearest retailer. www.pocketmail.com.au



IF YOU DON'T HAVE WEB ACCESS, AND DO NEED EMAIL ON THE RUN,



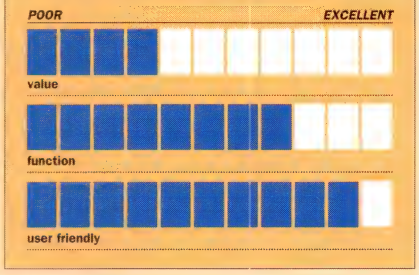
any email account other than the one supplied by PocketMail. So, there's no reading your work email while on the road, or logging on to your existing account with another ISP. You could perhaps set up an auto-redirection on your normal email service to re-send mail to PocketMail, however any replies you made using the device would have a return address of the PocketMail account, which is messy and complicated to all involved.

So really, PocketMail is designed to be entirely contained within the device, with the occasional visit to the PocketMail website (on your desktop machine) to pick up any attachments that people may have sent you. And at the rate of $19.95 a month for an email only account, PocketMail is a rather expensive way to keep in touch, especially when you factor in the $199 pricetag. Still, if you don't have an existing account, don't need web access, and do need email on the run, then PocketMail is just the ticket.

If they gave you the option of logging on to your existing email account and halved the monthly fee, everyone here at EA would go out and buy one at the drop of a hat. As it stands, PocketMail is a great concept that is hobbled by very limited options, a high up-front cost, and painful monthly fees. ■

THEN POCKETMAIL IS JUST THE TICKET.

PERFORMANCE: POCKETMAIL PM-32



PROS

- Easy to use
- Local call from anywhere in Australia
- No need for a desktop computer
- Good battery life
- Cheaper than a Nokia 9110...

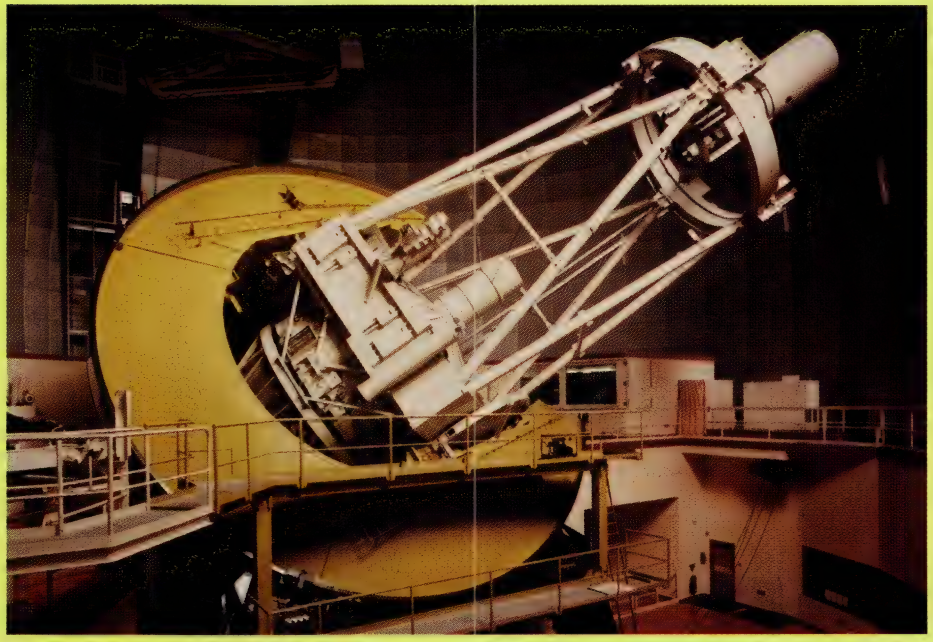
CONS

- Expensive up-front cost
- Steep monthly rate for email only account
- Can only access PocketMail accounts

TAKING A WIDER VIEW

By using newly-developed 8096 x 8096 pixel CCD detector systems, astronomers at Australia's Mount Stromlo and Siding Springs Observatories will soon be able to gather huge amounts of data in each observation run. They are in for a busy time, and it's all thanks to Australia's part in the global Wide Field Imager (WFI) project. By Geoff McNamara





AUSTRALIAN ASTRONOMERS are among the first in the world to herald in a new era of wide field imaging. At Siding Spring Observatory in northern New South Wales, two telescopes are being prepared to take delivery of a large format CCD array consisting of a total of 64 million pixels. Impressive as this number is, the real power of the array — known as a Wide Field Imager, or WFI — is in it's field of view: it can image portions of the sky a half degree across. This is the equivalent of the size of the full Moon, and as such represents an enormous advance in astronomical imaging.

Most people assume telescopic power is equivalent to magnification: the smaller details or objects a telescope can 'see', the better. But this is only one dimension to a telescope's capabilities, and despite satisfying the need for astronomers to see finer detail in astronomical objects, higher magnification carries a major drawback: a narrower field of view. This in turn limits the number and size of objects that can be seen in any one observing run. With astronomical observatories around the world already heavily oversubscribed, this is a major disadvantage. To produce an image of a large celestial object, or of lots of smaller ones, astronomers are forced to create mosaics of smaller images, a time-consuming and expensive process.

Australian astronomers have long been at the forefront of increasing the field of view of their telescopes: the 64 meter Parkes radio telescope has been fitted with a multibeam facility which has a one degree field of view, while the 3.9 metre Anglo-Australian Telescope has an unprecedented (for a four-metre class telescope) two degree field of view through the instrument called 2dF (see *Electronics Australia* September 1996 and September 1995 respectively). In the near future the United Kingdom Schmidt Telescope, also at Siding Spring, is to receive a device that makes use of its six degree field of view (appropriately called 6dF).

While the Parkes telescope is satisfying the wide field imaging needs in the radio band, in the optical there is still work to be done. While 2dF and 6dF have extraordinary fields of view, they were designed to collect the light from many individual sources and channel them via optical fibres to waiting instruments. Analysis of the

Above: The 3.9m AAT. Photograph by David Malin.
Left: Mare Humorum: ESR PR photograph.



light reveals physical details such as velocity, composition and temperature of the individual objects.

However these instruments do not create images of extended objects, and yet clearly there is a need for such wide field imaging. Anything that is faint and extends over a large part of the sky is an appropriate target. Images, as opposed to spectroscopic data, reveal the morphology of, and interaction between, individual objects. Such objects include low surface brightness galaxies and gravitational lenses, which can only be successfully discovered if they can be seen in their entirety. In addition, there are classes of objects that are faint, but could be anywhere in the sky, and astronomers have known for a long time that if there are fewer fish in the sea you need to use a bigger net.

Take distant solar system objects, for example. These bodies that hover on the edges of being minor planets and comets are faint, but could be anywhere in the sky. Unlike comets, which can be discovered by less advanced techniques when they brighten as they come close to the Sun, these celestial vagabonds skulk at the edges of the solar system, and at the edges of visibility. In that sense, the instruments mentioned earlier and wide field imaging have a common purpose: surveying. That is, they have been built to gather preliminary information on large numbers of objects to identify those that are worthy of further study using larger telescopes that can see fainter and finer detail, but have correspondingly narrow fields of view.

This page: *Star Forming Region RCW 108 in ARA, captured by the Wide Field Imager (8k x 8k CCD) on the European Southern Observatory (ESR) MPG 2.2m Telescope at La Silla. ESR PR image.*
Opposite page: *An observer adjusting the guide system on the UK Schmidt telescope at the Anglo Australian Observatory. Photograph by David Malin kindly supplied by AAO.*

Surveying with big chips

It is no surprise then that large CCD arrays are such an exciting development. The device to be mounted on telescopes at Siding Spring Observatory is known as WFI (pronounced "wiffee") and is being built jointly by the Research Centre for Astronomy and Astrophysics (formerly Mount Stromlo and Siding Spring Observatory and the Anglo-Australian Observatory (AAO). WFI and instruments like it have been made possible thanks to the tremendous advances in CCD technology in recent years. One of the major factors has been the increase in size of individual chips. Ten years ago the best you could get was a 1000 pixel chip. Then 2000 pixels became available. Nowadays 4000 pixel chips are routine, and 9000 pixel chips are possible. This may be reaching a limit, however, since there are restrictions on the size of the silicon wafers that can be made.

Now, these chips are large; but in astronomy size is, if not every-



thing, then awfully important. In astronomical terms even 2000 x 4000 (2K x 4K) chips are tiny, capable of imaging single celestial objects of limited size. Optical telescopes have fields of view that stretch many degrees across the sky. At the business end of the telescope, the images produced can be up to 300mm across. Until now, the only solution was for astronomers to use photographic film as the recording medium. In comparison with CCDs, however, film — or more specifically, the photographic plate — is a messy and inefficient recording medium. Whereas film records about three percent of the photons that strike, CCDs have a photon efficiency of more than 90%.

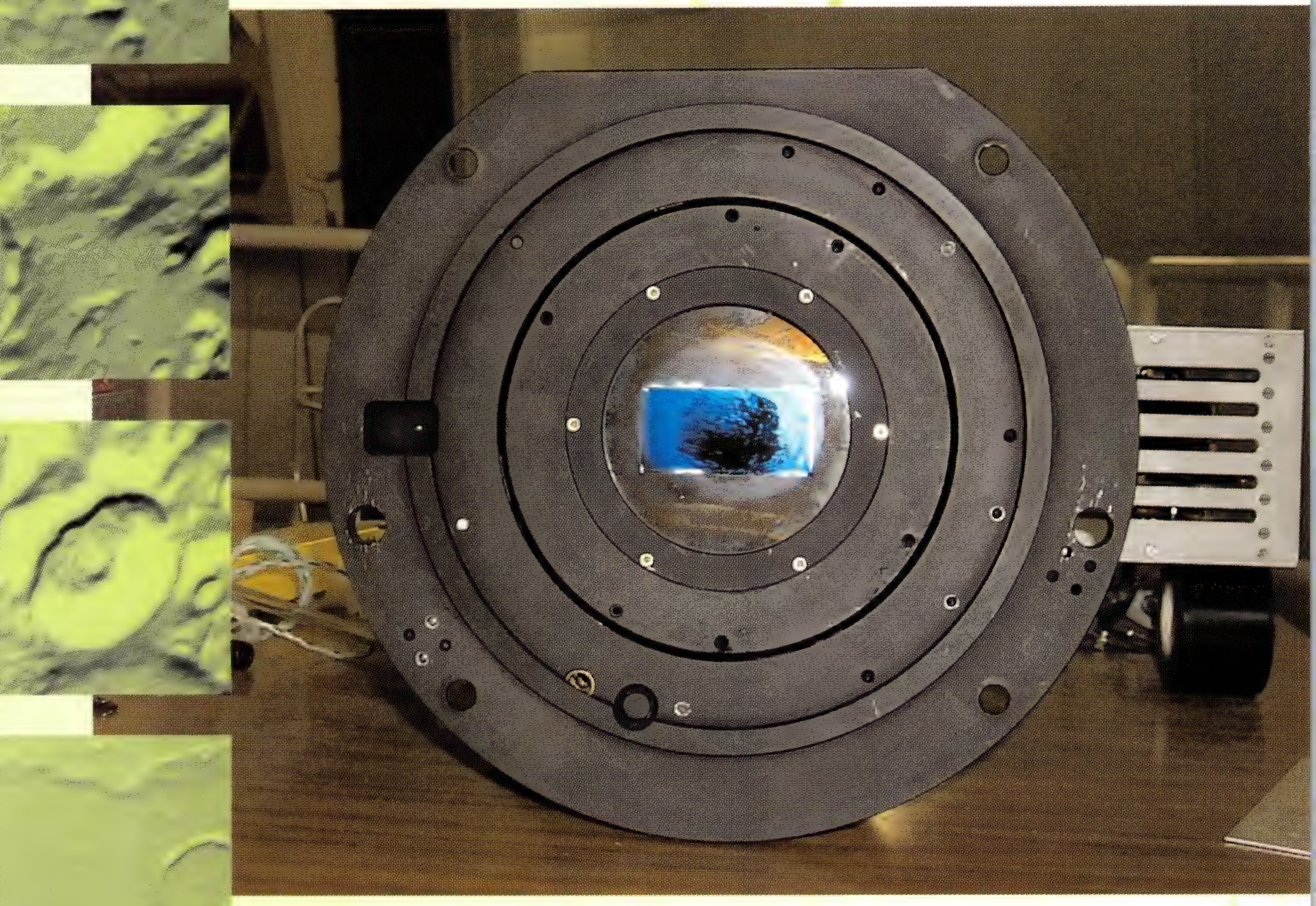
Ironically, the size of the array creates its own limiting factor: the time it takes to read out the CCD increases with size. Since the shutter on the CCD has to be closed before the data can be read, if CCDs go beyond a certain size, you end up spending most of your time reading the data rather than collecting photons. To read the CCD out with very small noise means very good analog-to-digital conversion, over a large range (16-bits). This takes time — in the order of 10 to 100 microseconds — and microseconds add up when you have to digitise millions of pixels!

But arrays like WFI have other advantages that more than compensate, such as a wide wavelength sensitivity range. The quantum (in)efficiency of photographic film is exacerbated by the fact that the peak spectral sensitivity is small, even with the most advanced film types. CCDs on the other hand have much wider peak responses, and can be manufactured for specific spectral ranges. The AAO/RSAA array, for example, has been optimised for 5000 Angstroms up to one micrometre deep in the infrared.

But so far the limited size of individual CCD chips has remained the biggest problem: where as photographic plates can be up to 300mm on a side, CCD chips remain not much bigger than a postage stamp. For example, the 2K x 4K CCD is 30mm x 60mm. To get around this problem, chips have to be combined into arrays, capable of creating a single, wide field image. While the largest arrays are still small compared with photographic plates — the AAO/RSAA array is 12cm x 12cm — they are still an amazing advance, and the increase in size is likely to catch up within the foreseeable future. At this stage the trade-off between size and efficiency has swung in favour of the CCD arrays.

Aligning the chips to make an array is no easy task, however. The 2K x 4K chips used in WFI have readout access on one end only, so they're long, thin and edge buttable on three sides. Since the individual pixels are 15 micrometers in size, they have to be flat and aligned to within 10 micrometres if they are to produce an image. The AAO/Stromlo array is being made by GL Scientific in Hawaii, one of the few companies in the world that have worked out how to align such chips.

Of course, actually paying for such chips and then turning them into arrays costs a lot of money. A single chip might cost $100,000, so to get a number of them becomes prohibitive for any one obser-



vatory. To get around this problem, a consortium of observatories — including the University of Hawaii, Canada-France-Hawaii Telescope, European Southern Observatory, Lick Observatory, and of course the AAO/RSAA partnership — banded together and approached Lincoln Laboratories in the United states to produce the chips en mass. Lincoln Laboratories is connected to Massachusetts Institute of Technology, but independently funded by the US government. A few trial foundry runs produced individual chips, some of which have been used on the AAT for about 18 months. It's taken longer to come up with 8 chips.

Meanwhile preparations are well underway at the AAO for the anticipated array. A problem for many astronomical detectors is heat, which creates signal noise, and CCDs are no different. To overcome this, the AAO/RSAA array will be mounted in a specially made dewar — a giant evacuated thermos flask with a fused quartz window on the front — that keeps the array at a nominal 150K. Two copper braids suck heat from the focal plain where the CCD chips lie into a liquid nitrogen filled flask. Left on their own, the copper braids would drop the temperature down to 77K, which is below the nominal temperature of 150K. However, heat comes in through the dewar window (which looks down at the telescope mirror), heating the array to near 140K. A series of tiny heaters allows fine adjustment to 150K, within a tenth of a degree.

The dewar and the enclosed array will be mounted in a new top 'end' for the AAT. This chunky piece of engineering rides at the front end of the telescope and is intended to support a variety of instruments. Its predecessor was designed specifically with photographic work in mind. Astronomers would perch themselves on a rather uncomfortable seat within the top end, riding the telescope across the sky as the plates did their work. All this will change with the introduction of WFI: astronomers will be able to conduct their business from within the relative comfort of the telescope's control room.

This page: *The MITLL3 2k x 4k CCD detector used in the Anglo Australian Telescope (AAT) for the WFI project - it's only one eighth of the area used to gather images. Photograph courtesy of AAO.*
Opposite page: *It's not an optical telescope as used in the WFI project, but Australia's Parkes Radio Telescope still plays an important part in worldwide observations. Photo by Rick Twardy.*

Data overload

Of course such an efficient device as WFI will produce huge amounts of data. WFI will produce roughly 120Mb every time the shutter is closed. And that's just the raw data in 2-byte integers; this has to be converted into 4-byte real numbers, which doubles the size of the file. Every image is 256Mb; a typical night's observing would produce 10Gb of data. So, data processing overheads do get large. Most of the operations you want to perform to process the data are very straight forward, so disk size and disk I/O is the limiting factor.



To cope with this the AAO/RSAA partnership has had to buy larger computers and disk arrays. Data is channelled to computers via dedicated ethernet links. A lot of effort has gone into streamlining the data processing since you only want to be held up by the speed with which you can collect the data, not by how long it takes to process it. At the close of the shutter, a dedicated piece of hardware (the 'CCD Controller') shuffles the acquired image out of the eight CCDs in parallel, digitising the voltage recorded by each pixel in about 5 microseconds, and buffering it via a dedicated ethernet LAN to a data acquisition computer for storage. Once the last pixel has left the CCD (well before the data has been transferred to the acquisition computer) the CCD and its Controller is ready to roll again. The total time from close of shutter, to open of shutter for the next exposure will be 60 seconds.

WFI will be used on two telescopes on Siding Spring: the 4-metre Anglo-Australian Telescope, and the 1-metre telescope operated by the RSAA. Wide field imaging is particularly suited to the AAT for a couple of reasons: one is that the telescope itself has an unusually wide field of view — a degree across in fact — so that it is suited to wide field work. Secondly, because the telescope is mounted at one of the darkest sites in the world. Put these two factors together and the AAT is ideal for wide and deep surveys of the sky, something not many telescopes in its class can accomplish.

So why not just keep the imager on the larger telescope? There are two reasons. Firstly, WFI isn't the only instrument that's used on the AAT. The telescope has a whole suite of instruments (including 2dF) that have specific roles to play. And there is a long queue of astronomers lined up to have their turn at the telescope. Sooner or later, WFI will have to make way for other instruments. But rather than leave WFI sitting in a closet when not in use, astronomers intend putting it to good use on the smaller 1-metre telescope.

Using the instrument on a smaller telescope isn't simply a way of keeping it busy, either. The fact is that since smaller telescopes are in less demand, the partnership of a wide field imager and a telescope with lots of free time means very large scale surveys can be completed. Such surveys may not be as deep as those possible with the AAT, but they are much larger, perhaps ten times as large.

The advance in the sensitivity of CCDs is more than a time-saving factor that translates into economy. It means that after decades of domination by photography for wide field imaging, CCDs have finally come into their own. For a long time their reduced size has been the limiting factor. But now the trade-off between size and quantum efficiency has turned the tide in their favour. Of course what this means is more science coming out of observatories like the one at Siding Spring: more discoveries, more problems, eventually leading to a greater understanding of the universe we live in. ■

BIOGRAPHICAL NOTE: Geoff McNamara is a Technology writer and teacher based in Sydney. He thanks Chris Tinney from the Anglo-Australian Observatory for his help in preparing this story.



Meet the Juke

We've had three, five and six-disc CD changers for quite a while, and even one holding 100. Now Pioneer has produced one that holds a whopping 300 discs — plus one more, for casual play. But what's the point? That's exactly what our reviewer **Jim Rowe** wondered, until he tried it out...

***It's big**, and black, and it stores and plays your entire CD collection. Pioneer's 301 disc player will do away with those oh-so-trendy CD racks – unless you use them to hold the 300 left-over CD cover notes instead, that is...*

I WAS A BIT LUKEWARM at first about the idea of a 300-disc CD changer, I have to confess. It seemed a bit like one of those ideas that design engineers turn into a product simply because they *can*, rather than because it's something that the end user will really find worthwhile. Even when I unpacked the Pioneer PD-F1007 from its box, my first reaction was that it looked like a normal CD player on steroids — or a throwback to one of those Wurlitzer jukeboxes you see in old 1950s-era movies.

But then I started to try it out, and as I did my attitude to the beast soon became more and more positive.

Sure, it may not be the most beautiful CD player you've ever seen. In fact it's a big black block of a thing, at least as big as two normal CD players stacked (420 x 433 x 193mm). But let's face it: as well as a CD player, that box holds a library of up to *three hundred* discs as well. How attractive would those 300 discs otherwise look on a bunch of standard CD racks — and how much space would they all take up, *along with* your normal player?

That's really what the PD-F1007 offers. It's not just a CD changer, but a 300-disc CD storage library as well. Or if you prefer, it's a 300-disc storage library with a built-in CD player. And because the two are integrated together in the one box, there are quite a few advantages.

For a start, you can call up and play any disc in the library, and then any track on it, just by pressing a few keys on the remote. There's no getting up out of your chair, searching for the disc you want to hear and then

HARMONIC DISTORTION IN THIS PART OF THE SPECTRUM IS UNLIKELY TO BE AUDIBLE ANYWAY, EXCEPT PERHAPS TO YOUR DOG.

loading it into the player. They're all there, and any one can be playing in a few seconds. Pretty convenient, as I soon discovered!

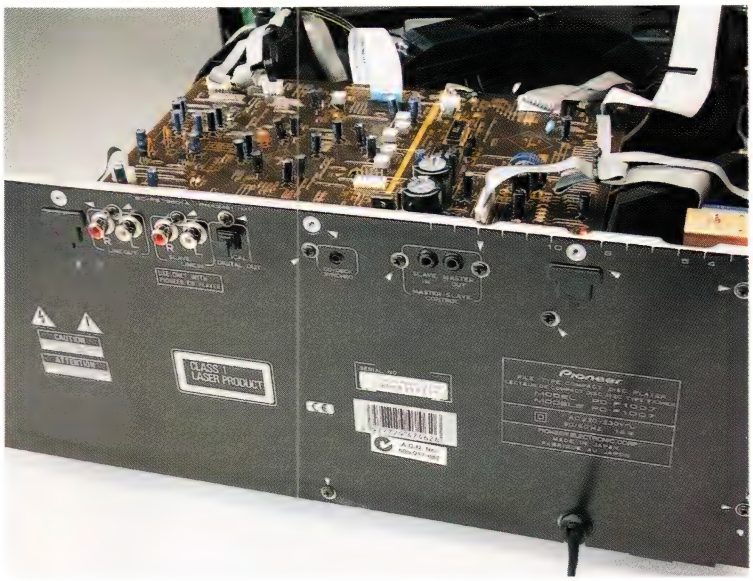
Because the discs are all stored inside the box, they're also protected from dust, scratches, beer/coffee/wine spills and any of the other usual causes of damage. They're all stored in the preferred vertical direction too, to minimise the risk of warping. So one way and another, they're actually likely to last a lot longer inside the PD-F1007 than they would 'outside'.

You aren't just limited to playing the discs stored in the player's library, either. Even when it contains the full complement of 300 discs, the carousel has a special slot that's reserved for 'single play' use. So there's no problem playing a disc that one of your guests brings along — or one you want to try out before buying.

But how easy is it to load in all those discs, and then find any particular one when you want to play it? Well, as you can see from the photos, the player has a curved front window of translucent plastic instead of the usual tray. This slides away inside to the right when you press the 'Unload' button on the front panel, revealing the front of the library carousel. The discs are simply rolled vertically into the slots on the carousel, one at a time and with their label side facing to the right.

It's a tad fiddly, but after all you'd normally only have to load each disc in once. The slots are numbered and the player moves the carousel around to make each one available, by turning the rotary 'jog dial' control at upper right. When they're all in you press the Open/Close button to shut the window again.

To make it easier to remember which disc is which, the player allows you to feed in and store an 'electronic label' or title for each one. Each title can consist of either one or two lines of 12 characters, and you have three options for feeding them in: using the jog dial, using the keys on the remote control, or best of all by borrowing the keyboard (PS/2 type) from your personal computer, and simply plugging it into the socket next to the headphone socket, down at the lower right of the front panel. (Once the titles are all fed in, you can simply unplug the keyboard and return it to the PC.)



With the titles all in memory, finding a disc is purely a matter of turning the jog dial or pressing the Disc +/- buttons on the remote, until its title appears on the top of the player's fluorescent display. Pressing the 'Disc Set' button on the remote then loads *that* disc onto the player's spindle, and it will begin playing...

So it's all pretty easy. And playing a 'casual' disc is just as easy; you just press the 'Single Loader Access' button, and the player slides open its window with the casual play slot to the front. You to slip in the disc, press the adjacent Play button and away it goes.

Other features of the PD-F1007 include the ability to connect two of them in tandem, so that they effectively form an integrated 602-disc system (for those with more than 300 discs!); the ability to display titles from discs with the 'CD Text' feature, as well as those you key in yourself; five programmed-play modes, including All (where it plays onward from your selected disc, until it runs out of discs), Single, Custom (where you can create and store 10 different programs, to play selected discs in any desired order), Program (where you set up and play a single program of up to 36 disc/track steps) and Random (where it plays discs and tracks at random); and the ability to scan through the tracks of any disc, by playing the first 10 seconds of each ('Hi-Lite').

On the technical side, the PD-F1007 uses Pioneer's Legato Link conversion/filtering technology to deliver high quality sound. It also offers an S/P-DIF optical bitstream output at the back, for feeding the digital audio directly to an external D/A converter or digital AV amplifier if you prefer (although found on many DVD players, this is a feature not found on all that many CD players). There's also a CD-Deck



SUMMARY

■ A carousel-type CD player with a storage capacity of 300 discs, plus one non-stored disc.

PROS

■ Well above average player performance, combined with high disc capacity;
■ easy to set up and use;
■ allows you to save electronic 'labels' for all discs;
■ optical S/P-DIF output.

CONS

■ Inserting & removing discs a bit fiddly, especially for single play;
■ CD-R compatibility unclear.

RRP

■ $999.

AVAILABLE

■ Pioneer AV dealers, or contact Pioneer Electronics Australia, 178-184 Boundary Road, Braeside 3195. Phone 1800 060 852.



Synchro jack, to simplify dubbing to a cassette deck, and a pair of sockets for Master/Slave control (when you're using two of the players together).

In short, this is by no means just a 300-disc CD library with a cheap player thrown in. The player itself is certainly well above average in terms of features and facilities.

Performance check

But how does it actually perform? That's what I was interested to find out.

First I tried loading it with a dozen or so discs, including my technical test discs. I did find the loading a bit fiddly at first, balancing each disc vertically in my hand and trying not to touch the track area, as I offered it up to the carousel slot and nudged it in. (There are no slot guides at the top; only at the bottom.) But after I'd done the first three or four, it became fairly easy.

Once the discs were all loaded, I next used the test discs to check its performance. And the results were really quite impressive...

The measured frequency response easily met the specification of 20Hz - 20kHz, being virtually ruler flat within 0.1dB from 20Hz to 12kHz and then rolling off very slowly to reach -2.3dB at 20kHz. At the bottom end it was still only 1dB down at 6Hz, so there's no shortage of bass.

The channel balance proved to be within 0.05dB at all frequences I measured, which is very good indeed. And the channel crosstalk measured at just over -96dB, which is also very good.

The fade-to-noise tracks showed the player's D/A conversion is very linear down to the -90dB level, and I measured the dynamic range at just on 100dB, with a signal to noise ratio of about 105dB. These figures put the PD-F1007 into the 'well above average' class, of course.

The THD (total harmonic distortion) figures weren't quite as good, though. They were well below the 0.01% mark up to about 5kHz, but then slowly rose at higher frequencies to reach a few percent at 19kHz. This may be a characteristic of the Legato Link system, and I suspect that the figures may represent aliasing components rather than true distortion. In any case, harmonic distortion in this part of the spectrum is unlikely to be audible anyway, except perhaps to your dog.

On the other hand when I checked the PD-F1007 on the squarewave and impulse tracks, the results were very impressive indeed. The waveforms were very clean indeed, with symmetrical ringing of only a few percent — much lower than from all except the very top grade of CD and DVD players.

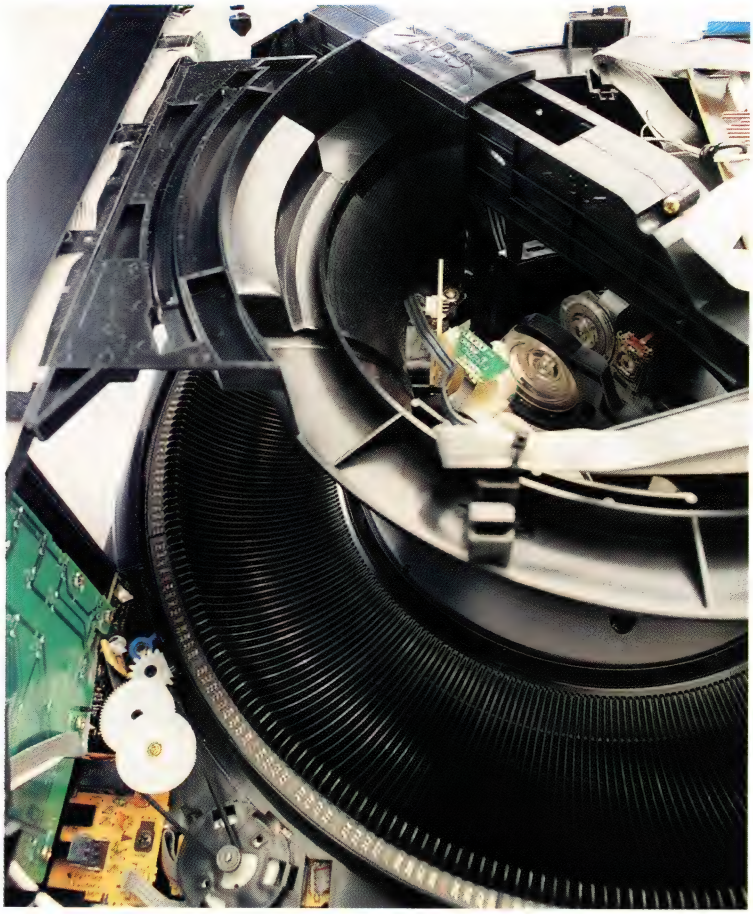
During the checks with the test discs I did discover one small quirk about the PD-F1007, though: it doesn't seem too happy about playing CD-R discs. While I was checking the low bass response with my computer-generated CD-R test disc, the player mechanism developed a strange mechanical 'whistle'. There's nothing in the player's manual or specs to suggest that it's not compatible with CD-Rs, but further checks suggested that it doesn't really like them.

After these technical checks I hooked up the player to my stereo system and listened to a variety of familiar tracks from the various reference music discs I'd already loaded in, to see if its aural performance matched the measurements. And it certainly did: the overall sound was very clean and well balanced, with good stereo imaging and nice warm bass.

So what's the final verdict?

Well, the Pioneer PD-F1007 is clearly quite a surprise package, and a very pleasant surprise at that. That 300-disc library carousel built into its big fat case makes a lot of sense, and is much more convenient to use than I expected. And the player itself is of a standard well above what you might think would be built into any kind of changer; in fact it delivers a performance very close to that of many 'audiophile' players costing thousands of dollars. Which is all pretty good, considering that the RRP of the player is actually only $999. ■

THE PIONEER PD-F1007 IS CLEARLY QUITE A SURPRISE PACKAGE



***As you'd imagine**, most of the player is taken up with the transport mechanism for the 300 discs. Note that the discs simply rest in their slots – tip the fully loaded player upside-down, and you'll have a bit of a problem...*

MicroGram Computers

PCI Plug & Play Printer / Serial Cards



Available in either 1, or 2 port versions, these PCI bus PnP bi-directional parallel ports have an 32 byte FIFO buffer. Support is provided for DOS, Win 95 & NT. Also available, are single, dual, 4 & 8 port PCI PnP serial cards.

Cat. 2618	1 Port Printer PCI	$79
Cat. 2687	1 Port Printer ECP/EPP/SPP PCI	$83
Cat. 2619	2 Port Printer PCI	$119
Cat. 2688	2 Port Printer ECP/EPP/SPP PCI	$125
Cat. 2620	Serial/Parallel 2S/1P PCI	$119
Cat. 2616	1 Port RS232 16550 PCI	$69
Cat. 2617	2 Port RS232 16550 PCI	$99
Cat. 2674	4 Port RS232 16550 PCI	$439
Cat. 2678	8 Port RS232 16550 PCI	$669

USB Active Extension Cable



Extend the distance between your PC & USB peripherals with this 4.8m long cable which includes an active amplifer to boost the signal level. It operates in accordance with USB Specification Ver 1.1 at 12Mb/Sec. Up to 5 cables can connect in series for extensions to 24m.

Cat. 9115 USB Active Extension Cable $74

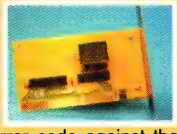
VGA Monitor Splitters



Splitter modules enable up to 8 monitors to simultaneousy share the information of a host computer. The ideal way of providing multiple displays in training rooms, airports, stock rooms, clubs, etc.

Cat. 3070	Two Output	$269
Cat. 3055	Four Output	$336
Cat. 3056	Eight Output	$574

Diagnostic Cards



Just plug into a vacant PCI slot and turn on the computer. A LED display shows a numeric error code indicating the area of the fault. By checking the error code against the appropriate BIOS listing, the type of fault can be identified. The errorcode messages for AMI BIOS, PHOENIX BIOS and AWARD BIOS are listed in the manual. An ISA card is also available.

Cat. 3422	Diagnostic Card - PCI	$89
Cat. 3128	Diagnostic Card - ISA	$69

Multi I/O ISA Card

A versatile interface card that supports 2 FDD, 2 HDD As well as 2 16550 compatible serial ports, 1 ECP/EPP printer port and 1 games port.

Cat. 2055 Multi I/O Card $50

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Our Point of Sale bundle includes a Citizen parallel printer (as required by Digitill & Attache) or a Citizen serial printer (required by QuickPOS), a cash drawer and our very popular CCD bar code scanner. The cash drawer (Cat 8897) connects to, and is triggered from the printer, while the CCD scanner (Cat 8196) connects between keyboard and computer.

Cat. 8903	Point-of-Sale GST Bundle - Digitill/Attache	$869
Cat. 8902	Point-of-Sale GST Bundle - QuickPOS	$869

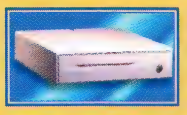
POS Customer Display



This POS customer display is driven from the serial port and has a vacuum fluorescent display with two lines of 20 characters. It is ergonomically designed with a 270 degree viewing angle. Choice of 11.25mm or 9mm high character display.

Cat. 8728	POS Customer Display (Pictured)	$379
Cat. 8907	POS Customer Display	$339

POS Cash Drawers & Citizen Printers



Compact Citizen docket printers are ideally suited to compliment these POS cash drawers which feature robust metal construction casing and a pearl white ABS fascia with a slip deposit slot. The bill tray has adjustable dividers for 4 or 5 compartments along with spring loaded bill clips. A separate coin tray has adjustable dividers for up to nine compartments. The printers feature 3 lines/sec, friction feed with 250 bytes input buffer, metal tear bar, 2 colour printing, paper end sensor & automatic paper load.

Cat. 8897	POS Cash Drawer -Epson/Star /Citizen	$195
Cat. 8898	POS Cash Drawer - RS232	$249
Cat. 5667	Citizen IDP460 Parallel Printer	$420
Cat. 5668	Citizen ISP460 Serial Printer	$420

Compact Keyboard

When desk space is at a premium an 80 key keyboard with full 101 key functionality will come in handy. It has dimensions of only 297(W) x 152(L) x 30(D) mm.

Cat. 8403 Compact 80 Key PS/2 $73

Omni-Directional Laser Scanner



An affordable, vertically mounted, Omni-Directional laser scanner, which is ideally suited to reading bar coded products at supermarket checkouts. Depth of field is 300mm.

Cat. 8521	Bar Code Laser Omni-Direct. KB Wedge	$1599
Cat. 8573	Bar Code Laser Omni-Direct. Serial	$1699

Magnetic Card Reader - KB Wedge



A bi-directional magnetic stripe reader for credit authorization terminals, POS terminals, PC's & banking terminals. Features easy keyboard wedge installation & requires no software modification, programming of I/O devices or additional power.

Cat. 8045	MCR - Track 2 KB Wedge	$349
Cat. 8681	MCR - Track 2 KB Wedge PS/2	$399
Cat. 8418	MCR - Track 2 Serial	$449
Cat. 8417	MCR - Track 1 & 2 KB Wedge	$439
Cat. 8203	MCR - Track 1 & 2 Serial	$449
Cat. 8218	MCR - Track 2 & 3 KB Wedge	$439

Infra Red Keyboard with Point Button



A handy compact sized 88 key keyboard with integral "mouse" pointing button. It is a cordless design using infra red technology. The receiver is fitted with a PS/2 Mini DIN connector.

Cat. 8750 88 Key IR Keyboard with Point Button $129

20 Key Programmable Keypad



Instant access to complex keyboard functions! This 20-key auxiliary keyboard makes it easy to save multiple keystrokes or complex commands to a single keystroke. Clear keycaps that are easy to remove allow you to create, apply and reapply custom legends. It can also be a standalone bootable keyboard for applications that do not need a regular keyboard.

Cat. 8904 20 Key Programmable Keypad $269

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Dolby Digital *sans* the Big Bucks



Now there IS a way to experience full Dolby Digital surround sound from your DVD player, without parting with even one arm or leg. The Kinyo D-560 Home Theatre sound system includes a Dolby Digital decoder and six-channel amp, plus five satellite speakers and a subwoofer — all for under $600! **by Jim Rowe**

NOW THAT A respectable number of movies have been released on DVDs here in Australia, there's understandably been a lot of renewed interest not only in home theatre technology but in surround sound as well. There's nothing quite like hearing the full impact of 5.1-channel Dolby Digital (formerly 'AC-3') surround sound from a blockbuster movie DVD, to make you realise just what you've been missing all these years...

The only real hurdle for most of us is the cost of upgrading to a 5.1-channel system. There's the Dolby Digital decoding, a five channel amplifier system, five main speakers and then ideally a powered subwoofer as well. It can all set you back thousands of dollars — even going for components that are fairly 'middle of the road'.



The speakers are quite compact, and do a pretty good job considering their small size.

Luckily, though, there's now an option that's much more affordable. It's the Kinyo D-560 Home Theatre Surround System, now available from Jaycar Electronics for the impressively low sum of only $599.

Perhaps surprisingly, for that modest outlay, it includes virtually everything you need to experience full Dolby Digital 5.1-channel sound: a fully licensed DD decoder plus six-channel amplifier, five satellite speakers and a compact subwoofer. There's even a credit-card sized remote control unit and all cables necessary to hook everything up. The decoder even provides an analog stereo input as well, with a 'fallback' Dolby Pro-Logic type decoder thrown in for decoding of matrixed surround software...

So what's the catch? How can they sell this kind of system for such a low price? Isn't there something missing? No, not really.

Basic Performance

Everything is there, it's just that the system has been carefully designed to deliver all of the basic performance that many viewers are likely to need, with no extra 'bells and whistles'. (It probably also helps that the system is manufactured in mainland China, where Jaycar's astute buyers discovered it.)

The complete system comes in a single compact carton measuring 420 x 380 x 340mm. When you open this up you find a small black ABS plastic case 180 x 132 x 62mm, which houses the decoder and control box; a black vinyl-covered wooden box 360 x 330 x 190mm, containing the power supply, power amplifiers and a 165mm subwoofer; five little satellite speaker boxes, again moulded in black ABS plastic and each measuring 130 x 90 x 85mm; and a very compact IR remote control, measuring only 85 x 45 x 8mm.

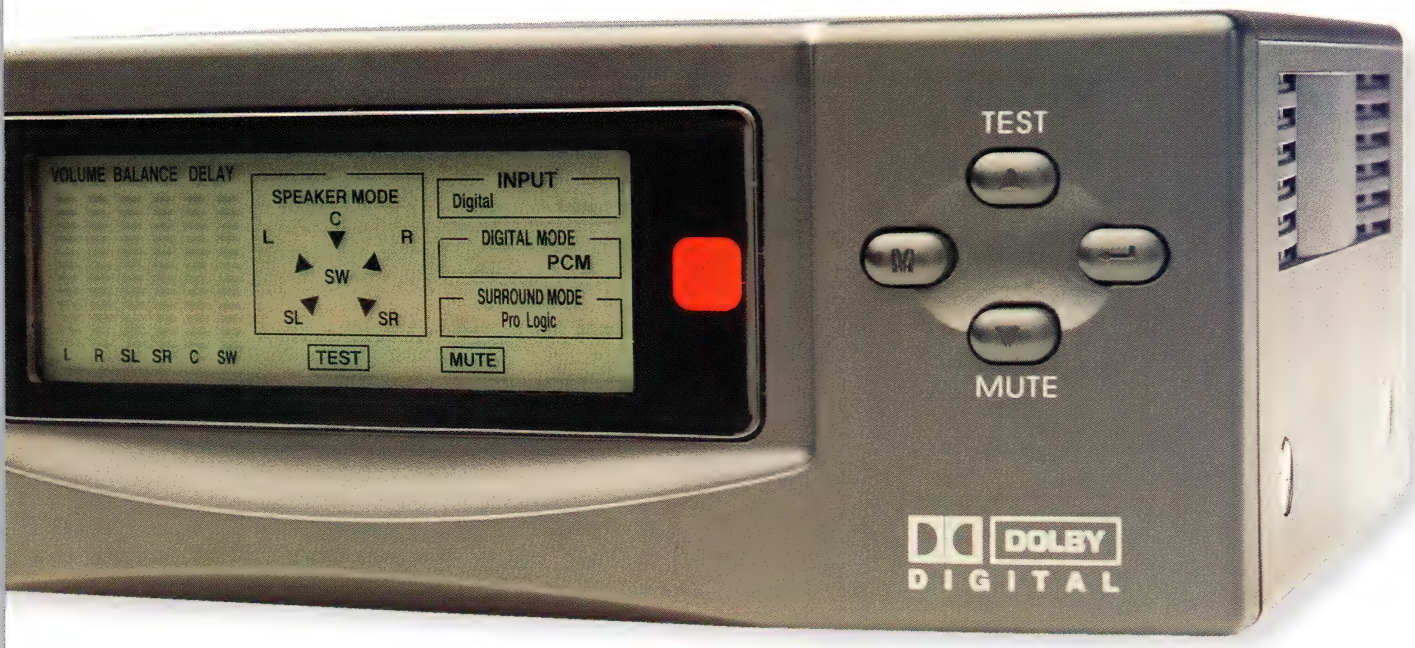
Each of the satellite speakers comes with its own connection lead and plug, colour-coded to match the corresponding sockets on the rear of the power amp box, and also with its own mounting stand/bracket. The system also comes with power and signal cables to interconnect the decoder box and power amp, and of course a user manual.

Of course for this kind of money, you shouldn't expect too much in terms of power output. The amplifier driving the subwoofer is rated at 40 watts RMS, while the five channels driving the 75mm satellite speakers are each rated at 5W RMS. You're unlikely to have the neighbours complaining about the deafening noise, but the 4-ohm speakers are quite sensitive and there's actually quite enough output to produce satisfying surround sound in a typical domestic viewing room.

Rated frequency response for the subwoofer channel is 40Hz to 120Hz, while the satellites are rated at 80Hz - 20kHz.

Functions and facilities

The decoder is provided with both optical and coaxial S/P-DIF bitstream inputs, for input from a DVD player or laserdisc AC-3 demodulator. There's also a pair of analog stereo inputs, as mentioned earlier. On the output side there's a 9-pin compact DIN connector for the cable taking the six decoded audio signals to the power



amp box, plus four 3.5mm sockets (two of them of the 'stereo' type) which provide alternative analog outputs for connection to other amplifiers. The remaining socket on the back panel is for the nominal 12V DC power input — which normally comes from the power amp box, although the decoder can alternatively be run from a standard 12V/1A plug pack if desired.

The front of the decoder is deceptively simple, with just five pushbuttons, one of which is a power on/off. The other four are in a small diamond array to the right of the compact LCD display panel — which only measures 70 x 25mm, but packs in a surprising amount of visual information. For example while the decoder is running it shows the signal levels in the various channels, like a graphic analyser, or the master volume setting when you adjust it; also shown is the active speaker configuration, the input mode (digital/analog), the digital signal mode (AC-3 or PCM) and the surround mode (AC-3/Pro-Logic/Stereo).

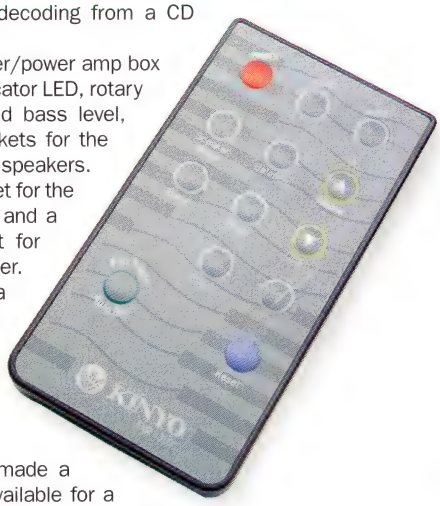
Although you can control much of the decoder's operation from the front panel, like many surround amplifiers it's actually easier to do so via the remote control. Here you have an array of 13 buttons, including handy Up and Down buttons for master volume control. While these have a total control range of only 20dB (10 steps of 2dB), this is quite sufficient for making the usual adjustments to overall volume. In any case there's also a Mute button on the remote, allowing you to totally silence the sound if necessary.

Other functions that are easily accessed via the remote's buttons are selection of input source, surround mode, speaker mode, bass emphasis on/off, channel balance and delay time. You can also activate a test signal which sequences through the speakers to check channel operation and connections, and finally you can enable or disable the automatic fallback from Dolby Digital to Dolby Pro-Logic decoding, when the source material isn't AC-3.

By the way the decoder will happily accept a PCM linear bitstream via the S/P-DIF digital inputs, so if you wish it will provide Pro-Logic decoding from a CD played via your DVD player.

On the back of the subwoofer/power amp box there's a power switch with indicator LED, rotary controls for master volume and bass level, and five colour-coded RCA sockets for the connections to the satellite speakers. There's also another 9-pin socket for the signal cable from the decoder, and a small concentric power socket for the 12V DC supply for the decoder.

And that's basically it — a very compact and unassuming little Dolby Digital/Pro-Logic system, designed for easy setup and use.



Testing, testing

Jaycar Electronics very kindly made a sample Kinyo D-560 system available for a few weeks, allowing me to check it out both with the instruments and in a typical home theatre setup.

First up, I checked the digital decoder performance using my usual test CDs. It gave a very creditable result, too. The frequency response measured flat within +0/-0.4dB between 20Hz and 20kHz, with the basic stereo channels balanced within 0.13dB. The response measured from the analog stereo inputs was even better, measuring within +0/-0.1dB from 20Hz to 20kHz and with the channels balanced within 0.1dB. (These measurements were with the subwoofer switched off, by the way — more about this shortly.)

The DAC linearity and noise performance was also very good, with excellent linearity down to -85dB and a signal to noise ratio of just over 93dB. Total harmonic distortion at a replay level of -10dB was less than 0.025% at all test frequencies below 19kHz, and only rose to 0.18% at 20kHz.

The transient response was also very good, with symmetrical ringing of only 4% or so on square waves

Top: *Although it looks huge here, the decoder is tiny - about the size of a clock radio.*

Above: *The 'small' theme is followed through with the credit card sized remote control.*



SUMMARY

■ A very compact, low cost 5.1-channel home theatre surround sound system offering both Dolby Digital (AC-3) and fallback Dolby Pro-Logic decoding, plus amplifiers and satellites-plus-subwoofer speakers.

PROS

■ Surprisingly good sound and surround field capability, despite the tiny speakers and modest power level
■ Remote control of master volume
■ Excellent value for money.

CONS

■ Setup a little fiddly, as you have to use the small LCD display as a guide
■ Only just enough system gain for some DVD sound tracks

RRP

■ $599

AVAILABLE

■ Jaycar Electronics stores, or order via either 1800 022 888 or on the company's website at www.jaycar.com.au

and 22% on the impulse track. This is very comparable with the performance of up-market CD and DVD players, and suggests that the designers haven't cut too many corners in the decoder's DAC and post-conversion filtering.

It wasn't too easy to measure some aspects of power amplifier performance, because of the 'integrated' nature of the system. For example measuring the output of the subwoofer amp wasn't feasible, because it's connected to the subwoofer inside the box and not made available externally.

I was able to check the satellite amp channels, because they are brought out. With two driven these proved to have an output of just on 5.5W before clipping became evident, which is comfortably better than the specs. The measured frequency response wasn't particularly flat, drooping to about -10dB at 80Hz and 20kHz, but the shape of the plot suggested that the amp performance has been carefully tailored to complement the behaviour of the satellite speakers themselves.

A further complication is that the response of the satellite channels is further rolled off at the low end when the 'Bass' button is used to enable the subwoofer. Presumably that's also part of the tailoring, with the emphasis on the final acoustic result rather than pretty measurements...

Checking the subwoofer channel using an SPL meter and by ear with an audio generator, I formed the same impression about *its* overall performance as well. The response seemed quite smooth from about 45Hz to 120Hz, falling away smoothly at each end; there's still useful output down to about 30Hz. Not bad at all, for what is essentially quite a small subwoofer driver and box volume...

Encouraged by the results so far, I set up the speakers in my home theatre room — with the satellites mainly sitting atop my usual speakers, and the subwoofer box alongside the 68cm TV I'm currently using. Then I tried it all out, with a selection of both tracks from my reference CDs, and various scenes from movie CDs with Dolby Digital tracks, selected to test the system's surround sound handling capability.

To be honest the system was a little more fiddly to set up than I expected, as there's no on-screen display system and some of the icons on the little LCD panel are a bit cryptic. The noise test signal for checking the speaker configuration is also a bit oddball in terms of channel sequencing, but it's all reasonably straightforward once you get the hang of it.

Convincing asteroids

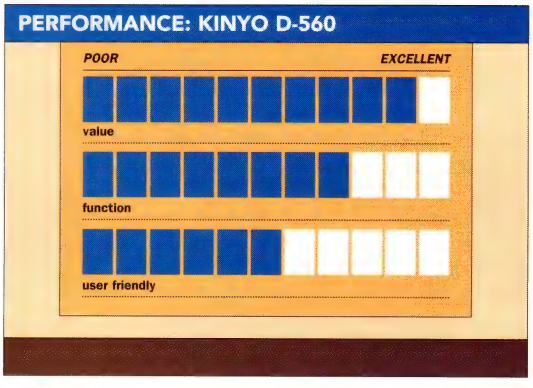
Frankly, the end results were surprisingly good. Despite its tiny satellite speakers and modest power output capability, the Kinyo system gave quite a convincing performance. In chapter 2 of the *Armageddon* DVD, where the asteroids are lobbing down on New York, they certainly whizzed past from the rear as they should; and in chapter 12 of *Dragonheart*, Draco's wing flaps and voice circled around the room very realistically.

It was much the same when I sampled typical explosion and 'atmosphere' scenes from *Terminator 2*, *Conair*, *Starship Troopers*, *Titanic* and *The Mask of Zorro*. The surround sound field created by the Kinyo system was on the whole very satisfying, with a good 'depth' and the kind of rich texture you normally wouldn't expect from such small speakers and modest power. In fact my son came in to see what I was checking, and was very surprised to learn that the sound he could hear was actually coming from 'those tiny little speakers'.

There was only just enough system gain to produce normal 'theatre' volume with some of the DVDs, and in my case there was an annoying interaction between the remote controls for the Kinyo system and my Kenwood KVF-5010 DVD player. The code from the Kenwood's 'Menu' key was clearly the same as that used to change the Kinyo's speaker mode, so whenever I called up a disc's menu I kept on disabling the Kinyo's centre and rear channels. Murphy's law strikes again...

Overall, though, I'm really very impressed with the Kinyo D-560 system. It may not be the most beautiful home theatre sound system ever released, nor the highest-fi, but it does a very creditable job of delivering Dolby Digital surround sound and at a genuine budget price. The fact that it also comes in a set of very compact boxes and is relatively easy to set up and use should be an extra plus for many people, too.

So if you're looking for Dolby Digital without the big boxes and even bigger bucks, this may well be the system for you. ■





Hitachi's CP-X940W

Compact and reasonably light in weight, the Hitachi CP-X940W projector is a mid-range model which uses three 0.9" LCD panels to deliver full XGA (1024 x 768) resolution with a rated light output of 1000 ANSI lumens. This plus low fan noise makes it very suitable for both computer-based presentations and home theatre work. **by Jim Rowe**

HITACHI MAY NOT perhaps be the first name that springs to mind when you think about data and video projectors. But in fact they produce quite a range of models, as you might expect from such a large and multi-faceted Japanese conglomerate. The model CP-X940W comes from about the middle of their range, as there are models with lower resolution and light output as well as a couple with nearly double its light output again.

This makes the CP-X940W a good median representative of the Hitachi range, and a credible representative it makes. While by no means the most compact projector we've seen, it's at the same time well down from the largest and heftiest. Overall dimensions are only 330 x 248 x 100mm, with a weight of 4.45kg.

The projector's optical system is based on three 0.9" (23mm) LCD panels, modulating the light from a 150W UHP halogen lamp. The LCD panels use polysilicon active-matrix TFT technology, with microlenses in front of the pixel cells to enhance optical efficiency. This coupled with a fairly fast (f/1.7 - 2.0) manual 1.29:1 zoom lens (38 - 49mm) results in a healthy 1000 ANSI lumens of light output — enough for giving very effective presentations in 'typical office' ambient light conditions.

Incidentally the optical axis is raked upward, as with many projectors, for convenient operation from relatively low desktops and tables. In this case it's raked at about 10°, so that the base of the picture sits at the same elevation as the centre of the projection lens. It's also corrected so there's no keystone distortion when the projector is on the level and the screen is vertical.

The native resolution of the LCD panels is 1024 x 768 pixels, for a total of 786,432 pixels in 24-bit colour — i.e., essentially 'XGA' format. However as the inbuilt microcontroller knows how to compress SXGA (1280 x 1024) image signals down to XGA, as well as how to expand VGA (640 x 480) and SVGA (800 x 600) signals up to the same format, this means that the projector is quite capable of handling virtually any current computer graphics format up to SXGA, in an automatic and transparent fashion. It also handles the main Mac formats too, by the way.

Computer graphics input is via a choice of two standard 15-pin high density sockets, labelled RGB1 and RGB2. There's also a further 15-pin HD socket which delivers buffered RGB output signals to drive a computer monitor, and finally a fourth such socket which can be used for both RS-232C serial control of the projector from the computer and/or control of the computer via the projector's remote control, acting as a mouse.

On the video side, the projector's XGA capability translates to more than enough resolution to cope with high-grade standard resolution video from DVD or laserdisc players, quite apart from video recorders and

SUMMARY

■ A compact LCD-based computer graphics and video projector.

KEY FEATURES

■ Full XGA (1024 x 768) resolution
■ 1000 ANSI lumens output
■ Compresses SXGA down to XGA, as well as expands VGA and SVGA signals up to fit screen

RRP

■ $12,950

AVAILABLE

■ Hitachi Australia, 13-15 Lyonpark Road, North Ryde 2113; phone 1800 032 689 or visit **www.hitachi.com.au**

broadcast TV signals. It should also be quite suitable for displaying digital SDTV images, when these begin soon. Needless to say the CP-X940W can cope not just with PAL video but also with NTSC, NTSC 4.43, Secam, M-PAL and N-PAL as well. In most cases it identifies the video format and automatically locks to it, again without intervention by the user.

There are two main video inputs, one an RCA socket accepting standard composite video and the other an S-video or Y/C input via the usual mini four-pin socket. Unlike a few of the latest projectors it doesn't provide component video (Y/Cr/Cb) inputs.

Sound system

As with most projectors the audio facilities are fairly basic, but quite adequate for sales presentation work. It has stereo RCA sockets for input of the audio associated with video, and also two stereo 3.5mm jacks for any audio associated with the computer graphics. The selected audio is fed to a pair of internal 1W amplifiers, which drive tiny speakers (size not specified, but about 30mm) mounted inside the upper rear corners of the case. In addition the active audio signals are fed out at 'line' level (200mV RMS, 1kΩ) for external use, via a third 3.5mm stereo jack.

All of the input and output connectors are along the right-hand side of the case.

Most of the projector's functions can be selected via a set of five control buttons on the top — the largest a tilting multifunction button used for menu callup and navigation. The others are for power on/off, input signal selection, sound muting and microcontroller reset.

Incidentally the CP-X940W warms up the lamp very gently when power is first applied, to extend lamp life. Like most of the latest projectors it also continues to run the cooling fans for a minute or two after the power is turned off, to ensure correct cooling down. There are two small cooling fans, one (the 'input' fan) at the front and to the left of the lens, and the other (the 'output' fan) at the rear of the left-hand side.

There's also an IR remote control, which can be used not only to control virtually all of the projector functions (including power on/off) but also as a computer mouse. And if that's not enough, it also includes a built-in red laser pointer as well, for presentation work.

The remote can also be used to access conveniently various 'often needed' functions that are somewhat harder to achieve otherwise. These include Picture Magnify (i.e., digital zoom), for use with computer graphics; Volume Up/Down; and Freeze, for securing a still image while you discuss it.

As well as the remote control, the CP-X940W comes with a good set of basic cables: a power cable, a three-conductor composite video and stereo audio cable, a 'VGA' computer graphics cable with 15-way HD connectors at each end, a Mac graphics adaptor with DIP switch, and three different mouse cables. There's also a lens cap and an A4 format Operating Guide, with sections for seven different European languages.

What we found

Hitachi's local office very kindly sent us a sample CP-X940W projector so that we could try one out for a couple of weeks. This allowed me to check it out with a video pattern generator and other instruments, as well as try it with a selection of video graphics modes from a computer, plus both composite and S-video from sources such as a DVD player (PAL, NTSC) and a laserdisc player (NTSC).

Hooked up to the pattern generator, the projector proved to throw up a good bright image with fairly even illumination — although the level was visibly down a little on the far left-hand side. My light meter basically gives only relative measurements, but the readings suggested a total light output a little over the rated 1000 lumens.

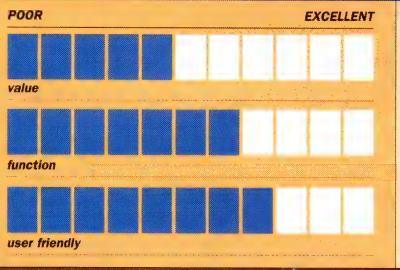


Temperature rise after an hour of operation was fairly modest; this is certainly one of the coolest-running projectors I've tested, perhaps by virtue of the medium-sized case and dual cooling fans. At the same time the fan noise is quite low, with a maximum of about 60dB (relative to 0.0002 microbar) at 300mm from the fans. This isn't quite as low as the Sony VPL-CS1 (the quietest I've checked to date), but it's certainly close — and fairly unobtrusive for home theatre work.

Fed with computer graphics signals from an HP Pavilion PC running Windows 98, the Hitachi gave very clean and rock-steady images at all of the standard screen resolution levels. There were no visible compression or expansion artifacts, and the projector seemed to recognise and lock onto each resolution very quickly. I



PERFORMANCE RATING: HITACHI CP-X940W



PROS

- Solid 1000 ANSI lumens of output
- XGA native resolution with the ability to display virtually all standard computer graphics modes, plus composite and S-video
- Remote control has mouse and laser pointer functions
- Cool running, yet low fan noise.

CONS

- No component video capability
- Screen illumination could be more uniform
- A bit too pricey for home theatre users.

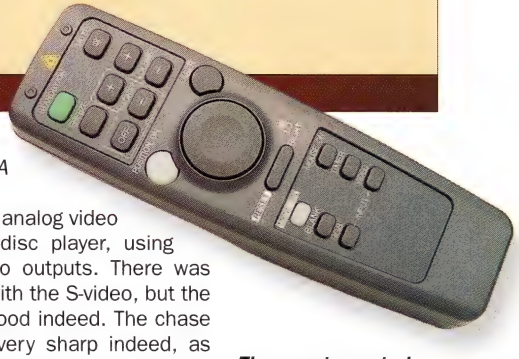
even fed it with digitised video from the WinTV Go card, in a scaleable window in 800 x 600 mode, and the resulting video was very clean and free from jerkiness.

Swinging over to check video operation, I first hooked the projector up to the S-video output of my Kenwood DVF-5010 DVD player, and tried feeding it the various test tracks from Chapter 15 of the Video Essentials DVDI 0711 test disc. The image quality was very good indeed, with good colour purity and just a faint smidgen of Moire patterning due to interference with the XGA cell array pattern of the LCD panels. The horizontal resolution on-screen appeared to be in excess of 450 lines/5.5MHz, and there was no colour fringing whatever visible on the Snell & Wilcox 'moving Fresnel zone plate' pattern. A very good result, in other words.

As you'd expect from this, the projector also gave an excellent account of itself when tried with various test scenes from other 'movie' DVDs, like the excellent Pixar digitally sourced material on Disney's disc of *A Bug's Life*.

I also tried it with high quality analog video from my Denon LA-2300 laserdisc player, using both the composite and S-video outputs. There was again a slight Moire patterning with the S-video, but the overall image quality was very good indeed. The chase scene from *Terminator 2* was very sharp indeed, as were the opening scenes from *Jurassic Park*.

In short, then, the Hitachi CP-X940W looks to be a very good performer, with plenty of light output and excellent image resolution. It should be very suitable for just about every application, including sales presentations, school and college lecture rooms — and of course home theatre work, for those whose budgets will stretch this far. At the quoted $12,950 it might be a bit pricey for most home theatre enthusiasts, though. ■



The remote control *boasts both laser pointer and mouse functions, and makes the projector easy to drive.*

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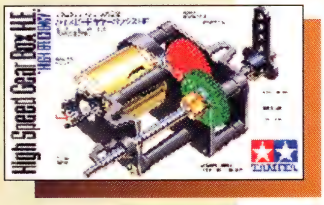
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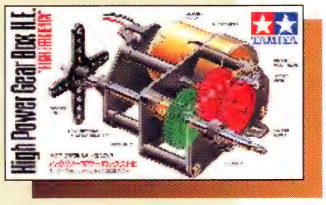
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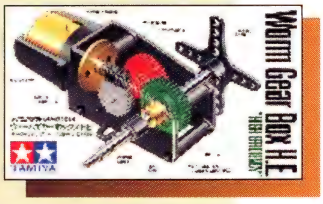
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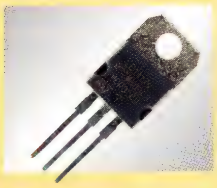
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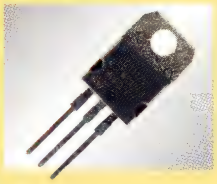


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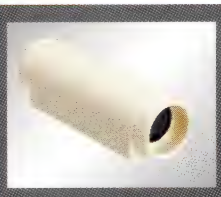


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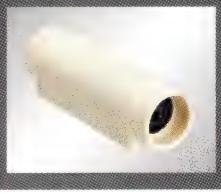


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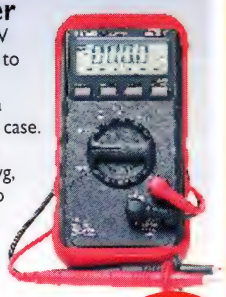
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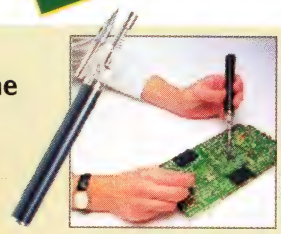
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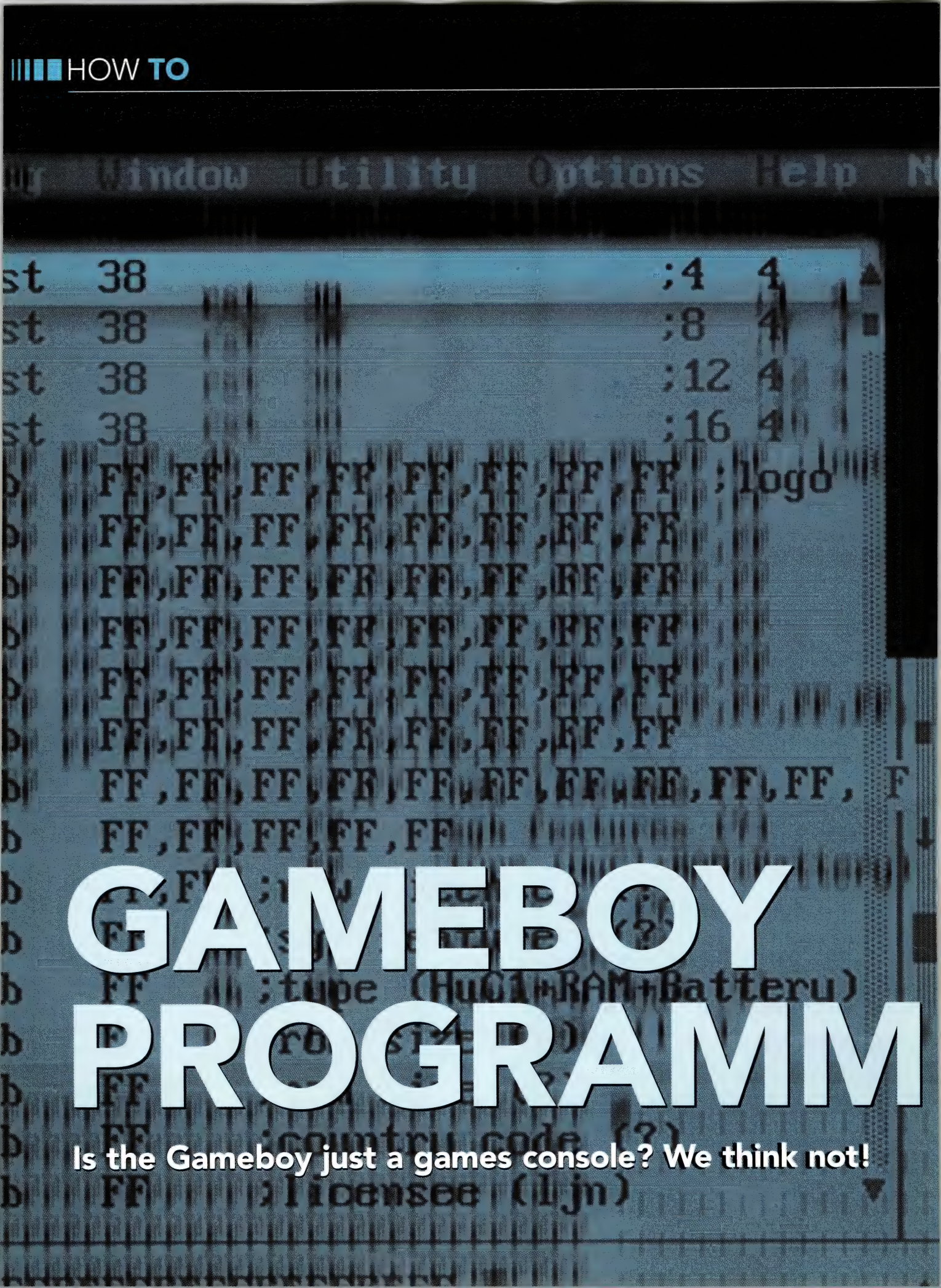
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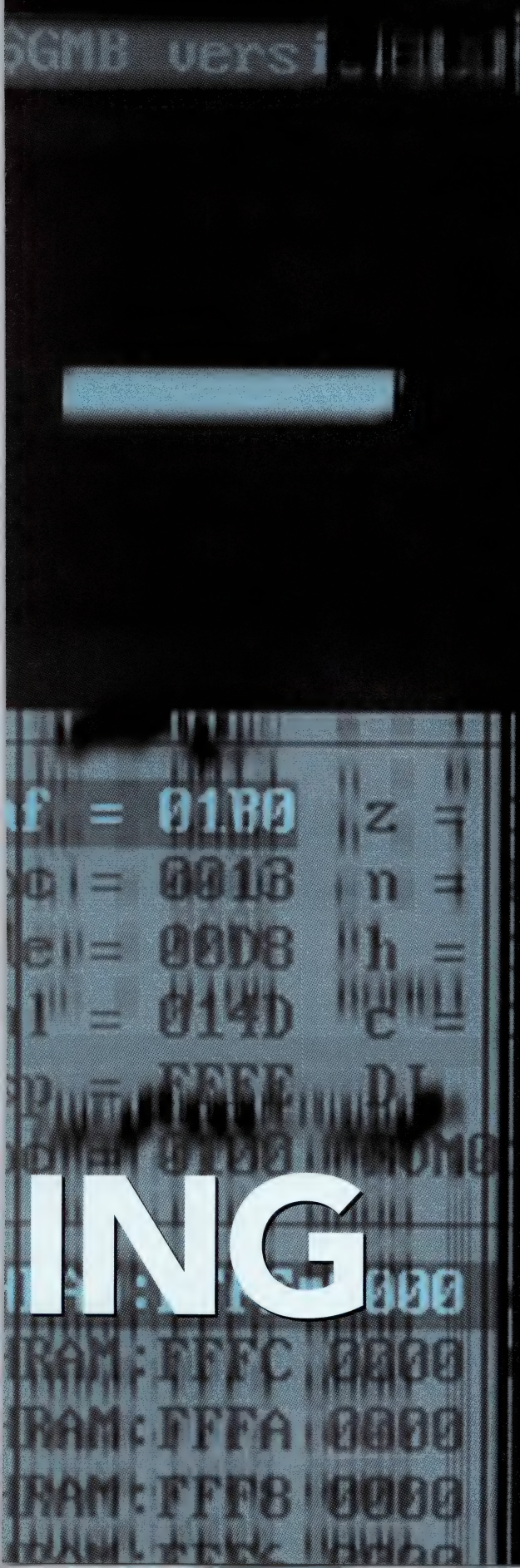
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GAMEBOY PROGRAMM

Is the Gameboy just a games console? We think not!



Do you have an old Gameboy lying in your cupboard? Got sick of buying games for it? Was a greyscale screen too boring to play games on? Well, start digging in your cupboard, raid your kids' bedroom — there is a new way to make use of that handy, cheap, unbreakable multi-function computing platform. Use it to score your local cricket game, use it as a shopping list, use it to control your sprinkler system, use it as a handy calculator, use it to control your home–built robot or use it to control industrial machinery. Sounds interesting? Then this series of articles is for you!

by **Peter Aigner** and **Nick Stone**

THE NINTENDO GAMEBOY is a general purpose, tough, portable and relatively cheap computing platform. You can take it anywhere, any time, and keep the kids entertained for hours... But, it can do a huge number of tasks if only you could program it — and now you can!

This series of articles explains the basics of Gameboy programming: what's inside of that colourful exterior, how you can interface it to the outside world, and most importantly how you can write software for it.

Let me just say from the outset that you do not need any hardware to get into Gameboy programming. In fact, you don't even need a Gameboy! You can write programs and emulate a Gameboy on your PC using some pretty cheap (or even free) software.

As well as looking inside the Gameboy, this article will also provide you with ways of programming your own cartridges.

Gameboy evolution

Since Nintendo introduced the first Gameboy back in the late 80s, there have been a few changes to the design and capabilities of this portable games machine. Since its first incarnation, it has shrunk in size (while maintaining screen size), uses only two AA batteries (instead of four), boasts a colour screen, has an infra-red 'link' port and has a processor which now runs at twice the speed.

As well as games cartridges, there have also been a number of add-ons that you could buy for your Gameboy. There are 'link' cables, so you could play games against your friends; the Gameboy digital camera; the Gameboy printer (to print out pictures taken with the camera), and even a voice recorder so you can use your handy game platform as a message taker.

Over the years many people have become interested in programming the little platform. This interest got people into building their own 're-programmable' cartridges simply by buying a cheap game, ripping the ROM off the circuit board and replacing it with an EPROM.

This method was a little cumbersome, as all the cartridges use surface mount ICs, but it was necessary the get access to Nintendo's propriety Memory Bank Controllers (MBCs) that they use to address a whopping 8MB. Without the MBCs you can only address 32KB which is still plenty if you don't want truckloads of graphics or specially recorded WAV files.

Thankfully the days of hacking ROMs are now left to only the heartiest of hackers. Re-programmable cartridges are now available, and they include battery backed up RAM so you can even save high scores and the like. A cartridge programmer that plugs into your PC's parallel port is available that can also read your standard game cartridges, so you can back them up on your PC — just in case.

Software packages to program the Gameboy are also available for free on the web. You can choose to program your Gameboy in C, Assembly and even Basic — but more on these later.

Inside the box

As I mentioned before, the Gameboy has gone through a number of changes over the years. There have been several different incarnations with varying differences.

The early versions needed four AA batteries. The Gameboy Colour, which is currently on the market, needs only two. There are also slight variations in screen dimensions, and a few minor internal differences as well, apart from the obvious miniaturisation. Lets look at the specs of the original Gameboy and the new colour version:

ORIGINAL GAMEBOY

CPU	Z80 like (8 bit)
CPU Speed	4.194304MHz
RAM	8KB internal
Video RAM	8KB internal
ROM	32KB — 2MB cartridge
Sound	4 channels (stereo)
Video	Reflective LCD 160x144, 4 shades of grey, 40 sprites
DMA	None
Serial Port	Up to 512kbps, can connect 4 Gameboys
Infra Red Port	No
Controls	8 way pad and 4 buttons
Power	4 AA (35 hours)

GAMEBOY COLOUR

CPU	Z80 like (8 bit), 2 modes
CPU Speed	8MHz
RAM	32KB internal
Video RAM	16KB internal
ROM	8MB ROM and 128KB RAM in a cartridge
Sound	4 channels (stereo)
Video	Reflective LCD, 160x144, 10, 32, or 56 on-screen colours from a palette of 32,000, 40 sprites (4 colours)
DMA	DMA transfer modes (necessary because of colour display requirements)
Serial Port	Up to 512 kbps, can connect 4 Gameboys
Infra Red Port	Yes
Controls	8 way pad and 4 buttons
Power	2AA (13 hours)

The CPU used is a Z80 derivative, and you can use most of the assembly instructions that are available for the Z80 when programming the Gameboy. The Gameboy Colour is compatible with any games that were designed for the older black and white Gameboy varieties, hence the two modes for the CPU. A clock frequency of either 8MHz or approximately 4MHz is also selectable.

Now that you know what's inside lets have a look at the externals. The Gameboy has a 3.5mm stereo headphone socket and a small 3V DC socket. This connector is perhaps the most useful one, as it avoids battery costs escalating when you are sitting at your desk, testing your software. On the left hand edge there is a volume control and the GameLink (serial port) connector.

On the back you will find the battery compartment as well a slot into which you insert the cartridges. The cartridge connector is a single sided edge socket that relies on a PCB thickness of approx. 2.0mm (or a thin PCB together with the plastic of the cartridge housing). The pin-out of the cartridge connector is shown in the diagram at right.

Ports and sockets

Most of the connectors or controls on a Gameboy are fairly self-explanatory. The serial port however deserves a closer look. It is a far cry from the RS232 standard that you might be used to from the PC. The serial or GameLink port is simply an 8-bit shift register and operates at normal TTL (0 to 5V) levels. A clock signal to shift the data into or out of the Gameboy can be provided from the Gameboy at a rate of 8.192KHz, or from an external source at a much higher (or lower speed). The serial port hardware inside the Gameboy can be set up to generate an interrupt every eight clock cycles, and the inputting of data occurs at the same time as the outputting of data.

The GameLink port connector also comes in two sizes. The older Gameboys use a larger connector, whereas the Gameboy Colour and the Gameboy Pocket both use the small connector. The serial port will be used in our next article to provide I/O interfacing functions, including eight inputs, 16 outputs, a PC keyboard connector and more.

The cartridge port of the Gameboy is also reasonably straightforward. It provides access to the 16-bit wide address bus as well as the 8-bit data bus. Some additional connections include read/write lines, a chip select line, clock output, a reset line and an audio in pin. The audio in pin allows audio signals to be routed directly to the speaker. Due to the Gameboy's address map, 32KB is easily addressed on the cartridge port.

Programming

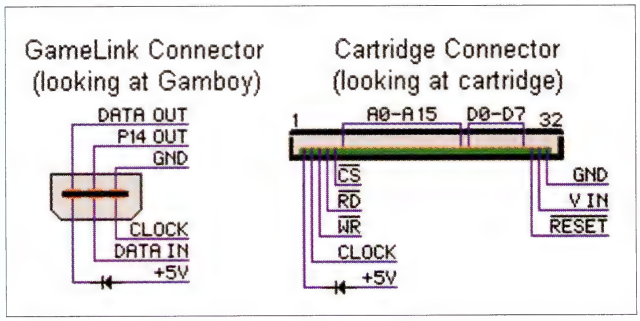
Programming the Nintendo Gameboy is not as hard as you might think. There are several options available to the budding Gameboy programmer. You can write your program in assembly, C and Basic. Additionally you do not have to own a Gameboy get into programming. There are several well written Gameboy emulators available on the net either for free or as shareware for a small fee.

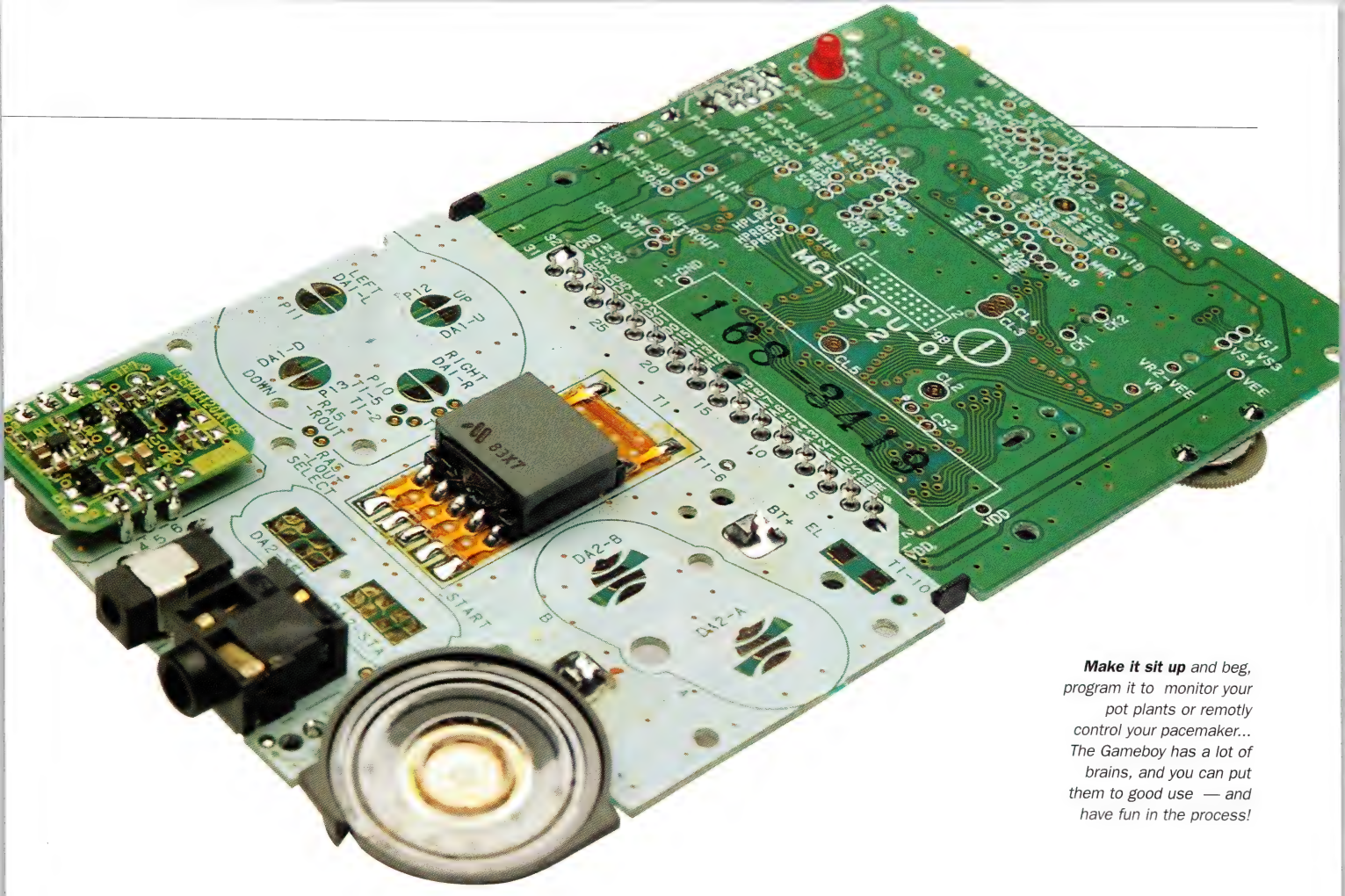
No matter which option you take, the eventual aim is to end up with a single file that has a .GB extension. This .GB file is a binary file and is the actual ROM image of your newly written Gameboy cartridge. Once you have this file, you can emulate a Gameboy running your program, burn an EPROM for your own cartridge or use the re-programmable cartridge described in this article.

Before we discuss the how of programming, let us examine each of the programming language options in turn. The first option is to write your program in assembly. As mentioned already, Gameboy assembly is very similar to Z80 assembly (some people also say it to be similar to 8080 assembly).

You can check out **www.geocities.com/SiliconValley/Peaks/3938/z80_home.htm**for an instruction set for the Gameboy, as well as the Z80. Once you have written your code, assemble it using TASM (available from **www.devrs.com/gb/software.php**, and with the correct setup you can get your .GB file running in no time.

However, be aware that there are a number of things to be done to set the Gameboy up before it can run your software. This includes setting up interrupts for screen refresh, interrupts for keypad scanning, setting up what cartridge type you are using (e.g. ROM only, ROM and RAM, which MBC you are





Make it sit up *and beg, program it to monitor your pot plants or remotly control your pacemaker... The Gameboy has a lot of brains, and you can put them to good use — and have fun in the process!*

using, etc.) and providing the Nintendo logo, (more on this later). There are plenty of code examples on the net, and these can provide you with a good starting point to getting the right setup so that your assembly code will run.

Another programming option is Gameboy Basic (GBBasic) which is shareware, written by Jeff Frohwein, and available for download at **http://hiwaay.net/~jfrohwei/gameboy/software.html**. This option may appealing to those of you who have played with and programmed the Basic Stamp microcontroller.

GBBasic is a very rudimentary form of Basic making use of line numbers. You can write programs up to 7.4KB in length, and if you are using GBBasic with a programmable cartridge (such as the cartridge described later in this article) that contains RAM, you can enter, save and load your code within the Gameboy.

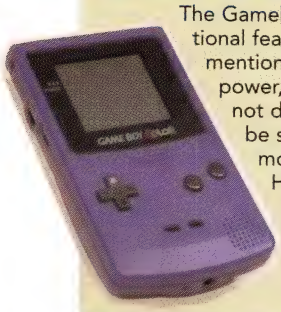
You can type your code using a 'keyboard' that appears at the bottom of the screen, where you can scroll through the letters and select the one you want. However, this process is rather tedious.

To remedy this problem, you can build a link cable (details at **www.komkon.org/fms/GameBoy/Tech/LinkToLPT.gif** to connect the Gameboy via its serial port to the parallel port of your PC. The software provided can upload and download code as required.

The third programming option (and possibly the easiest way to get into Gameboy programming) is to do it all in C. A considerable amount of effort has been put into the development of a Gameboy Software Development Kit (GBSDK or GBDK). This GBDK is freely downloadable off the internet (**http://gbdk.sourceforge.net**, and is a C programming package based around the lcc C-compiler.

Numerous libraries have been written to deal with the header and logo issue. To get some simple 'Hello World' code running using this package is a matter of a few minutes work. This is the most comprehensive way of starting in programming the Nintendo Gameboy, and if you are familiar with C, then it is definitely the way to go. The linker that comes with GBDK can also link code components that you have written in assembly (very useful for extra speed).

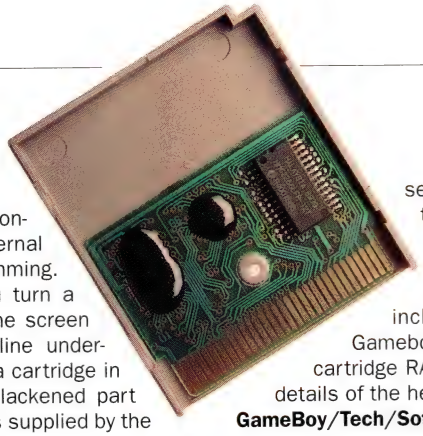
Gameboy features



The Gameboy has some additional features which deserve a mention. To conserve battery power, when the Gameboy is not doing anything, it can be switched to low-power mode by executing the HALT instruction. The Gameboy wakes up from the HALT when an interrupt occurs. The video buffer of the Gameboy is a matrix that stores 256 x 256 pixels (organised as 32 x 32 tiles of 8 x 8), only 160 x 144 are displayed on the screen at one time. This feature can be used to achieve some simple scrolling effects.

Special registers store the index of the top left hand corner of the 32 x 32 matrix, and sprites are used to animate graphics with up to forty 8 x 8 or 16 x 16 sprites of displayed on the screen at once.

On the sound front, the Gameboy has two channels (in addition to audio in). Sound can be generated in four ways — either generated by the CPU (white noise, sweep and envelope functions), or are prerecorded as WAV files. It should be note that WAV files on the Gameboy are limited to approx. 8KHz sampling rate and 4-bit resolution. Finally, the Gameboy also provides a programmable timer that can generate interrupts at regular intervals.



Programming issues

Apart from choosing a programming environment, let us now consider some of the internal issues of the Gameboy related to programming. One issue is the Nintendo logo. When you turn a Gameboy on without a cartridge in place, the screen will display 'GAMEBOY' and a blackened line underneath. When you turn on the Gameboy with a cartridge in place, the same screen appears but the blackened part now displays 'Nintendo'. The Nintendo logo is supplied by the cartridge.

Within the CPU is a very small ROM which contains a program to check if the Nintendo logo is present in the cartridge. If it isn't, the CPU is simply halted and will not pass control to the ROM in the cartridge. Therefore, any code you write and want to sell, you have to pay royalties to Nintendo for the use of the logo. For personal applications this is not really an issue as you can safely insert the logo into your code.

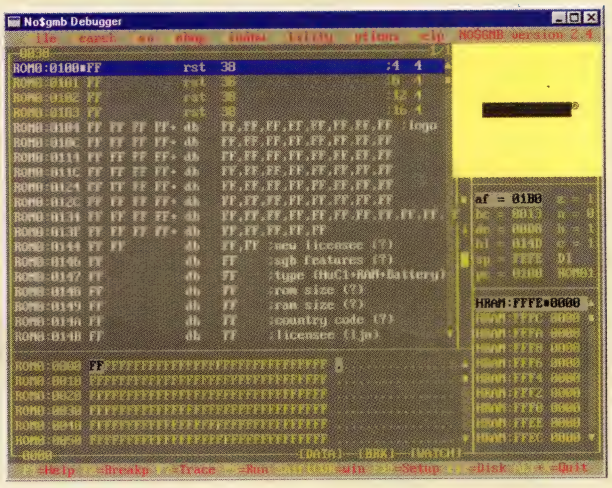
A header is required in your program to set up a variety of functions on the Gameboy. The header which starts at memory location 0000h and ends at 014Fh is divided into two sections. These sections are from 0000h to 0103h and 0104h to 014Fh. The first section includes code for interrupts (screen, keypad, timer and serial) and a link to your actual code. The second section is the information section and includes the Nintendo logo, cartridge title, Gameboy type, cartridge type, cartridge ROM size, cartridge RAM size, license code and a checksum. Exact details of the header can be found at **www.komkon.org/fms/GameBoy/Tech/Software.html**.

DIY cartridges

We have discussed programming language, environment options and some programming features, let us now have a look at the hardware required to run your programs on the Gameboy. As mentioned in the introduction, you don't need any hardware, not even a Gameboy (provided you have a PC).

But what fun is it emulating your Gameboy when you want to take it places or use to control mobile robots? There must be a nice way of getting the code that you wrote on your PC (and possibly even emulated) onto the Gameboy. There is!

Gameboy emulators





Want to program *your own cartridges? The GBXchanger is an ideal way to get into Gameboy programming, and it's pretty cheap too.*

If you are strapped for cash or want to just have a play before spending any money, the Gameboy emulators are a must. Get into programming the Gameboy without hardware... All you need is an emulator and a pretty basic PC. There are many Gameboy emulators available on the internet, some better than others. What sets the emulators apart are issues such as speed, implementation of colour (for Gameboy Colour games), correct implementation of sound, provisions to modify the program etc.

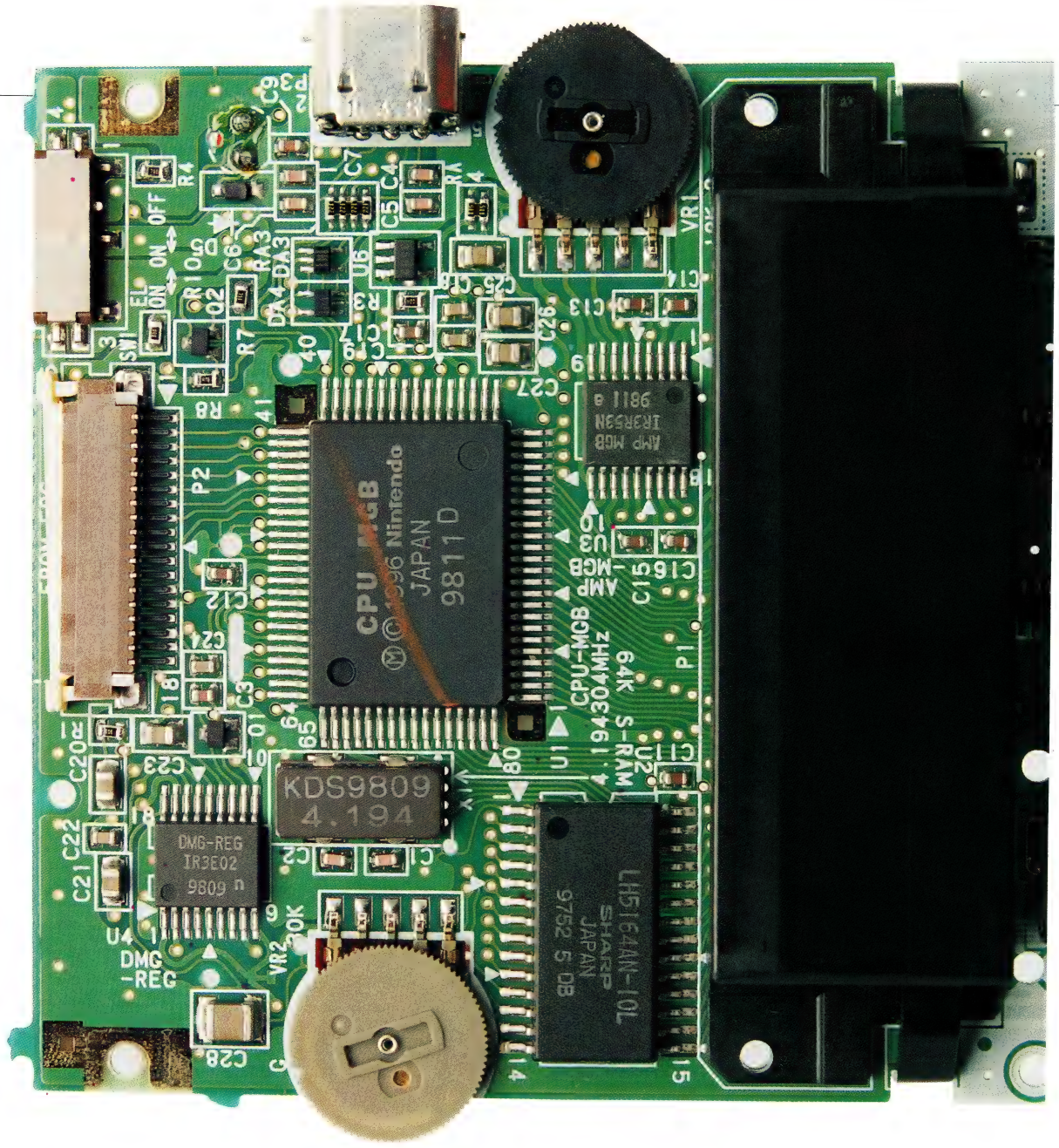
I am sure there a number of emulators that perform quite well. One emulator that I have been working with is the NO$GMB emulator available from **www.zophar.net/gb.html**. The name implies no money for a Gameboy. The emulator provides colour support, sound support and 100% speed. It also provides code disassembly, facilities to modify running code and much more.

We recently used the GBXchanger to read a purchased game cartridge for the Gameboy Colour. The .GB game file used up 2MB of hard drive space, and the emulator simulated the game without a hitch — and all this on a free software package!

Where to get the GBXchanger Development System

We are distributors for the Dr. Gameboy Development System. Presently we have available the GBXchanger and 16Mbit cartridge together with a suitable parallel port cable, 9V plug pack and software for AUS$150. Presently only limited stocks available, so please e-mail or snail-mail us before ordering to check availability (include your phone number and e-mail address).

Check our web-site at **www.sautec.com. au/gameboy**, it contains ordering details, links to Gameboy resources and other cool stuff. Email us at: aigner@usq.edu.au, or contact us via snail-mail at: P.O. Box 617 Darling Heights Qld 4350



The insides of a Gameboy, *exposed here for all the world to see. In this compact package you get a Z80-style processor, 32KB RAM, 160 x 144 LCD with display controller, serial port, 4-chanel stereo sound and more!*

The way to get your code to run on the Gameboy (other than burning your own EPROM) is to use a re-programmable cartridge and special cartridge programmer.

The re-programmable cartridge goes by the name of the 'Dr. GB Card', while the programming unit is entitled the GBXchanger. The cartridge is available in four different sizes of 4, 8, 16 and 64 Megabits, and contains an EEPROM that can be re-programmed many times. The cartridge also has hardware to emulate all memory bank controllers (MBCs) that Nintendo has ever produced, and some are available with 32KB of battery backed up RAM. This amount of memory on an 8-bit machine is enough to keep most programmers happy for quite a long time!

The GBXchanger plugs into your PC's enhanced parallel port (EPP), and comes with a bundle of Windows compatible software to make the programming of the cartridge a breeze.

The software even allows you to program the cartridge with several different programs or games — a menu is automatically produced when you turn on your Gameboy. Just imagine, all your games on just one cartridge! (Well, maybe just the small ones as some games push the memory to its limits...)

The GBXchanger also allows you to read standard cartridges of purchased Nintendo games. You can read these and store them on your hard drive. You can also back up saved games or high scores that would normally be stored in the cartridge RAM.

There is of course a Gameboy Development Studio that provides a code editor and menu options to set it up to use GBDK. In effect, your code development can be done in an environment similar to that of any commercial software development package.

We hope that we have given you a taste for programming on the Nintendo Gameboy. In the coming months we will feature a construction article on building a multi-purpose interface board for the Gameboy. This will give the GB 16 digital outputs, eight digital inputs, two servo control channels, two analog to digital converters an RS232 port and a PC-type keyboard interface. A must for any Gameboy enthusiast who wants to do cool stuff such as controlling lights, robots and many other things. We will also describe an experimenter's cartridge so that you can use a 32K EPROM to drive your Gameboy. Stay tuned! ■



OPEN FIST

BY STEWART FIST

UK research and the press

THE BRITS ARE A FUNNY LOT. Even though they asked my ancestors to leave, and helped them on their way with free passage to Tasmania and board and lodgings for a few years, I bear them no animosity.

However they go about things in a very 'English' way. For instance, for the last ten years, they've paid almost no attention to the cellphone-health debate, then suddenly they are up in arms over a finding by Dr Alan Preece at Bristol University that cellphone exposure slightly improved the reaction times of a few students.

This happened a couple of years back, and since then the UK has been in turmoil. Among the thousands of research projects around the world (many with worse consequences) they believe only the Preece finding to be of overwhelmingly importance. It's the ultimate in English arrogance.

Canary worms

At the same time another pommy scientist, David de Pomerai (with a decidedly foreign name), was making far more important discoveries using nematode worms. De Pomerai and his team from Nottingham University have been genetically engineering special worms by adding a fluorescent gene which turns on whenever the animal is subject to stress. In this context, 'stress' means any external factor likely to kill or harm the animal.

The interest here was in finding a type of canary-in-the-coal-mine indicator of toxic chemicals. These little worms breed rapidly and live only a few days, so if they can grow a line of worms which carries its own marker, whenever they encounter slight traces of a very wide-range of toxic chemicals in the environment they will glow. In effect, he is measuring the protein damage in the worm's body.

As an incidental side to his toxic chemical research, de Pomerai also tried his worms out with cellphone radiation giving them two to 16 hours of exposure. He found a dose-related response "comparable to those observed with moderate concentrations (in soil or water) of metal ions such as zinc and copper".

A follow up experiment showed that "Overnight exposure to microwave radiation (750 MHz, 0.5 W) shifted the worm size distribution markedly towards the larger size ranges. The size increase was correlated with a faster rate of progression through the stages of larval development."

So, the worms grew quicker when exposed to cellphone radiation, and they showed clear evidence of damage to their shock proteins — which suggests some minor increase in DNA damage. And remember this is after only a few hours of exposure.

If you are worried about cells proliferating and forming cancers over a lifetime of cellphone exposures, then clearly de Pomerai's work with nematodes is far more significant than Preece's human reaction times. But the Brits are a funny lot, and they don't see it this way; they will take studies on humans over worms any day.

Anyway, to cut a long story short, the House of Commons decided to hold a hearing into the subject, and came up with the typical non-committal statements you always get from bi-partisan political inquiries.

They wanted the National Radiological Protection Board (NRPB), to provide guidance. The NRPB is the organisation "responsible for providing advice to government, carrying out research and providing services in the field of radiation protection including non-ionising radiation".

It gets £13m each year to fund radiation research, but of that, only £1m is spent on investigating the impact of radiation from general transmitter masts and £330,000 on the effects of mobile phones.

And, since the organisation was part-privatised during the Thatcher years, it has effectively become a paid research arm of the radio industry. If you run a cellphone company and want some work done, the NRPB will bid for it enthusiastically.

Furthermore, the NRPB expects to benefit from the government's £22 billion windfall from the sale of third-generation mobile spectrum licences, so currently it is an enthusiastic promoter of the cellphone industry.

So no one in Britain trusts the NRPB, even though it is still responsible for developing the national radio exposure guidelines — which is probably why permitted exposure levels in the UK are the highest in the world.

To find a way out of all this mess, the Blair Labour government set up the Stewart Inquiry last year as an independent committee. The Inquiry is nominally under NRPB control, but the board itself was specifically excluded from any involvement in writing the report.

And as a public demonstration that they had not been 'captured' by industry, the committee went even further, choosing to exclude the NRPB Secretariat from the 3 day final residential meeting while the final report was prepared.

The committee consisted of 12 experts, and it was chaired by Sir William Stewart of Tayside University who was once the chief scientist to the Cabinet Office. Their final report was handed to the government last month, and it is expected that Blair will act on these recommendations.

At the time I write this, the official information hasn't been released, but there are plenty of leaks and some rumours. Those that found their way into print in April were totally fictitious, probably fallacious, and certainly ill-informed. The suspicion is high that the industry floated these positive stories as a way to confuse

...THEY DON'T SEE IT THIS WAY; THEY

the public about the Stewart findings.

The first newspaper to jump the gun was the UK 'Guardian' which ran a front page story headed "Expert report gives mobile phones a clean bill of health", and then the 'London Evening Standard' (probably stealing its copy from the Guardian) ran with a banner headline "Phew, our mobile phones ARE safe!"

In fact, according the organisation Powerwatch and some very well sourced leaks, the Stewart report call for national guidelines to control the construction of

mobile phone masts, and wants each handset to carry a label warning users about the potential for long-term health damage.

This is not a claim of fact, but a precautionary statement: they say that mobile phone companies must give their customers more information on the potential dangers of radiation from handsets. The committee is also telling the government to put much more money into independent research.

The Inquiry was very concerned about the siting of cellphone towers near schools and residential areas, and they want the NRPB's rules on exposure safety to be tightened up. They may even require a reversal of the Permitted Development Rights for cellphone antenna masts up to 15 metres high, and for the 'street furniture' (lamp post) types, but I'm not clear about this.

They were also particularly concerned about a 20 year-long epidemiological study conducted by Professor Stanislaw Szmigielski with more than a 100,000 members of the Polish Army released earlier this year.

Szmigielski has been tracking large numbers of service personnel over their lifetimes, and he has identified a small group (3 percent — roughly 3,000) who were substantially exposed to low and high levels, mainly of pulsed (radar) microwaves at frequencies close to cellphones. He checked the medical records of servicemen in the Army between 1970 and 1990, and compared the exposed group's medical histories and death rates with a matched group of soldiers known not to be exposed.

He found that the exposed soldiers were more likely to get some particular cancers (skin, brain, blood, digestive system, blood and lymphatic system), and they were also more likely to develop these cancers a decade earlier in life. The major cause for concern was a 14-times increase in adult leukemia among those over 50 years of age who were exposed to relatively low-levels.

The Stewart report will concluded that none of these effects are causually established (proved to come from microwaves), but it stresses that substantial scientific evidence exists to give rise to genuine public health concerns. They are saying that governments must pay attention to the health consequences of long-term cellphone use.

In particular, they want many more independent academic institutions to be funded by the Department of Health (through the UK's Medical Research Council). In fact, the first £250,000 of funding has already been approved by the government, according to one leak.

This is a long way from giving phones "a clean bill of health" as the newspapers claimed.

Hands free kits

But misreporting and poor science happens everywhere. In March, the UK Consumer Union's publication 'Which?' claimed that hand-free kits, using an earpiece and microphone on a cable so the handset isn't held against the side of the head, didn't lower the levels of EMF exposure for users. In some cases, they claimed, it actually increased the head exposures.

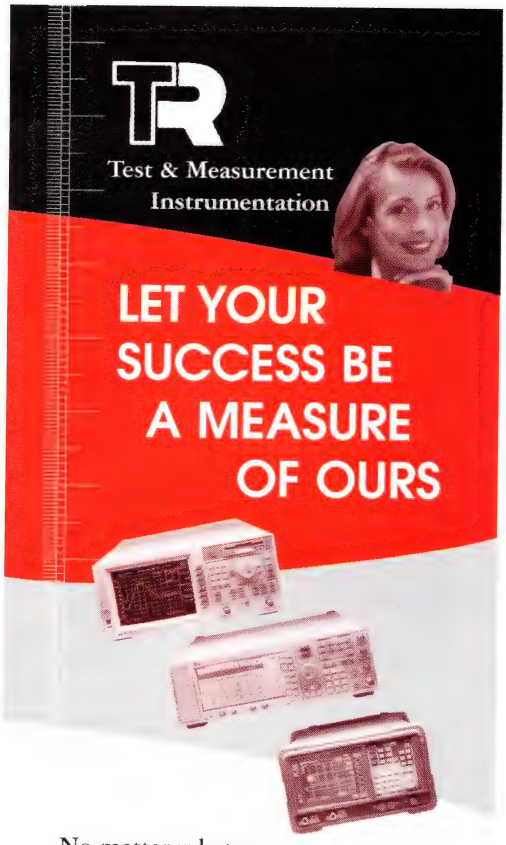
Despite howls of outrage from hand-free kit-makers and loud cries of "rubbish" from most measurement laboratories, the Union says: 'We stand by our research into hand-free sets and shields. If people are buying these devices for health reasons, they are barking up the wrong tree.'

WILL TAKE STUDIES ON HUMANS OVER WORMS ANY DAY.

The fact is that some cellphones do appear to have hot-spots down around the microphone end close to the socket for hands-free cables. So it is possible that highly variable amounts of coupling could occur between the handset and the cable.

However no laboratory, apart from the one use by 'Which?' (which apparently had no prior experience with these kinds of measurements) makes any claim of increased levels over the phones themselves — but they all agree that more power than is generally thought can be channelled up the cable.

The Stewart committee received the Consumer Union's report at the end of its deliberations, but I have no idea which experts they choose to believe. It will be interesting to watch and see how closely the leaks and guesses match the reality. ■



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Civil rights, family troubles and a disturbed pianist



Picture: ■■■■■
Sound: ■■■
Movie: ■■■■
Bonus Extras: ■■

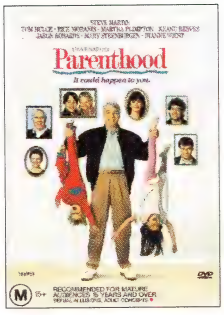
MISSISSIPPI BURNING

Orion Pictures, 1988. *Directed by Alan Parker, with Gene Hackman, Willem Dafoe and Frances McDormand. Widescreen; colour, 122m. SS/SL disc, Dolby Digital 2.0 Surround; Columbia TriStar Home Video, RRP $34.95.*

■ **ON THE SURFACE** this gripping Alan Parker film simply tells the story of three young civil rights activists who disappear in 1964 in rural Mississippi, and what happens when the FBI sends in two of its agents to solve the mystery. But Parker expertly uses the friction between the two agents, with their very different backgrounds and approaches, and the way their investigation triggers off a violent reaction in the local community, to explore the dynamics of racism and the difficulties involved in stamping it out. Hackman and Dafoe both put in convincing performances as the two agents, as does Frances McDormand as the wife of the corrupt deputy sheriff.

The picture quality on this Sony Gold Standard DVD transfer is excellent, as is the sound — although it's only two channel with matrixed surround. There isn't much in the way of bonus features, though; just the US trailer and profile/filmographies of Hackman, Dafoe, McDormand and Parker.

Still, the disc provides an excellent way to see this powerful and moving anti-racism drama, plus some excellent acting. (J.R.)



Picture: ■■■■
Sound: ■■■
Movie: ■■■■
Bonus Extras: ■■

PARENTHOOD

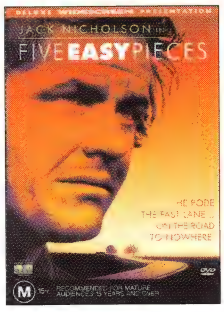
Universal/Imagine, 1989. *Directed by Ron Howard, with Steve Martin, Mary Steenburgen, Jason Robards and Dianne Wiest. Full screen; colour, 118m. SS/DL disc, Dolby Digital 2.0 surround; Columbia TriStar Home Video, RRP $34.95.*

■ **MORE THAN** just a 'family comedy', Ron Howard's *Parenthood* tries to explore the pressures on parents and their children in modern suburban America, with a gentle humanity. Funnyman Steve Martin doesn't grimace too much as trying-too-hard dad Gil Buckman, and is well supported by an ensemble including Mary Steenbergen as his wife, Dianne Wiest as his divorcee sister, Jason Robards as his father, Tom Hulce as his chronic-gambler brother and Keanu Reeves as his daughter's layabout boyfriend. It's all good fun, and Howard generally manages to stop it from becoming maudlin.

Although this DVD is a pan-and-scan transfer, the image quality is very good. The sound is quite good too, bearing in mind that it's a Dolby Digital 2.0 track with only matrixed surround.

There's not a great deal in terms of 'bonus extras', though. You get some production notes telling how the movie came about, and then filmographies of the principal cast members and director.

An entertaining and warm-hearted look at Hollywood's slant on family life, as played out in their own suburbs. (J.R.)



Picture: ■■■■
Sound: ■■■
Movie: ■■■■
Bonus Extras: ■■

FIVE EASY PIECES

Columbia, 1970. *Directed by Bob Rafelson, with Jack Nicholson, Karen Black, Susan Anspach and Ralph Waite. Widescreen; colour, 95m. SS/SL disc, Dolby Digital mono; Columbia TriStar Home Video, RRP $34.95.*

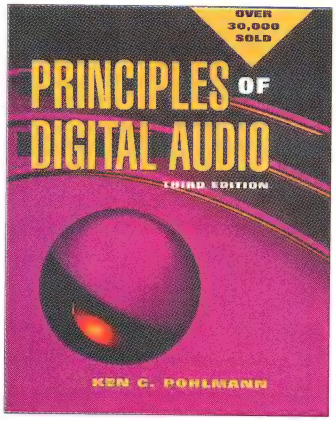
■ **JACK NICHOLSON** was nominated for Best Actor of 1970 for his impressive work in this low-key but moving character study by Bob Rafelson. Nicholson certainly is excellent as the restless, self hating former classical pianist who flits from job to job and woman to woman, but he's also well supported by Black as his luckless current girlfriend, and Waite and Anspach as his smug brother and intended sister-in-law. Sally Struthers also shines as a cynical prostitute. The writing and photography are both very good, making it quite a classic.

The picture quality is excellent in this Sony Gold Standard transfer to DVD, and although the sound is only mono it's also very clean and well balanced.

There's really very little in the way of 'bonus extras', though. All you get is a brief 'talent file' on Nicholson, Black and Rafelson — not even the theatrical trailer, which looks to be provided on the Region 1 disc menu pictured on the rear of the slick.

Still, the DVD is an excellent way to see one of Nicholson's best performances, in a movie that won three NY film critics' awards and three Oscar Nominations. (J.R.) ■

Third edition of a classic, and a measurement technique reference



Digital audio classic

PRINCIPLES OF DIGITAL AUDIO, by Ken C. Pohlmann. Third edition, published by McGraw-Hill, 1995. Soft covers, 234 x 158mm, 622 pages. ISBN 0-07-050469-5. RRP $115.95.

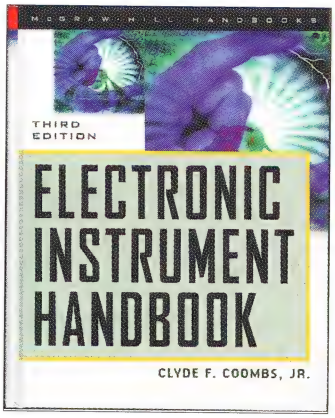
■ The first edition of this introduction to digital audio technology came out in 1985, and rapidly became a 'classic' — used very widely in technical college and undergraduate uni courses, around the world. Its popularity grew again when the second edition appeared in 1989, and no doubt this latest edition will have produced another surge. All of which is as it should be, because the University of Miami's Professor Ken Pohlmann has both an excellent grasp of digital audio concepts, and a real flair for explaining them clearly. Long-time readers of *EA* may recall that he wrote some very popular articles on the subject for the magazine, some years ago.

For this third edition he's extensively re-worked many of the original chapters, and added some new ones as well. As a result there are even better explanations of some of the harder-to-grasp concepts like dither, perceptual coding and digital filtering, plus some very illuminating and accessible material on DAT, MiniDisc, DCC, audio DSP, MPEG-1 and MPEG-2, AC-1/2/3, low bit-rate conversion and noise shaping.

In short, it has been very significantly revised and updated, and is now even better than before as a sound but entirely readable introduction to digital audio.

My only concern is that in his preface to this edition, Prof. Pohlmann says that it will be the last — because even he is finding it too hard to keep up with this accelerating technology. Please don't give up, Ken; without your help, what hope will the rest of us have in trying to keep up?

The review copy came from McGraw-Hill Book Company Australia, of PO Box 239, Roseville NSW 2069. (J.R.)



Instrument reference

ELECTRONIC INSTRUMENT HANDBOOK, edited by Clyde F. Coombs Jr. Third Edition 1999, published by McGraw-Hill. Hard covers, 243 x 194mm, 50mm thick (pages not cumul. numbered). ISBN 0-07-012618-6. RRP $235.

■ The latest edition of this best-selling classic reference on electronic measurement technology, which essentially distils the knowledge and expertise of some 37 engineers in what is now Agilent Technologies (the original Hewlett-Packard, and then its T&M division). Or 38 when you count its editor-in-chief Clyde Coombs himself, because he too was an HP engineer before he became a best-selling technical author.

The first edition of the book appeared in 1972, by the way, with a foreword by Professor Fred E. Terman himself — the man who inspired Dave Packard and Bill Hewlett to start up HP in the first place. His foreword is reprinted in this edition too, and makes interesting reading.

Like the earlier editions this one provides an outstanding reference on virtually every aspect of electronic measuring instrument operation, theory and use. There are 47 chapters in all (10 more than the previous edition), all written by expert engineers from one of the many Agilent labs and plants around the world, and those that aren't new additions have generally been extensively updated.

They're pretty well all concise, accurate and accessible, making the book an essential one-stop resource for anyone needing to understand and use modern test instrumentation. If you only buy a single book on electronic measurements and test instruments, this would be it.

The review copy came from McGraw-Hill Book Company Australia, of 4 Barcoo Street, Roseville 2069. (J.R.) ■

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Cat. MS-4045
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WE HAVE SOME SENSATIONAL DEALS FOR JUNE, SO DON'T HESITATE!!!
Call into any one of our stores, ring our phone order number or order online at our website: www.jaycar.com.au

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Basic Electronics NEW EDITION
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$29.95ea or $55 for both
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BUY A JAYCAR SUBWOOFER AMP IN JUNE AND SAVE $$$

See 2000 Cat. page 81 for full details. All 240V mains operated.

65 WRMS / 4Ω
Cat Price $183.90
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Cat Price $369.70
JUNE $319
WITH REMOTE CONTROL
SAVE $50.70
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Low Cost 240V Soldering Iron Bargain

Ideal for the hobbyist and handy person. Our lowest price 240 volt quality iron has a stainless steel barrel. 25 watt. Fully SAA approved. Cat. TS-1450

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We have made a scoop purchase of some high quality German made PAPST brand 80mm fans. These fans are die cast, sleeve bearing, 240V, measuring 80 x 80 x 38mm and are priced WELL BELOW NORMAL.
•Max. Air Flow: 29.4 CFM/50 M3/h •Voltage: 230V AC •Noise: 30dB(A) •Bearing System: Sleeve •Speed: 2650RPM •Temp Range: -10 to+70°C •Service Life: Max Temp 20,000 hour/40°C 35,000 hour
•Input Cable: 400mm
Size: 80x80x38(D)mm Cat. YX-2507

ABOUT HALF PRICE
Only $33.47
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Fantastic Speaker Kit, hundreds sold. See Cat. page 77.

Speaker Kit
Was $536
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Cat. CS-2560

Cabinets
Was $312
JUNE $279
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Cat. CS-2562



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JV50
10" 3 way. TOP SOUND. See Cat. page 77.

Speaker Kit
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Cat. CS-2550

Cabinets
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JUNE $279
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Cat. CS-2552



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JC30
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Speaker Kit
Was $240
JUNE $210
SAVE $30
Cat. CS-2590

Cabinets
Was $203Pr
JUNE $183Pr
SAVE $20
Cat. CS-2596



Full Kit $363 SAVE $50

JC25
5" 2 way bookshelf speaker kit. See Cat. page 76.

Speaker Kit
Was $175
JUNE $155
SAVE $20
Cat. CS-2585

Cabinets
Was $203Pr
JUNE $183Pr
SAVE $20
Cat. CS-2586



Full Kit $316 SAVE $40

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Buy in June and Save. Prices will rise due to $A

AV-GAD 5 Sector Deal
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New model with smaller remotes

WITH STANDARD SIREN LA-8915 $149.50
WITH BACK UP BATTERY SIREN LA-8916 $169.50

EQUATOR

See page 114 of 2000 Catalogue.



$189

New Model with Backup Battery Siren

Cat. LA-8950

Isobarik Active Subwoofer Kit

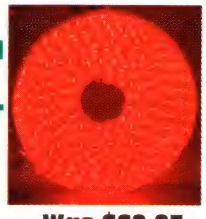
Refer Electronics Australia Sept. 99. An Isobarik or compound speaker arrangement simply involves coupling 2 woofers together to perform the one job. The kit uses 2 x 12" polycone woofers (speakers not included CW-2130) and either a 65 WRMS or the larger 150 WRMS prebuilt amplifier module. The 65W module is quite adequate, but if you require more than average grunt, then we suggest the 150W module.
See 2000 Cat. page 78 for full details



Kit complete with 65W Amp
Cat. Price $559.50 JUNE $499.50 Save $60
For 150W Amp Module add $120

SAVE $10 IN JUNE ON 8 METRE ROPELIGHT

Chasing ropelight with controller which produces 8 different effect patterns. Available in 5 colours.
RED Cat. SL-2821
GREEN Cat. SL-2822
LIGHT BLUE Cat SL-2823
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CLEAR Cat. SL-2825



Was $69.95
JUNE $59.95
Save $10

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PRICES SHATTERED ON 1.8A/h Sub C Nicad

We're overstocked. Your chance to grab some at a "never to be repeated price". These are solder tab type, and used in drill battery packs etc. Cat. SB-2468

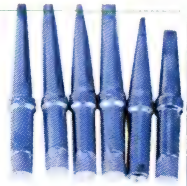


Normally $7.18ea.
June Buy 1+ $6ea, Buy 6+ $5ea, 12+ $4ea

Weller Soldering Iron Tip Sale

Two types available: A) For WTCPS/T Station and TC Series Pencil (PT Series) B) For EC1201A (ET Series Tips). These are not factory Weller tips but are a quality 2nd source OEM tip maker for many reputable soldering iron manufacturers. BE QUICK, LIMITED QUANTITIES.

A) WTCPS/T & TC Mainly 700° & 800°F (370° & 430°C). Most are fairly standard - ie pointy with double flats from 0.8 to 4.0mm, with the odd 6mm. This pack was released in March, & unfortunately some tips in the packs were for the ET series. If you have bought a pack, and have some ET, return them to us for replacement for the correct PT series. We apologise for this. PT tips currently sell for $12.82. This pack has 15 tips, value $192.30. Be quick, there is only about 70 packs left. **Cat. TS-1370**



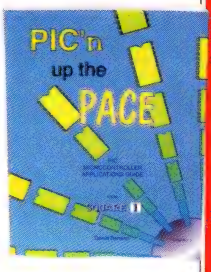
Only $35

B) EC1201A (ET SERIES) These tips suit the following: EC1000/EC2000 WES50 STATIONS FITTED WITH EC1201A/EC1204A WEP50 SOLDERING PENCILS AND WTL24 PENCILS. Tips are conical double flat with no tip we could see over 2mm. Very handy sizes. ET series tips sell for around $16.50 each. This pack contains 5 tips, value $82.50. Be quick, only about 70 packs available. **Cat. TS-1371** **$17.50**



Pic'n Up the Pace

This well written book expands on the knowledge gained from our popular "Easy Pic'n"(Cat.BS-1500) & introduces the reader to more complex and useful experiments. Learn how to scan keyboards, drive LC displays, interface to sensors, do A/D & D/A conversion, perform maths functions and more. Soft cover. 210 x 280mm, 269 pages. **Cat. BS-1502** **$76.95**



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Each bag contains up to 2kg of electronic goodies -"Junk"" if you like! Cat. XB-9000 **$17.95**

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Bargain Boxes

These are basically a bargain bag, plus even more goodies, bigger bulkier items. Cat. XB-9001 **$29.95**

Velleman 5mhz Personal Scope

$399



This portable oscilloscope is about the same size and price as a good multimeter. Cat. QC-1906

Its high sensitivity - down to 5mV/div - and extended scope functions make this unit ideal for hobby, service, automotive and development purposes. It's ultra fast full auto setup function, makes measuring waveforms very easy.

SOME FEATURES: •High contrast LCD with wide viewing angle •Full auto set up for volt/div and time/div •Trigger mode run - normal - once - slope -/+ •True RMS and dB measurements •Readout: Vdc - Vpp - Vrms - dBm (x1 and x10 calculation option) •Display mode: none - markers - grid - crosshair •Marker readout: dt - 1/dt (frequency) - dV •AC/DC/GND input coupling •Automatic zero reference for DC measurements •Auto power off or continuous on •Low battery detection •Includes battery charge circuit.

ACCESSORY PACK:

LOGIC PROBE Cat. QC-1902
MAINS POWER SUPPLY Cat. MP-3007
ALKALINE BATTERIES 5 X AA Cat. SB-2425 x 2

Value $62

Buy in June and buy the Accessory pack for only $29 extra. Save $33!



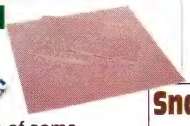
SAVE $20 ON DURATECH SOLDERING STATION

See 2000 Cat. page 51 for details. **Cat. TS-1380**

Cat. Price $181 JUNE $161

Double Sided Fibreglass PCB

NEW for 2000



BUY 10 LESS 10%

We've made a scoop purchase of some quality fibreglass double sided blank PCB. Size 300x300mm. Great price.

Cat. HP-9516 Only $19.95

Mixed Crimp Connector Pack Bargain

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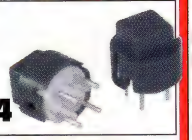


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SPST PC mount. Pin spacing 5mm. Gray in colour, square front to switch **Normally 95c ea.**

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PC Interface DMM



- •PC Interface
- •Auto Ranging
- •Temperature
- •Capacitance
- •Continuity Buzzer
- •Transistor Test
- •Back Lit Display
- •Diode Test
- •Holster Included
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Cat: QM-1350 $128.43

See our catalogue for all our DMMs

3.75 Digit, True RMS, PC Connect Bench Multimeter



NEW for 2000

- •RS-232 Interface
- •Auto Ranging
- •Diode Test
- •Capacitance
- •Analogue Bar Graph
- •Data Hold
- •Frequency
- •Max/Min

Cat. QM-1240 ONLY $299

Intelligent DMM



- •Triple display
- •2 x 3.75 digit
- •Bargraph •Auto ranging •Manual ranging overide
- •Recording
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- •Relative mode
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- •Diode test
- •Capacitance test •10A •40 meg
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69 Channel UHF Hand Held Transceiver

NEW for 2000



This sophisticated transceiver operates in the 433Mhz band & uses the full legal power to provide up to 1km line of site range. The transceiver has CTCSS selective calling, a clock with alarm and stopwatch capabilities, low battery indicator, 10 different paging tones, LCD display, plus 10 memories. Best of all, you don't need a license to use it and could save a fortune on expensive mobile phone calls. Comes with belt clip and instructions. Requires 4 x AAA batteries (not supplied). Size: 65 (W) x 105 (H) x 30 (D).

Cat DC-1000 Yellow
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Cat DC-1004 Green

Only $99ea

Low Cost DMM

- • 3.5 Digit
- • 12.5mm High Display
- • Transistor Test
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Cat. QM-1500 $15.95 SAVE $3

Temperature DMM

- •Professional Look
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- • Holster Included
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Desk Mount Magnifier Lamp



Cat QM-3525 $125

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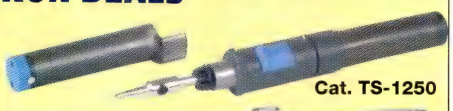
See 2000 Cat. P48 for details.

Buy in June our VULKAN 100

Cat. TS-1250 **For $48.65**

And receive a free can of gas

Cat. NA-1020 **Value $6.55**



Cat. TS-1250

Cat. NA-1020

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Cat. NS-3010

Cat. NA-1020

Cat. TS-1260

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And receive a free can of gas, a 200g solder reel 1mm and a tip cleaner

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Cat. NA-1020

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Cat. TS-1205

Cat. TS-1510



Budget 8 Sector Home Alarm Kit Sale



This kit includes all components needed to give you a quality basic home system. Add your labour, and you will have a reliable affordable alarm that offers you peace of mind.

•Personal attack buttons on panel •User programmable sectors •Backlit keypad

50 SETS ONLY

KIT INCLUDES

1 x 8 sector Jaytech panel	$129.50
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1 x Mains power supply	$23.65
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Cat. LA-5450	$263.06

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The easy way to start a car with a flat battery in as little as 5 minutes. You don't even have to lift up the bonnet. Easy start is a lead with a cigarette lighter plug on each end and a black box in the lead. **Cat. MB-3595**



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10 x 500mm x 10mm wide
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20 x 400mm x 5mm wide
30 x 300mm x 4mm wide

Cat HP-1209

Lots and Lots of Cable Ties

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Fantastic new bulk packs.

Length	Pack	Cat.	Price
100mm	500	HP-1211	$12.95
150mm	500	HP-1212	$22.95
200mm	500	HP-1213	$29.50

1400MAH AA Ni-Mh Rechargeable Batteries

BUY 10 LESS 10%

NEW 2000



They just keep getting bigger!! Higher current & about $1 less than last years catalogue!

NIPPLE Cat. SB-2436 **$4.30**

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Gooseneck Desk Lamp

NEW 2000



Plugs into a cannon socket, flexible gooseneck, and 5W 12V globe.

Cat. SL-2800 **$19.95**

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5mm 80mcd GREEN / CLEAR Cat. ZD-1794

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NEW 2000



Includes 5W 12V globe, on/off switch and mains plug pack adaptor.

Cat. SL-2804 **$49.95**

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MOFFAT'S **MADHOUSE**

BY TOM MOFFAT

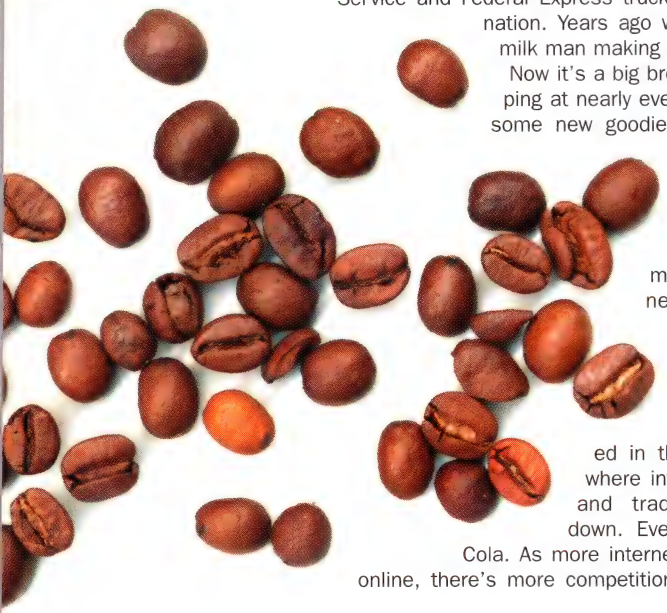
How's your **java** bean? (plus updates)

SHOPPING ON THE INTERNET is becoming a way of life over here in the USA. Especially in situations like mine, where you live in a small town with few major shops or department stores, and a tourism-based economy. With the exception of the two supermarkets, most of our shops are aimed solely at tourists, and they charge accordingly. They carry only a minimum range of goods, and most of them have never heard of things like size 13 shoes. Clothes on offer always seem to have the town's name 'Port Townsend' on them somewhere (said as I sit here in the only windcheater I could find to fit me, with Port Townsend splashed on the front...).

One alternative to Port Townsend's restricted shopping is a 150km return trip to Silverdale, which has a large selection of department stores and malls. Port Townsend merchants cry bitter tears as their customers head for the big smoke, wallets in hand. "Support your local economy" they yell, but we just can't do that if it costs us a 40 percent premium.

One can avoid that 150km trip and save even more money by sidling up to the computer and tapping a few keys. You can buy anything, literally anything, on the internet. Need a new kidney to replace yours that's on the fritz? No problem, and if you buy it from a state other than your own, you don't even have to pay sales tax.

Anything electronic is a natural for internet commerce, because it's high in value but small in size, easily carried by the enormous fleet of United Parcel Service and Federal Express trucks that blankets the nation. Years ago we used to see the milk man making his morning rounds. Now it's a big brown UPS truck stopping at nearly every house, delivering some new goodie purchased on the internet from a shop on the other side of the country.



So online commerce is big business, threatening more and more the traditional 'brick and mortar' business of old. This is especially reflected in the stock exchange, where internet stocks go up and traditional stocks go down. Even things like Coca Cola. As more internet businesses come online, there's more competition for each potential customer. This comes about through advertising, and internet advertising means having the flashiest web site possible, to dazzle your prospect away from the opposition.

And here is where I have a bone to pick. If I log onto a business' web site, it's because I'm hoping to buy something, not spent time waiting for the flashing animated screens to load. Some sites have little mini-windows all over them, flashing off and on at different rates. Guaranteed headache.

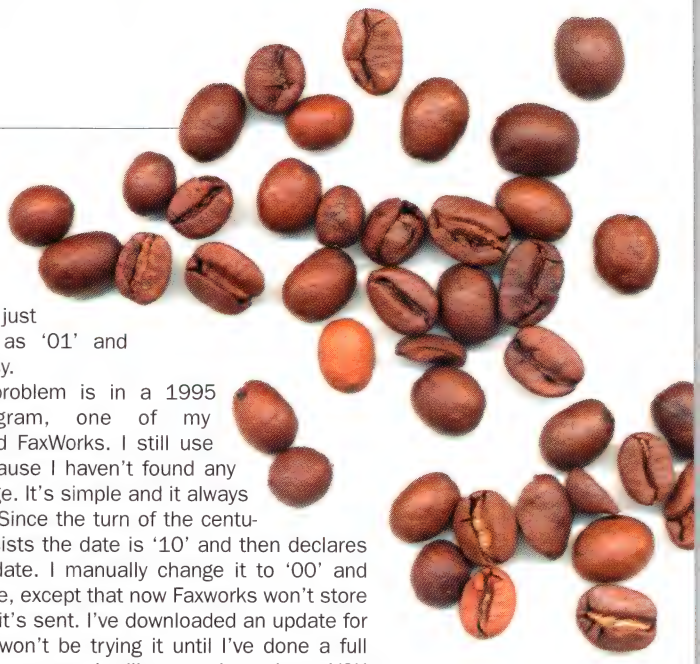
Much of this frumpery comes about through the use of Java, a 'universal' computer language that can download a file into your computer and then execute it. Most of this you see is some form of advertising or other. There are indeed some commercial web sites that refrain from all the whizz-bang and simply conduct the business at hand. And in my opinion, these simple sites are going to be the eventual winners.

My computer uses a two-browser setup to cruise the web. The browser of first choice is Opera — you've heard about that in this column before — because it's very small and light and fast. On a non-Javafied site, it slurps in the material in a few short seconds and then sits there quietly as I study what it's delivered to my screen. It is possible to make Opera handle Java by adding-on Java as an accessory, but I have purposely refrained from doing that. I want Opera to remain small and fast.

Often a web site will cause Opera to throw up messages announcing "Could not find plug-in required to show this content". That means it's just been confronted with Java. The way I cope with Java is to copy the URL of the site in question to the clipboard. Then I shut down Opera, start up Netscape with its Java capabilities, paste-in the site URL, and turn 'er loose. We then sit there as Netscape loads file after file, with more and more moving ads filling the screen.

Here comes something internet merchants should take note of: When Opera starts complaining about Java, I have two choices: One is to load Netscape. The other is to ask myself if I really want to view that site after all, or should I try somewhere else. In other words, because of its sheer complexity and my impatience, that site trying to constipate my computer with unwanted Java doodles is on the verge of losing business.

When I'm doing non-shopping internet stuff, like researching magazine articles, I seldom encounter Java. Few government or education sites use it. For instance, the last two Madhouse columns have been devoted to aviation safety issues, gleaned from sites such as the National Transportation Safety Board. This site opens with a tiny graphic of the NTSB logo in the



upper left-hand corner, and the rest of it is pure text. You can search for every aircraft incident involving the elevator control jackscrew, or uncommanded rudder hardovers, and the information is on your screen in the blink of an eye.

Look at university web sites: How many of them invite you into their ivory towers by dragging you through a Java minefield? Take particular note of computer science departments, and their lack of Java. Does that tell us something? In fact, with Melbourne Uni's Computer Science department, I inspected their HTML code itself, and it certainly looks like it might have been hand-generated by intelligent human beings, instead of an automatic contraption such as Netscape Composer or Microsoft Front Page. In Australia at least, the internet began with the universities, and it's good to see that they are still leading the way with simple elegance on their web sites instead of flashing hype-o-rama.

Upon accessing a web site, internet browsers generally identify themselves as to their manufacturer and version. What I'd like to see is a message sent along with the ID code, telling the distant site whether or not you are prepared to accept Java. If no, the site should send you a simplified version of its page, instead of trying to force the Java into a non-receptive browser, with resulting crashes.

Many years ago in Melbourne there was a newspaper columnist named Keith Dunstan who was fed up with the media forcing football down the public's throat every day of the week. Who will ever forget the long-running and very boring saga of Kekovitch's knee? Over and over and over.

Dunstan responded to football overload by forming the Anti-Football League. It started as a joke, but it kind of grew into a grass-roots movement to take back Saturday afternoons from footy mania. It wasn't long before lots of people were wearing the little Anti-Football lapel pins with their square footballs.

Who out there thinks it's time to form an Anti-Java league, to campaign against the force-feeding of Java content down slow and shaky internet links that have better things to do with their time? Maybe this should be discussed in Forum! (Yeah, Jim Rowe, I sicked them on ya again...). Seriously, though, why SHOULD we suffer something that gives us little more than extra advertising?

Y2K Update

Remember a few months back when I said, with Y2K, little or nothing would happen? Well, something happened. To me. Twice. As a proud owner of the fat gene, I spend a lot of time dieting and exercising and recording my weekly weight in a program called Patterns, a 1994 product in MS-DOS. The first time I tried to enter '00' as the year, Patterns chundered violently and then crashed. Now I just fake the year as '01' and everything's rosy.

The other problem is in a 1995 Windows program, one of my favourites called FaxWorks. I still use this simply because I haven't found any reason to change. It's simple and it always works. Almost. Since the turn of the century, Faxworks insists the date is '10' and then declares it's an invalid date. I manually change it to '00' and everything is fine, except that now Faxworks won't store copies of faxes it's sent. I've downloaded an update for Faxworks but I won't be trying it until I've done a full backup on the computer. I still worry about these Y2K 'fixes' — the cure is worse than the disease.

Aviation Safety Update:

Two months ago we discussed the problems surrounding aircraft vertical stabilizers getting stuck due to problems with the jackscrew / gimbal-nut assembly that causes the elevators to move. The problem first became public knowledge following the crash of an Alaska Airlines MD-80 aircraft which plunged into the sea, killing 88 people. All records of the flight, including voice conversations in the cockpit, point to a stuck elevator making the plane uncontrollable.

Prior to that crash, and unrelated to it, an investigation had been going on into Alaska Airlines' maintenance facility at Oakland, California. It was alleged that maintenance supervisors were signing off work as "done" when it fact it hadn't been done at all. According to the Seattle Times, a group of 64 Seattle mechanics claimed that they were "pressured, threatened, and intimidated" to cut corners on repairs. Alaska airlines says it's put a top manager on leave while it investigates the claims.

This weekend the Times revealed that the FBI has now been called into what was formerly an NTSB investigation into the faked maintenance records claims. This suggests that criminal charges could be forthcoming. As for the MD-80 involved in the crash, inspection of the jackscrew assembly recovered from the site has revealed that it had no grease, it was entirely devoid of any lubrication. That would explain those photos of shards of metal being stripped off, and the jackscrew's total failure.

The mechanics' revolt was triggered by their concern over the standard of repairs done to another MD-80 jackscrew assembly. The airline has declined to confirm or deny the report, but the FAA says there has indeed been a "debate" at Alaska airlines over an elevator repair. Where this is all leading is unclear, but it does make one wonder if some airline procedures could do with more government supervision. Stay tuned.■

THAT SITE TRYING TO CONSTIPATE MY COMPUTER WITH UNWANTED JAVA DOODLES IS ON THE VERGE OF LOSING BUSINESS.



FORUM

CONDUCTED BY JIM ROWE

Low power (and legal) 434MHz transceivers: How DARE they sell them to ordinary mortals!

A couple of Australia's leading retail electronics chains are now selling small and very low power 'walkie talkie' transceivers which operate at 434MHz. They're fully legal and covered by an ACA Class Licence — but nonetheless the firms concerned have received a torrent of abuse, from angry radio amateurs who regard this band as their own property.

I'M PROBABLY GOING to regret buying into this argument, because the last time I had the temerity to comment about radio amateurs in the magazine, I too was subjected to a torrent of scorn and abuse. That was back in March 1995 when the then Spectrum Management Agency (now the Australian Communications Authority) wanted to increase amateur licence fees, and I was foolish enough to suggest that this mightn't be all that unreasonable in view of the significant amount of valuable spectrum they used.

Boy — did they dump on *me*! Not only was there a heap of abusive letters and faxes (some of them even threatening personal violence), but I was 'flamed' on various amateur radio broadcasts and nets as well.

A similar thing had happened to our popular contributor Tom Moffat a couple of years earlier, when he'd commented about the behaviour of a small number of 'full call' amateurs who would freeze out, ignore or abuse new amateurs and those with limited (i.e., 'no Morse') licences. He too was given 'the treatment'.

The ironic thing about this kind of behaviour is that in reacting so badly to any criticism of the amateur radio movement — real or implied — the people concerned are actually demonstrating that amateur radio often *isn't* the wonderful 'friendly fraternity' it professes to be. No wonder quite a few people in the wider community now tend to regard hams as an elitist bunch of angry old techies at best, and at worst a gang of nasty spectrum squatters and thugs.

Of course the people I'm talking about are really only a minority within the amateur radio ranks; most hams are generally pretty decent people, happy to both welcome and help newcomers as well as to consider calmly and objectively any criticism of the amateur movement. It's a pity that because they're so vocal and aggressive, this nasty minority gives the rest of the movement such a bad name.

Anyway, that's all by way of an aside, because my reason for bringing up the subject of radio amateurs and their behaviour here again this month is a new kerfuffle that's arisen, in connection with the sale and use of very low powered handheld UHF transceivers.

Here's the background. Small handheld 'walkie talkie' transceivers are very handy little devices for short range two-way communications in all kinds of situations. You can use them for 'feedback' when you're up on the roof, trying to optimise reception from a TV antenna; to call a family member for a meal or to meet unexpected visitors, when they're out walking the dog (or working in a remote paddock); for maintaining communications between a group of people on a bushwalk or hike; and so on.

Small handhelds working on the 27MHz (HF) and 476-477MHz Citizens' Bands have been available for some time, of course, but both of these bands have become quite 'crowded' and are often dominated by truckies and other groups (some of *them* being pretty abusive, too). CB transceivers have also tended to become fairly complex, and 'overkill' for those who really only want basic short-distance or 'line of sight' communication.

Happily in 1997, the then-SMA announced a new Class Licence covering a wide range of 'Low Interference Potential Devices', including very low power transceivers. As part of this Class Licence they allowed for handheld transceivers to operate in a narrow frequency range from 433.05MHz to 434.79MHz, and with a maximum RF power output (EIRP, or equivalent isotropic radiated power) of only 25mW. That's 25 *milliwatts*, or 1/40th of a watt — less than 1% of the output from a typical mobile phone.

At the frequencies concerned, though, even that tiny output is enough to give a handheld transceiver a useful range of about 1km or so — making such a device quite practical for short range communications. And since this type of Class Licence equipment needs no user licence or licence fee, it therefore has a lot of potential appeal to the general consumer market.

I DON'T KNOW

So once the new Class Licence had made them legal, a number of firms saw the opportunity and made arrangements to source and sell this type of transceiver.

One of the first firms to bring them to market was Dick Smith Electronics, which in the middle of last year announced a 20mW narrow-band FM model offering 20 channels, spaced at 25kHz intervals between 433.750MHz to 434.225MHz inclusive. It's known as the Digitor D-1099, and I had the opportunity to evaluate a pair soon after they were released. My review

appeared in the September 1999 issue of this magazine; I found them excellent little units, which performed well at distances of up to about 1km (assuming a fairly clear path).

Their band...

Now what you should realise is that the 433.05 - 434.79MHz band which the SMA/ACA has allocated for use by these very low power transceivers is slap-bang in the middle of a UHF band which radio amateurs have long regarded as their own property. That's because the so-called Amateur Radio Service has for many decades had the use of a full 30MHz chunk of this part of the spectrum, from 420MHz to 450MHz. To amateurs, this is all *their* 70cm band — despite the fact that to my knowledge, amateurs have always been the 'secondary' user of this band. (Its 'primary' use has been for Radiolocation services, while there have been other secondary users as well, including the Military.)

In particular the section of this band from 433.05MHz to 434.79MHz is within the segment where 'Novice' radio amateurs can operate, and also allocated by the amateurs themselves for use as repeater input frequencies, for simplex FM communication and for RTTY (radio teletype), SSTV (slow-scan TV) and WICEN (Wireless Institute Civil Emergency Network) use.

Notwithstanding all of the above allocated uses, if you listen to virtually any frequency on this band segment at almost any time of day, you'll hear virtually nothing — even in the suburbs of Sydney. So it's not exactly awash with signals, from the amateurs themselves or any other users.

The reality is, then, that in allocating this modest 1.74MHz-wide band segment for use by very low power transceivers, the ACA has merely added to its existing range of users — none of which have been exactly conspicuous by their presence. And the new users, by virtue of both their official 'can't complain about interference' status as well as the very low power of their equipment, are very much going to be 'tertiary' users of this spectrum.

Hardly a major problem in the making, you'd think. Nevertheless, as soon as Dick Smith Electronics announced their Digitor D-1099 transceivers last year, they started to get a huge amount of aggro from aggrieved hams. The staff in their retail outlets were abused, their buyers and head office staff received angry phone calls and emails, and again there were 'flaming' sessions on the amateur bands.

By the way this was despite the fact that DSE had actually done quite a bit of research to ensure that the 20 channel frequencies used by the D-1099 were carefully chosen to avoid frequencies used by amateur repeater inputs, etc.

Of course it was also despite the fact that DSE was selling a product that was *entirely legal*, and fully conforming to the specifications for transceivers operating within the ACA's new Class Licence. So if they did have a problem with the transceivers, the amateurs really should have been taking it up with the ACA, not heaping abuse on Dick Smith Electronics.

Anyway there's been a further development more recently when a second retail chain, Jaycar Electronics announced in March this year that they would be selling a similar range of transceivers for the same band.

Jaycar's units are known as the Tek City Two Way Radio, and are in a very compact case which comes in three fluorescent colours: yellow (Cat. No. DC-1000), purple (DC-1002) and green (DC-1004). The units provide no less than 25mW output and 69 channels over the range 433.075 - 434.775MHz (almost the full Class Licence band), and offer a range of handy features including CTCSS subsonic signalling, 10 memory channels and a built-in clock.

Needless to say the Jaycar units also fully meet the requirements of the ACA Class Licence. Nevertheless as soon as Jaycar began advertising them, their stores and head office were swamped with complaints and abuse from irate radio amateurs.

It didn't seem to matter that to date, there's apparently been no evidence whatever that users of the new transceivers have actually caused any kind of interference to amateur radio repeaters or other activities. The bottom line seemed to be that here was another chain of stores selling transceivers that operated in *their* band, and could be used by ordinary people who didn't need any licence at all — what a cheek!

Now I don't know about you, but this doesn't strike me as reasonable or sensible behaviour. It certainly hasn't improved the image of radio amateurs in my eyes, either. In fact it's basically just confirmed my impression that the original breed of 'friendly experimenter' radio amateurs have largely gone, replaced by a bunch of bullies who don't make much use of the RF real estate they've inherited, but are sure as Hell determined to stop anybody else making use of it either.

Let's face it, what exactly are they upset about? Basically about ordinary people being able to buy handy little flea-power transceivers, for use now and again when the need arises. Transceivers that operate entirely legally on a band that the ACA has allocated, as tertiary users.

Sure, the 434MHz band concerned is in the middle of a bigger UHF band that amateurs have regarded as 'their own' for a long time. But the reality is that (a) amateurs have always been, and still are, one of the *secondary* users of this very wide band; (b) there hasn't been all that much activity on it anyway, so they can hardly scream that there 'isn't room'; and (c) we're talking about very low power transceivers, with a range of about 1km tops, operating in a band segment amounting to less than 6% of the total available to amateurs (30MHz).

It's also true that if the amateurs still feel that they have a valid problem with the new transceivers operating on the band they do, they should take it up with the body responsible for allocating this band for this type of use: the ACA. Abusing and threatening retailers like Dick Smith Electronics and Jaycar Electronics is surely neither reasonable nor constructive; it simply reinforces the community's negative views about hams in general.

But what do you think? Am I being too critical of radio amateurs, or do you think I'm right and it's they who are being unreasonable? I'm interested in your views — just don't send me another swag of abusive

ABOUT YOU, BUT THIS DOESN'T STRIKE ME AS REASONABLE OR SENSIBLE BEHAVIOUR

FORUM



and insulting letters/faxes/emails for daring to suggest that there are a few rotten apples in the amateur radio barrel.

Like most people, I don't really react all that well to abuse, insults or threats. Mind you that kind of behaviour isn't a very successful way to win anyone's heart and mind, really.

Plug pack safety

To end up this month, let's change the subject to one we haven't looked at for quite a while. Here's a little note that turned up via email from long-time reader Dave Jeanes, who if my memory still serves me is also the author of a couple of books on caravan electronics. This time, as you'll see, Dave is concerned about the possible fire risk from some of those plug packs which nowadays seem to be plugged permanently into many of our power outlets:

For some time I have been concerned by the possible fire risk of actively powered plug packs. There are six plug packs permanently connected to GPO's in my house — some get quite warm to the touch, others seem to be at about room temperature.

The units power items such as a bubble jet printer, a cordless phone, TV masthead amp, electric broom charger, external modem and TV headset amp. Some have approval numbers, eg. V/75733, but others have symbols that could indicate an approval type or some manufacturer's code.

The worry is that these units do not appear to have fuse protection, and one assumes that they are double insulated, as they have no earth pin to the GPO. GPO's are individually wired back to the house switchboard and protected by fuse/breaker at 10 amps.

A plug pack could develop an internal fault, drawing say 8 or 9 amps — enough to start a fire, and yet not open the 10 amp protective device.

Do you know the electricity authority regulations covering safety aspects of plug packs? There is always a chance of imported packs not meeting these rules, particularly if brought in by airline travellers.

Do you know of any hazards or over voltage problems attributed to regulated output plug packs?

Thanks for raising this topic, Dave. I'm sure it's something that has concerned quite a few of our readers, not only because so many smaller appliances now seem to be powered by plug packs, but because quite a few of them seem to run either 'quite warm' or 'downright hot'.

I must confess that I'm not familiar with the chapter and verse of SAA regulations regarding plug packs, but I do have a vague memory that transformer-type plug packs actually have to be fitted with a thermal cutout which breaks the primary circuit in the event of overheating. So I'm pretty sure that they *are* in effect provided with fuse protection — it's just that the fuse is internal, and not user serviceable.

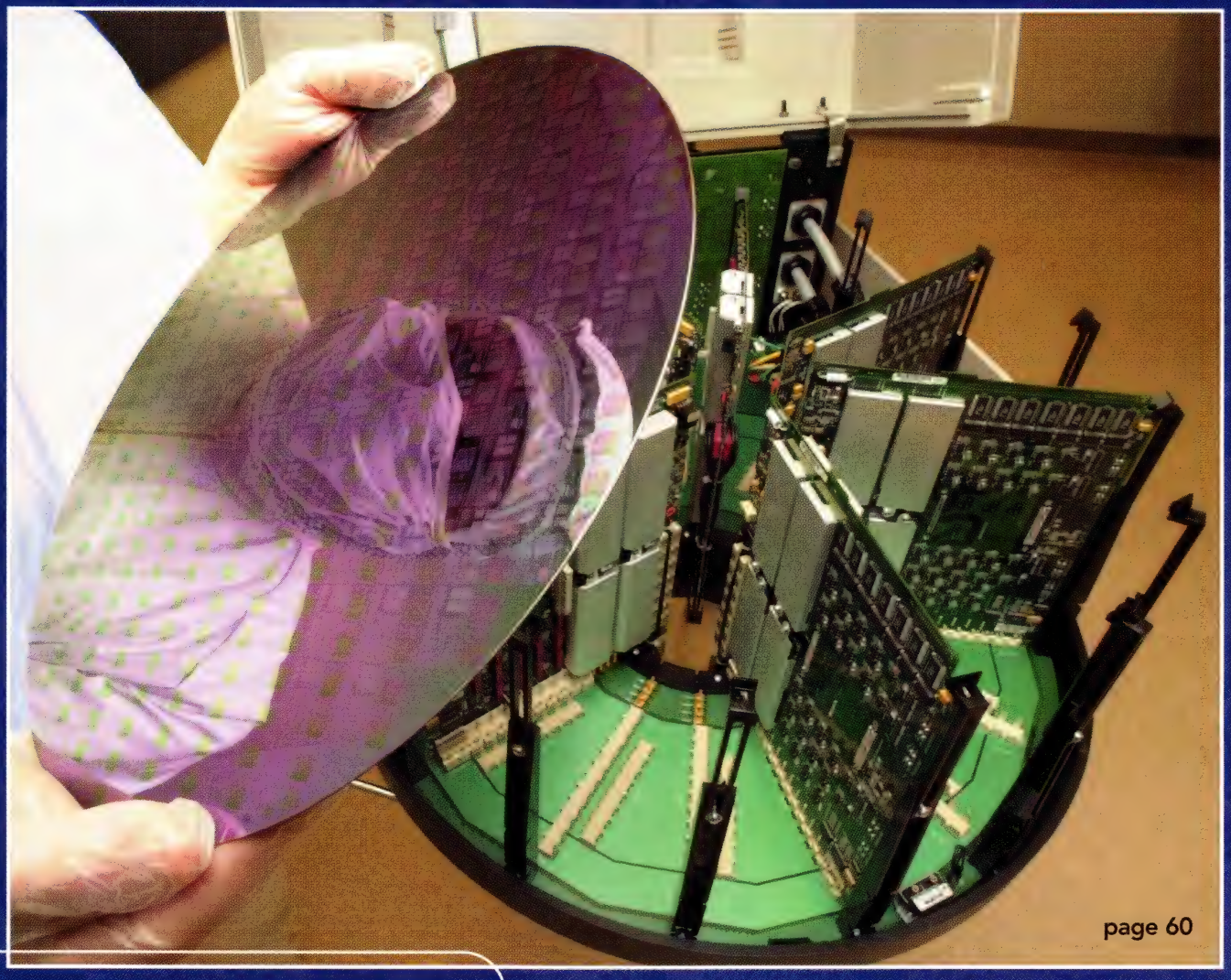
The rationale behind this is probably that the plug packs are deemed cheap enough to be thrown away and replaced, in the event of an overload, rather than repaired. I'm not sure how many people would agree with this, in view of the price of some plug packs nowadays, but there you are.

As to whether there might be any specific problems associated with the more elaborate *regulated* type of plug pack, I confess I'm not aware of any. But nor would I really expect any, either. Although they obviously contain more components, in the way of the regulator circuitry, the extra components will generally be of a type less likely to fail than those already present in a standard unregulated unit: namely, the transformer and reservoir electro.

That would be my guess, anyway. But perhaps we'll all have our understanding of these devices increased, if a reader who's more knowledgeable about them (and the regulations covering them) cares to share their knowledge with us.

That's it for this month. I hope you'll join me here in the Forum next time, if I'm not ambushed by a lynch mob of angry radio amateurs in the meantime. ■

Professional electronics



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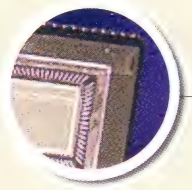
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SILICON **VALLEY**

NEWS

IN BRIEF

■ Despite the booming demand for chip equipment tools and the growing need for lithography systems capable of handling sub-0.1 micron geometries, electron beam-based lithography continues its run of not living up to decade-old expectations.

Now Ultratech Stepper, a leader in photolithography said it has decided to discontinue operation of its Ultrabeam unit, which has been focused on electron beam technologies for the photomask manufacturing industry.

UltraBeam is based in Murray Hill, New Jersey and employs approximately 30 people. It has not generated any revenues to date.

■ Silicon valley graphics chipmaker NVIDIA announced it has received a $200 million advance payment from Microsoft on future deliveries of advanced graphics chips that will power Microsoft's X-Box video game player systems.

The chips will work in combination with a 700MHz Intel CPU chip.

■ Chipmaker Fairchild Semiconductor is to invest more than US$300 million in its Korean subsidiary over the next three year as the company, Silicon Valley's original IC pioneer, hopes to increase production of its analog circuit.

The company plants to invest US$79 million this year to expand production lines in facilities in the Puchon, Kyonggi Province near Seoul. A year ago, Fairchild bought a Samsung Electronics unit for $450 million as part of a plan to expand the company's line of specialized semiconductors.

In the chips

THIS MONTH'S Professional Electronics cover (page 59) shows a technician at Keithley Instruments in Cleveland, Ohio, inspecting one of the new 300mm semiconductor wafers being produced in plants being built around the world.

The industry's drive toward the new 300mm standard, which allows more computer chips to fit on each wafer produced, is driving demand for test equipment made by companies like Keithley, as manufacturers build new plants and re-configure existing production lines to test the new-sized wafers.

The industry trade group SEMI forecasts demand for semiconductor manufacturing equipment to rise 18 percent in year 2000 to a record $23.4 billion. (Feature Photo Service)

National Semi processor for Web boxes

NATIONAL SEMICONDUCTOR HAS continued its push into the market for Web appliances with the launch of the Geode GX1 processor.

The GX1 was designed for information appliances such as personal access devices for the Internet, thin clients and interactive set-top boxes, a market that is expected to increase to an annual volume approaching 100 million units per year in the next three years.

The Geode GX1 processor is produced using a 0.18 micron process. The chip includes a Pentium-class processor core, complemented with a display controller with 2D accelerator, system memory, and PCI bus host controller. Typical power consumption varies between 0.8 to 1.2 watts.

TI & Sharp accused over chip patent

TEXAS INSTRUMENTS AND Japan's Sharp have been accused of violating a small Californian company's patent for packaging chips, in their digital signal processing (TI) and flash memory (Sharp) ICs.

Tessera of San Jose claims the two companies are using its design for chip-scale packaging, a state-of-the-art process that lets chipmakers produce ICs whose ceramic or plastic packages are only a fraction larger than the chips themselves. Chip-scale IC packages are used increasingly in cellular phones, advanced pagers, digital cameras, and other portable computer and communications devices.

Tessera has filed a patent infringement lawsuit against TI and Sharp with the US International Trade Commission, asking the ITC to order stop the firms from producing ICs whose packaging infringes on its patents.

The lawsuits are the apparent results of a business deal that has gone sour. TI signed a technology licensing agreement with Tessera in 1996. Tessera has been trying to renegotiate the agreement for the past year and to collect royalty payments on which TI was allegedly not forthcoming. The licensing agreement ended in March and negotiations for renewal were not making any progress, prompting Tessera to take legal action.

Texas Instruments spokeswoman Gail Chandler said that TI, not Tessara, developed the packaging technology for the chips involved. She said that TI filed a lawsuit against Tessera a month earlier asking the Court to declare that its DSP chip packaging wasn't covered by the Tessera agreement.

In the case of Sharp, Tessera claims that its licensing agreement with Sharp does not cover flash memory chips. To date, Sharp has refused to broaden its licence agreement with Tessera.

NEC & Motorola adding more fabs

JAPAN'S NEC HAS announced plans for two new state-of-the-art chip fabs costing nearly US$3 billion in total, while Motorola announced it had agreed to take over an abandoned Hyundai chip fab in Scotland and spend $2 billion to make it a state-of-the-art IC production facility.

The NEC fabs will be located in Roseville, California and Hiroshima in Japan. Construction of the facilities will start later this year. The plant in Roseville, located 30 miles east of California's capital Sacramento, was originally announced back in 1998. But DRAM market conditions and the Asian economic crisis caused the plans to be postponed.

Both plants will make high-end DRAM memories, including 256 megabit and one gigabit DRAMs, as well as high-performance multimedia chips, system-on-a-chip processors and other logic devices.

The two new plants add to other fab expansions announced by NEC in the past months, including US$900 million for a facility in Yamaguchi prefecture, western Japan, to produce system LSI chips and $100 million for expanding output of wafers and to start producing liquid crystal display (LCD) driver chips at a plant in Scotland.

Meanwhile, Motorola said it will spend $2 billion to buy and outfit a semiconductor plant in Scotland owned by Hyundai and use it to produce advanced ICs for use in mobile phones. The 150-acre facility, located in Dunfermline, offers one million-square-feet of manufacturing space.

The site has stood idle since Hyundai stopped construction in 1998. Motorola has agreed to pay Hyundai some US$160 million for the facility and will spend another $1.8 billion to complete it. ■

Low-Noise Variable Gain Amp for Ultrasound and Wireless Applications

IN AN ULTRASOUND SYSTEM, signals reflected from tissue close to the surface are received quickly and require no amplification, while signals received from reflections off the deepest tissue require amplification. These signals are at such low power levels that noise in the receiving channel becomes the limiting factor in defining the capabilities of the system.

Burr-Brown's new VCA2612 is a low noise variable gain amplifier designed for ultrasound and wireless communications systems, and features unequaled levels of performance and integration, while providing the necessary low noise amplification to improve the performance of these systems

Many wireless base station systems implement receiver channel amplification using discrete products. The VCA2612 provides a cost-effective, highly integrated solution for these AGC (Automatic Gain Control) type applications where noise performance is critical.

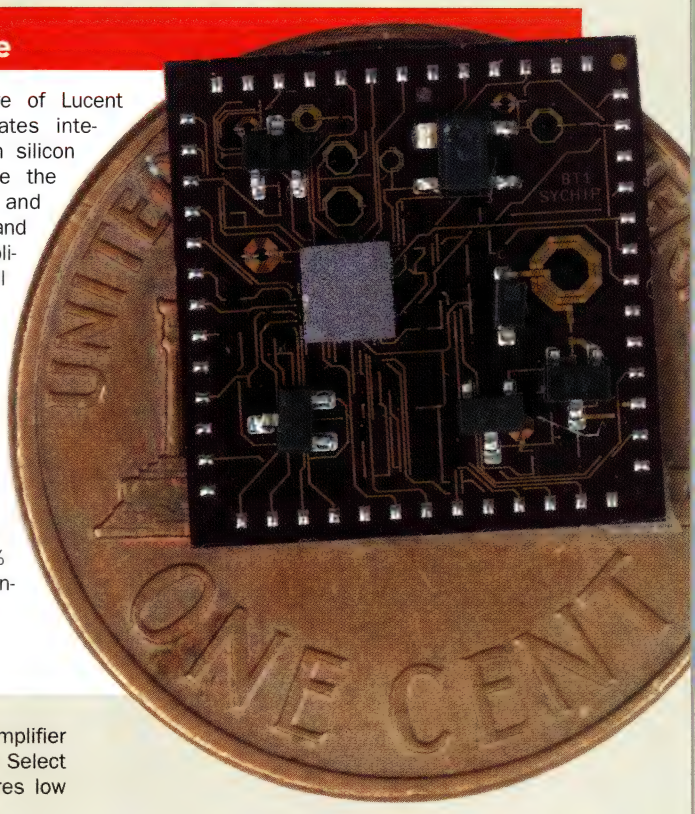
Each channel of the dual VCA2612 consists of three main blocks: a Low Noise Preamplifier (LNP), a Voltage Controlled Attenuator (VCA), and a Programmable Gain Amplifier (PGA). The combination of Active Termination (AT) and Maximum Gain Select (MGS) provides excellent noise performance. The VCA2612 also features low crosstalk and outstanding distortion performance.

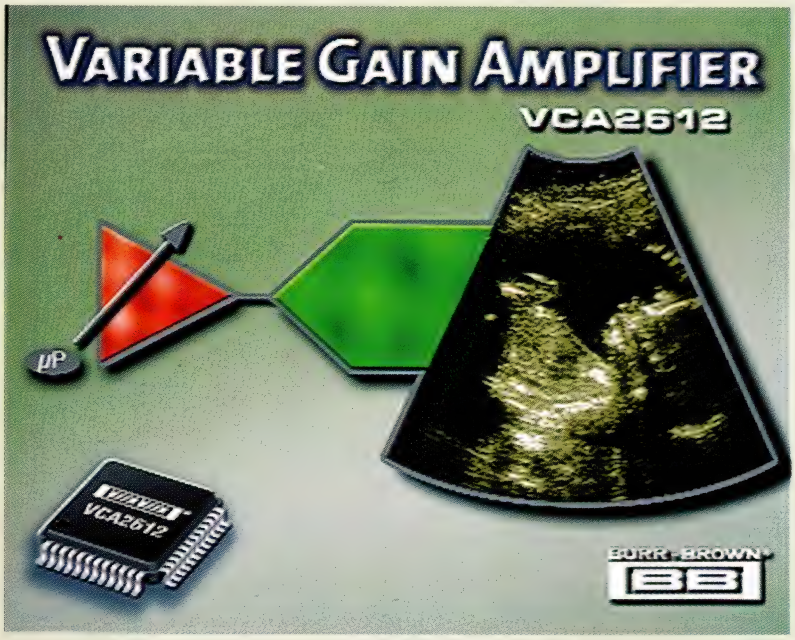
For more information, contact Kenelec Scientific, 23 Redland Drive, Mitcham Vic., 3132.

Mighty Mite

SYCHIP, a venture of Lucent Technologies, creates integrated systems on silicon chips that improve the performance and reduce the size and cost of Internet appliances such as cell phones and personal digital assistants. Shown here on a US penny is a complete 2.4 Gigahertz radio frequency receiver, of the type used in cell phones. SyChip's products are 70% smaller than conventional components.

PHOTO BY BUSINESS WIRE





Jaycar ELECTRONICS
JOB VACANCY
Kit Department Manager
Due to ongoing expansion at our Sydney Head Office, we are looking for a new Kit Department Manager.
This challenging position requires someone with a 'can do' attitude, strong interest & knowledge of electronics and good computer skills.
This job also involves many aspects of marketing, purchasing and management.
Send resumé to: **Murray Roberts**
email: mroberts@jaycar.com.au
PO Box 185, Concord, NSW 2137
Fax 02 9743 2066

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"Take Mr. Murray of Penrith for example, who placed an order at 6:55PM EST . The order was picked, packed and dispatched that afternoon and arrived on his doorstep at 8:00AM the next morning (well before most local businesses were even open!) travelling at an average speed of 246 kmph"

Jack O'Donnell, Managing Director

SUPER SURVEILLANCE SPECIALS

4 Way AV Switcher



Monitor up to 4 A/V channels with this advanced automatic A/V switcher. Any combination of the four cameras can be scanned and displayed on either of the two monitors, it switches both video and audio. The time and date is displayed on both monitors making it ideal for surveillance applications. The scan rate and duration of each camera can be configured using the on screen menu functions. (Includes remote)

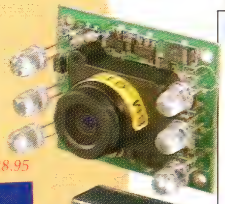
S 9200
Was $225, NOW
$199

PCB & Lens Cameras.

Using only a 3 wire connection, these mini cameras can be installed so they are virtually undetectable. 3 models to choose from.

S 9010
S 9011 with Audio
S 9021 Pinhole + Audio
All Only $119

All models require regulated supply. (M 9449) $28.95



FREE PLUG PACK OFFER!!!
Every camera purchased this month will include a free plug pack , valued at up to $ 28.95

Wide Angle Miniature Camera

Supplied with in-line BNC connectors for video and a DC Jack for powering the unit. Includes an internal regulator. *M 9272 Power Supply to suit $14.95*

Features:
- Simple to install • 3 Wire connection • Composite Video Signal Output • Small unobtrusive size
- 500 x 582 pixels • 380 lines• 12V DC Operation
- Diecast housing • Adjustable swivel bracket • 130° viewing angle.



S 9001
Was $139, NOW
$119

The Polestar Video Modulator

This video modulator converts composite video into modulated RF enabling a video camera an microphone to be connected to your television antenna system, making it ideal for use as a door monitor and one way intercom without the need for a dedicated CCTV monitor.

Features: • 12VDC power • Adjustable RF frequency UHF Channel 28-47 • Test pattern output for easy tuning • Includes RF and video cable • Provision for optional external "Call" button

New in '2000



S 9220 ONLY
$129

M 9449 Power Supply to suit $28.95

Programmable Remote Control



Very simple to program and operate. Replaces up to eight remote controls plus adds up to 10 one-touch macro functions for armchair comfort.

Features: • Auto power save • Useable with all modern AV equipment (e.g. DVD) • Stylish touch screen display • Adjustable Backlit display • Smart and easy to programme.



Requires 4 x 'AAA' Batteries (2pks) S 4950 $1.90 per Pack

A 1001 ONLY
$199

Digital LCD Panel Meter



This LCD module will take care of most of your requirements of digital voltmeter displays. Ranges and decimal place options are easily configured by PCB links. Compact and reliable ,comes complete with plastic surround for a professional finish.

SAVE 40%!!

Features • 3.5 Digits • up to 1000V DC range • 9VDC power supply • ± 0.5% (2 digit)

Q 0560 Was $45,
NOW **$25**

32 Range DMM + Temp

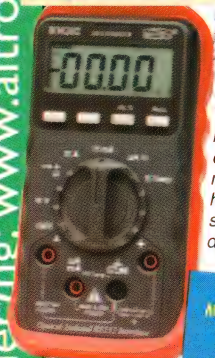


Featuring an extra large display, this multi-function meter hosts all the usual functions as well as a transistor tester, capacitance up to 2000pF, continuity/diode test, temperature and frequency counter up to 20kHz.

Q 1066 Was $89,
NOW ONLY
69.95

Includes Holster & Temperature Probe! Ideal meter for students, teachers, tradesmen, etc.

Brymen® Multi-Function DMM



Features: Auto ranging • EF Detect • Data Hold function • Temperature • AC/DC Voltage 250mV–750V • AC/DC Current 250µA–10A • Resistance 250Ω–25MΩ • Diode Check & Buzzer • Optically Insulated RS232 Interface (Q 1082)

*The Brymen® **Q 1080** digital multimeter is truly an amazing piece of test equipment with features only found in meters 2 or 3 times the price! One of the handiest features is the EF function, in short, this function will enable the user to detect 240VAC mains without even connecting a single test lead!*

240V Rated
Meets EN61010–1 IEC1010–1 CATII 1kVDC/750VAC CATIII 600VAC/DC with 6.5kV transient protection!

Q 1080
$155

Optical RS232 Interface



Q 1082 Optically Isolated RS232 Interface

This interface is perfect for converting your Q 1080 into a fully fledged Data Logger. It is very simple to setup and use with any PC running Windows 95/98. A unique feature of the kit is the optical interface which ensures the Q 1080 and PC it is connected to do not fail in the event of either device becoming faulty.

Q 1082 RS232 Interface **$25**

Mains Power ANYWHERE! ANYTIME!

600 W Inverter

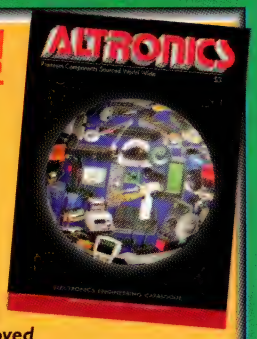


M 8118 Was $389
NOW **$279**

Features:
- ±10% regulation, modified square wave output
- 90% Efficiency • Thermal and overload protection
- Compact and lightweight • Audible Low Battery Alarm & Shutdown • High Surge Capability
- Fan cooled

This inverter will generate 240V AC power from your car battery! Up to 600W of appliances can be powered such as televisions, VCR's, incandescent lights, shavers, etc. Use it as an emergency back-up power supply for your home or as an independent power source in a caravan, avoid the costly conversion of mains powered appliances to 12VDC.

It's Official!



We are pleased to announce that the release of our 18th edition 2000 - 2001 catalogue is just around the corner. 256 pages, jam packed with hundreds of exciting new products, improved specifications, new format and expanded index!

*To register for your **FREE** copy either e-mail us at: catalogue@altronics.com.au ,or phone us on 1800 999 007. Priority will be given to e-mail requests.*

Please Note: EA (Electronics Australia) & Silicon Chip subscribers will automatically receive their catalogue FREE with the respective July editions i.e NO NEED TO REGISTER WITH US!

INSPECT-A-GADGET

ILLUMINATED MAGNIFIER
NO MORE EYE STRAIN!!

"Excellent for servicing PCB's and identifying micro miniature circuitry"



A 0970A Was $129, NOW JUST **$99**

Identify those impossible to read micro miniature components with our "Inspect-A-Gadget" illuminated magnifier.
Uses are not only limited to electronics, of course. It's ideally suited to stamp and coin collectors, model makers, embroiderers, jewellers and the like.

FREE !!!
This month buy the Inspect-A- gadget and you will receive a bonus A 0960 Hand Held Illuminated Magnifier valued at $11.50

120W Gas Soldering Iron Kit

SOLDERING GRUNT TO GO!!

"This has all the convenience features of a normal gas iron, such as quick heating, no power cords, light weight and best of all, it comes with a blow torch tip."
Silicon Chip Mag, Sept '97



The T 2601 kit comprises of a 120W Gas Soldering Iron PLUS a handy carry case with a range of tips and accessories including cleaning sponge, solder dispenser, blow torch, hot air blower and hot knife cutter.

T 2601 Was $149 , NOW **$129**

MASSIVE 120W Heat capacity! Simple "thumb-start" piezo ignition refillable gas storage!

23 Range Digital Multimeter

This compact meter will easily slip into your pocket, it's great for anyone on the move, or alternatively for a students toolkit. Includes an audible continuity buzzer, Transistor Tester, Diode Tester, 'K' type thermocouple, and square wave test output. Measures DCV to 1000V, DC Amps to 10A, ACV to 750V, resistance to 2MΩ and temperature from -40°C to 250°C. All this plus a HOLD function for this tiny price!



Q 1059 Was $32.95,
NOW **$25**

Includes temp probe for measurements up to 250°C!

TV Across Australia

A comprehensive guide to Television stations and frequencies in rural australia. Covers all states and territories. Perfect for people on holiday or for people who are always on the move.



B 2195 ONLY **$21.95**

The Most Comprehensive guide to Australian Television Channels. DON'T LEAVE HOME WITHOUT IT!

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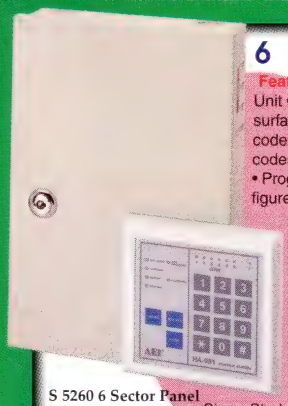
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12 months minimum warranty*

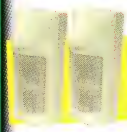
ALTRONICS

6 Sector Alarm System



Features: • Separate Keypad and Control Unit • Keypad suits standard 2 gang wallbox or surface mount block • Programmable Master code, Client Code and 8 user codes • All user codes are equipped with Duress Function • Programmable Zones • All zones can be configured for single or multiple triggering • Full memory of alarm events • Programmable entry / exit delay and alarm duration • Programmable response time for each zone • Exit/ entry beep enable / disable options • Instant arming codes for home or away options • Provision for arm / disarm with up to 3 remote keyswitches • Power watchdog resets the system before the battery is exhausted • Non-volatile memory • Connection for remote Siren, Strobe • Built in dynamic battery charger and tester • Battery condition can be checked manually or automatically • AC/DC Operation • Battery backup capable • 12 months warranty

S 5260 6 Sector Panel ONLY **$249**



SECURITY SAVER DEAL !!
Purchase the 6 sector alarm panel and a S 5309 Dual detection PIR for $299 , and receive a second S 5309 PIR absolutely FREE!!! That's $55 Extra Value.

Inductance & Capacitance Meter



An essential piece of test equipment for designing crossovers, power supplies, RF circuits, etc.

- 3.5 Digit LCD Readout • Diode & Continuity Test
- Auto Power Off
- Shock-proof rubber holster
- 20µH-20H Inductance Range
- 200pF-20,000µF Capacitance Range
- Continuity Buzzer
- Diode Check
- Individual zero adjust for capacitance & inductance range

Q 1150 WAS $109, NOW **$99**

SAVE 20%!!

150W Active Sub-Woofer Module



The inclusion of this sub-woofer will enhance any existing sound system and add a touch of realism to any home theatre sound system.

This completely self-contained amplifier module simply fits into the back of a sub-woofer cabinet. The unit will automatically spring into life from it's Standby mode once a signal is received. The Volume and Crossover Frequency Controls together with the Phase Correction Switch allows the sub-woofer to be set for a desired sound. Installation can be completed in just minutes.

A 2450 Was $275, NOW ONLY **$199**

Features: • Auto Power On/Off with signal presence • Compact design • High & Low Level Inputs • High Level Outputs • Volume Control • Short Circuit Output Protection • Active Crossover variable from 50Hz - 150Hz • Phase Correction Switch • Power On Indicator • 240V Operation

Dual Detection PIR



Features: • Double twin optics for improved detection • Automatic temperature compensation • Compatible with many standard alarm systems • Vertical adjustment for detection angle • Normal or Pulse count modes

Alarm systems with standard P.I.R's are prone to false triggering. The S 5309 features double twin optics which reduces the number of false triggers, all at the price you would expect to pay for a standard P.I.R.

S 5309 ONLY **$55**

UHF Remote Control Switch



This little gadget can easily be used to create a very simple panic alarm, remote lighting control or to control any other item you may wish to operate remotely.

Operates in 3 modes: • **On/Off** The contacts are switched alternately. • **Momentary** The contacts are held closed while the button is held down in the momentary mode. • **Panic** The button must be held down for 2 seconds to operate the relays and also trip the transistor output.

Features: • Latching/Non-latching Contacts • 2 Relay & 1 Transistor Outputs • Code Hopping • Audible confirmation • Incorporates handy key ring • 387 billion combinations • 30m operating range (open area) •24 V DC 1 Amp contacts

A 1018 Was $110, NOW **$99**

PECC Bass Drivers



If you like your bass loud, these 8Ω bass drivers are for you. They feature poly emulsion coated cones (PECC) with rubber surrounds, low Q and high efficiency. Manufactured exclusively for Altronics, to our own specifications, these drivers are ideal for subwoofer enclosures in Hi-Fi, Home Theatre or Car Audio systems.

AMAZING VALUE!
Perfect for hi-fi or car audio subwoofers!
SAVE 40%!!

	Was	NOW
C 3022 165mm (6.5") 60W	$45	**$29** ea
C 3024 200mm (8") 100W	$64	**$45** ea
C 3030 300mm (12") 160W	$155	**$89** ea

Aluminium Case



This quality aluminium tool case measures 460 x 325 x 150mm.

Features all aluminium side panels, unlike others around which have plastic panels!

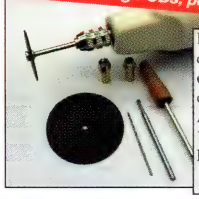
T 5020 **$65***

**Tools in case not included*

THIS MONTH ONLY!!
A Q 1053 19 Range DMM valued at $19.95 *FREE* with every purchase of a T 5020 Aluminium Tool Case

MINI DRILL KIT

Great for drilling PCBs, polishing, or engraving.



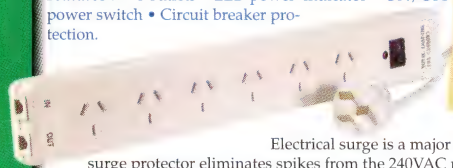
Includes two cutting disks, sand paper sleeve, engraving bit, four chucks and a PCB drill. A powerful high speed 12VDC motor will easily handle any task.

T 2303 **$29.95**

6 Way Power Board + Surge Protector

NEW in '2000

Features : • 6 outlets • LED power indicator • ON/OFF power switch • Circuit breaker protection.



Turn one GPO into six and protect your valuable equipment at the same time!

P 8140 6 way mains filter ONLY **$35.95**

P 8150, 6 way mains filter + Tel. protector ONLY **$44.95**

Electrical surge is a major cause for home appliance breakdown. This surge protector eliminates spikes from the 240VAC mains supply, saving your household appliances. Suitable for any standard 10A GP outlet. The P 8150 model also has standard telephone connectors enabling you to protect your telephone.

NEW KITS

DIGITAL VOLTMETER

NEW in '2000



(SC Feb. '2000) Keep tabs on your car's battery condition. See website for full details.

K 4338 **$34.95**

RCD TESTER

NEW in '2000

(SC Feb. '2000) Safely test the operation of a Residual Current Device. See website for full details.

K 6040 **$14.95**

SINE/SQUARE WAVE GEN.



(SC Feb. '2000) Generate sine/square waves with this audio waveform generator. See website for full details.

K 2549 **$44.95**

ACTIVE MASTHEAD AMPLIFIER



(EA Jun. '98) Improve your TV reception . See website for full details.

K 1795 Was $39.95 NOW **$24.95**

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*No Risk 14 Day Money Back Guarantee: If you are dissatisfied with our goods for any reason, please return to our premises within 14 days of our despatch date and we will refund your purchase in full, less transport costs. All items must in *NEW* condition.

**12 months minimum warranty: 12 months from date of supply. Goods becoming faulty in this period should be returned to our premises with evidence of purchase and $6 money order, cheque or stamps to cover return postage.

Standard Delivery & Packing Charge: $5.00 to 500gms, $6.00 500gms-1 kg, $9.00 1kg-5kg. Where possible we process your order the day received and despatch via Australia Post. Allow approx 9 days from day you post order to when you receive goods.

*Overnight Jetservice: Up to 3kg is $9.50, 3kg to 5kg is $16.00—We will process your order the day received (if placed before 2.00PM WST) and despatched for delivery the next day. Country areas please allow an additional 24-48 hours.

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NEW PRODUCTS



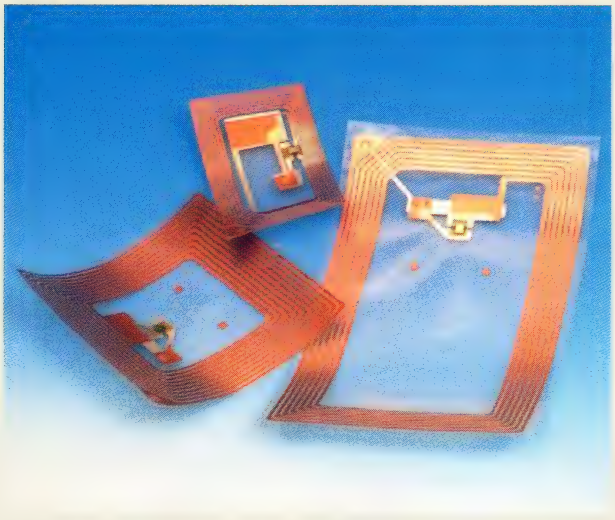
Tektronix' TDS7000 Series

The world's fastest real-time oscilloscope

THE NEW TDS7000 Series Digital Phosphor Oscilloscopes (DPOs) lead the industry in addressing the critical measurement needs of engineers who design next-generation global communications and Internet products.

Based on a new, open Windows platform, the innovative TDS7000 family combines exceptional performance — including up to 20GS/s real-time sample rate, record length to 32MB (option 4M) and up to 4GHz bandwidth — with operational simplicity and unmatched connectivity.

More information on the TDS7000 can be found on Tektronix' DPO micro site at **http://dpo.tektronix.com**.



New miniature smart-label from TI

TEXAS INSTRUMENTS has announced the addition of a new Tag-it transponder to its family of radio frequency identification (RFID) smart label inlays. This miniature 22.5 x 38 mm (0.9 x 1.5in) rectangular-shaped inlay can be easily incorporated into smart labels, or embedded into source tags used for authentication and brand protection of valuable products. It can also be incorporated into plastic cards for access control, applied to containers and totes for logistics automation, or used to track and manage important insurance, legal, or medical files.

Like previous Tag-it inlays, the new miniature model is paper-thin, re-programmable, flexible and capable of being read simultaneously by fixed-position readers or handheld scanners.

Inlays consist of an integrated circuit, an anten-

na and require no batteries. Having a maximum thickness of 0.360mm, the inlay is small enough to be laminated between layers of paper, film or plastic to produce inexpensive consumable labels and cards that can be customized using ordinary print-on-demand printers. They can also be directly embedded into materials such as plastic, wood, and fiber, to create a hidden and durable ID tag.

In basic terms, RFID technology involves wireless communication between a transponder and reader unit. Signals from the reader unit instruct the transponder to transmit back stored data, which is then used to activate a system, authorise a transaction, locate an item, or retrieve an asset profile.

For further information goto **http://www.ti.com/mc/tiris**.

Thin substrate presensitised PCB

TURN-AROUND time, cost savings and security are all reasons printed circuit boards are manufactured in-house. While the standard 1.6mm thick substrate PCB is suitable for many applications, occasionally a thinner substrate is required.

In addition to the 1.6mm phenolic paper PCB and 1.6mm fibreglass PCB, Kinsten have released single-sided fibre-glass PCB in 0.6mm, 0.8mm, 1.0mm and 1.2mm thickness.

Double-sided fibreglass PCB is available with the same thickness range as single sided PCBs, but is also available with a 0.4mm substrate.

The presensitised PCBs are supplied in 150 x 300mm sheets, with 1oz copper foil. They are individually packed, with an additional light-tight adhesive protective cover over the presensitised surface.

All of the Kinsten PCB has machine-applied positive photoresist, giving an even coating ready for immediate use. The resist remaining after etching acts as a solderable lacquer to protect the copper tracks, removing the need to strip or scrub it before further processing.

Further information is available from Computronics Corporation, Locked Bag 20, Bentley Business Centre WA 6983. Phone (08) 9470 1177, Fax: (08) 9470 2844, Web: **www.computronics.com.au/tools**.

Computer monitor test generator

EMONA INSTRUMENTS is offering the GV-241 Test Generator from Promax, which is an indispensable instrument to verify and repair computer monitors. The GV-241 is a universal generator that accommodates the wide range of the different graphic systems which are used today — it supports up to 29 possible graphics systems.

The instrument can manage all of the following parameters: horizontal and vertical scanning periods or frequencies, horizontal and vertical scanning front porch time, horizontal and vertical scanning back porch time, horizontal and vertical synchronisms, polarity of synchronisms and interlace. The user can select each graphics system via the front panel buttons and easy to read, backlit LCD display.

The GV-241 offers three types of connectors for direct connection to the monitor: the D9 is for Hercules, CGA and EGA monitors, the D15 miniature is for VGA monitors while the D15 is for MAC II monitors. In addition, there are the individual outputs: R, G (with manual synchronism select), B, CVS (video without synchronism), VS (vertical synchronism) and CS (composite synchronism) through BNC connectors.

A total of eight pattern charts are available and can be selected for any of the graphics systems generated. They are: 4 colour bars, white 100%, multiburst, crosshatch and scales of grey. Each pattern enables a particular adjustment or the detection of defects in the various modules of the monitor through simple observation of the resulting picture or the video signal with an oscilloscope.

For more information, contact Emona Instruments on (02) 9519 3933, fax on (02) 9550 1378 or email testinst@emona.com.au. ■

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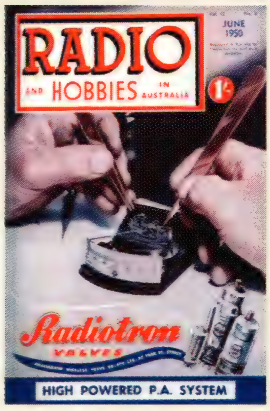
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HISTORY & CROSSWORD

Published since 1922, **Electronics Australia** is one of the longest-running technical magazines in the world. Here are some interesting items from past issues:



50 YEARS AGO

Interesting Binary system: According to T. M. Berry, General Electric Company engineer, whose work centres about calculating machine design, most "electronic brains" work with a number system based on only two numbers instead of ten.

The method, known as the "binary system," uses only the symbols "0" and "1" and disregards two, three, four, five, six, seven, eight and nine.

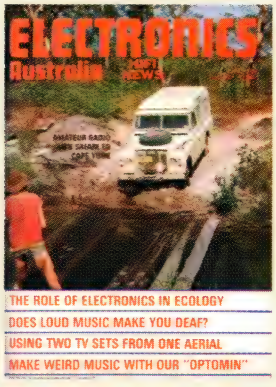
This, incidentally, is the year 11110011101.

Crystal triode: The transistor, a crystal device which can amplify, has made quite an impression overseas, and many new uses have been found for it.

The transistor is a germanium crystal device. It differs from the familiar crystal diode, of which the 1N34 is a well known example, chiefly in that the transistor has two catwhiskers instead of one.

One whisker, called the emitter, acts in a manner comparable to the grid of a triode vacuum tube. The point of the second whisker, called the collector, touches the surface of the germanium crystal extremely close to the place of contact of the first whisker and acts like the plate of a triode tube.

The crystal itself (called the base in crystal triode terminology) is comparable to the cathode of a tube.



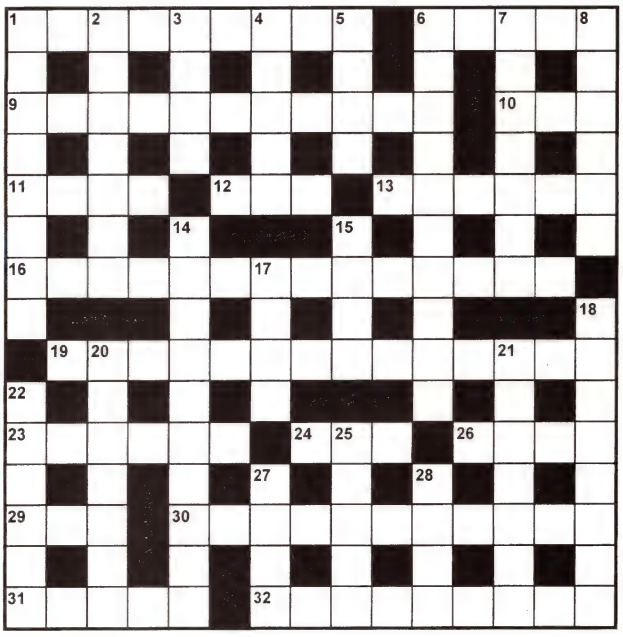
25 YEARS AGO

Schoolboy cracks computer system: A 15-year-old schoolboy completely cracked the security system of a major London computer time-sharing service several months ago, gaining access to secret files stored in the computer by other users. The schoolboy, Joe, worked on the project for just four months, his sole access to the computer being the teleprinter terminal at his school.

The trick Joe used was to listen to the sign-on procedure to learn the account name and password of highly privileged users, and then pretend to be them in order to gain access to secret files.

CCD TV camera: RCA recently demonstrated broadcast television's first "tubeless" TV camera to produce colour pictures from solid-state image sensors known as charge-coupled devices.

The experimental camera uses three postage-stamp size CCD's - one for each of the red, blue and green components of the picture - instead of the three pickup tubes used in most conventional colour cameras. ■



ACROSS

1 Large unit of frequency. (9)
6 Pierre —, Nobel prize-winner for radioactivity study. (5)
9 Feature of certain valves. (4,6)
10 Society of automotive engineers. (1,1,1)
11 Relationship of Marie Curie to 6 across. (4)
12 Major brand of electrical consumer goods. (3)
13 Network of conductors. (6)
16 Insulated conductor. (9,5)
19 Vital component of a computer. (14)
23 Metallic chamber. (6)
24 Cathode ray tube. (1,1,1)
26 Operatic song. (4)
29 Optical character recognition. (1,1,1)
30 Excessive control of oscillations. (11)
31 Details (abbr). (5)
32 Feature of a long-play VCR. (4,5)

DOWN

1 Large unit of power. (8)
2 Profitable. (7)
3 Break into a computer system. (4)
4 Limit of operation. (5)
5 Align two elements of a system. (4)
6 Made parallel. (10)
7 Train for new job. (7)
8 Ability to do work. (6)
14 Sequences of steps. (10)
15 Reverse of undo. (4)
17 Exclamation after an error. (4)
18 Placed in a pattern. (8)
20 Opposite in effect. (7)
21 Availability of telecommunication. (7)
22 Reflections. (6)
25 Part of the electromagnetic spectrum. (5)
27 Hand-operated switches. (4)
28 Complementary metal oxide semiconductor. (4)

May Solution

	M	U	L	T	I	F	U	N	C	T	I	O	N	
M		N		R		E		E		E		V		M
U	R	A	N	I	U	M		P	L	A	T	E	A	U
L		R		P		T		E		R		R		L
T	I	M	E		B	O	A	R	D		C	A	S	T
I		E		E		A		S		T		L		I
V		D	Y	N	A	M	O		O	U	T	L	E	T
I				T		P		E		T				R
B	U	C	K	E	T		R	A	D	O	M	E		A
R		A		R		G		R		R		L		C
A	U	R	A		H	E	C	T	O		D	E	S	K
T		I		S		A		H		L		C		I
O	R	B	I	T	E	R		B	U	I	L	T	I	N
R		O		A		U		U		F		R		G
	M	U	L	T	I	P	O	S	I	T	I	O	N	



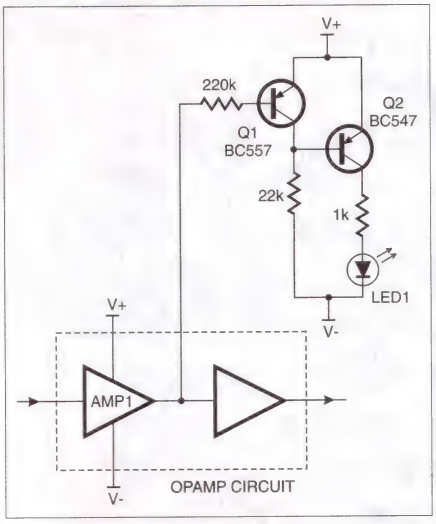
THIS MONTH:

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90 Vintage Radio
93 Review: Mains Monitor Kit
94 $10 Wonders: Urgent alert
96 Marketplace
98 Webwatch
98 Dilbert

generator

IDEAS FOR EXPERIMENTERS

Clipping indicator for opamp stages



IN A CIRCUIT that uses a series of opamp stages it's often helpful to know when one of the earlier stages has been driven into overload — particularly when that stage has a variable gain control. A conventional level sensing circuit (detector, comparator, LED diver, etc) can be used to monitor the stage, but a much simpler circuit can do pretty much the same job. It uses just two transistors and a LED, and detects an overload by monitoring the voltage difference between the opamp output and the positive supply rail — when there isn't any difference, the opamp must be clipping...

As well as being simple, the other big advantage of this type of sensing is that clipping will be detected regardless of the supply rail voltage or it's fluctuations. Plus of course you don't have to set it up to 'trigger' at a particular signal voltage level (as it the case with the conventional approach), and it can cope with a very wide range of power supply voltages (with appropriately-rated components).

The circuit is direct-coupled to the opamp output via a 220k resistor, which biases Q1 normally on. This in turn holds Q2 normally off, preventing current flow through LED1. If the opamp output swings within about 0.7 volts of the positive supply rail, Q1 momentarily turns OFF, allowing Q2 to be biased on via the 22k resistor. LED1 will therefore illuminate to indicate an overload, at a rate determined by the frequency of the incoming signal — the 1k resistor sets the LED brightness.

Note that the circuit must use the same supply rails as the stage it's monitoring, and the components values will need to be altered if the rail voltage is not in the region of +/-12V.

THIS MONTH'S WINNER!

Golf Buggy Speed Control

FOLLOWING THE REPEATED failure of the output drive transistors in my brother's 12V electric golf buggy, I devised the following replacement that has been in operation for a year now.

In the circuitry, output drive to the buggy motor is now provided by two BUK456-60 MOSFETs wired in parallel. The output drive to the motor is pulsed with a variable mark/space ratio and ensures that the MOSFETs are either driven hard on or are completely in the off state.

I found that with the control set at full speed and the drive motor stalled, there was a current flow of 40A. The BUKs are rated at 50A continuous for each, so the paralleling two of them provides a suitable safety margin. The 120 ohm resistor to the gate of the MOSFETs proved to be necessary to obviate some spurious oscillation in the output to the motor.

The MOSFETs are mounted with the rest of the circuitry inside a metal box, using the correct insulating materials to isolate them from the box and the metal frame of the buggy. The switch and speed control pot are mounted in a small box high on the handle of the buggy.

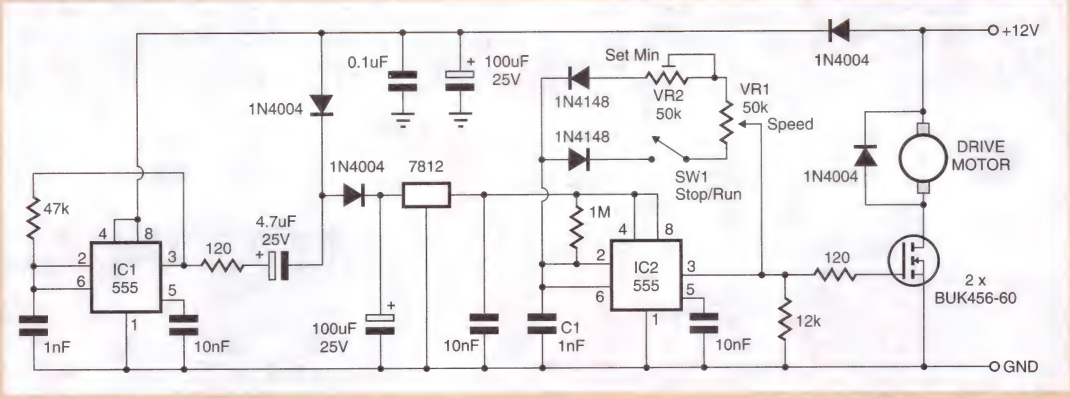
The drive pulses to the MOSFETs are provided by IC2, an LM555, that operates as an oscillator with a frequency of around 13kHz. The pot, VR1, is a 50k linear type and acts in conjunction with the two routing diodes as a speed control by adjusting the mark/space ratio of the drive signal. The trimpot, VR2, is used to adjust the slow speed of the buggy, and is currently set at about 30k with a pulse mark/space of almost 40%. There is no point in having the buggy moving at a speed less than a slow walk.

IC1, its diode pump output and the 7812 voltage regulator provide a supply of 12V to IC2 even when the buggy battery has dropped below 10V. Buggy users tend to drain the last drop out of a prematurely dying battery, and this voltage doubler scheme supplies a constant 12V rail to IC2. The gate drive from IC2 is therefore maintained at an amplitude sufficient to ensure that the MOSFETs are fully saturated when conducting.

The switch is used to stop any drive to the motor. The 1M resistor to pins 2 and 6 of IC2 is included so that C1 will be held high while the switch is off. The value of 1M has little effect on the mark/space ratio while in the run mode.

Any circuit board tracks for both the drains and the sources of the MOSFETs carry high current, and should be beefed up by soldering heavy tinned copper wire onto them.

Colin Christensen
Redcliffe, QLD **$25**



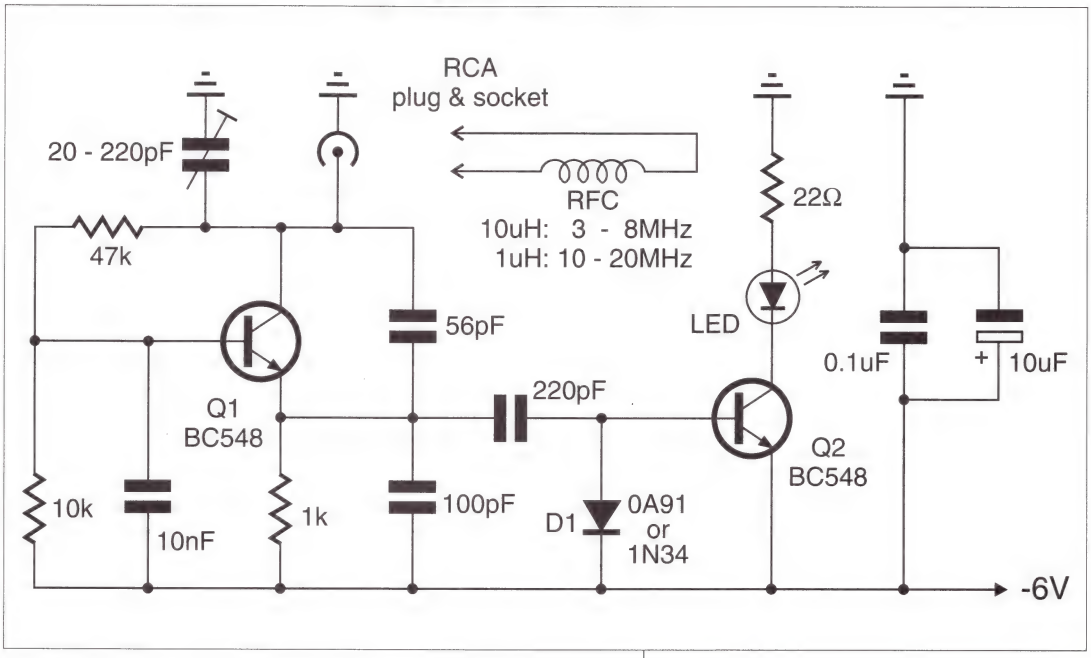
IDEAS

Interesting original circuit ideas and design tips from readers. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide any further information.

Win our 'IDEA OF THE MONTH' Prize! Valued at $469!

As an added incentive for readers to contribute interesting ideas to this column, the idea we judge most interesting each month now wins its contributor an exciting prize, in addition to the usual fee. The prize is a Video Inspection Capture System from Allthings Sales & Services, which consists of a colour CCD camera, close-up lens set, adjustable stand and lamp, PCI video capture card and software, plus video cable and two plugpacks. You can find out more about this great system at the Allthings website; www.allthings.com.au.

The Dip Led



RADIO AMATEURS and electronics experimenters know the value of a grid dip meter in the workshop. A dip meter provides several useful functions for the radio experimenter — the ability to determine the resonant frequency of a tuned circuit, an absolute wave meter, a source of variable RF frequency, to list a few.

I recently developed this modern version of the old valve dip meter, which uses a LED to indicate oscillator activity rather than a fragile and costly (these days) meter movement. The Dip Led uses a BC548 (Q1) in a conventional oscillator circuit. The tuned circuit consists of a cheap variable capacitor (Dick Smith Electronics R2970) with both gangs (10 - 60pF and 10 to 160pF) in parallel, and a plug-in coil (using several RF chokes).

The oscillator is coupled to a rectifier/LED driver transistor (Q2, a BC548) to indicate oscillator output. When the oscillator coil is brought near a tuned circuit, a clear dip in the LED brightness indicates the resonant frequency of that tuned circuit. The oscillator coils for each range are mounted on RCA plugs, and these are inserted into a panel mounted RCA socket. This provides an additional benefit of turning off the grid dip meter when a coil is not plugged in.

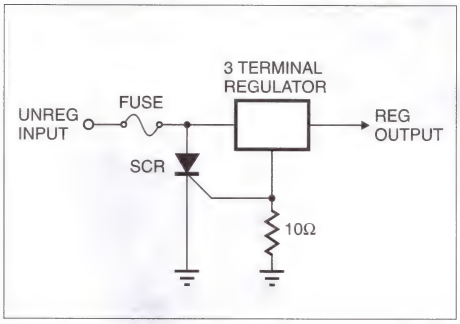
Oscillator frequency can be determined by bringing a 'sniffer loop' of approx 10 turns of wire connected to a frequency counter near the oscillator RFC.

The circuit is powered by four 'AA' cells connected in series, and the RF chokes are available at Dick Smith Electronics (R5200, R5214, etc).

Grant Wills
Gosford, NSW **$30**

IDEAS FOR EXPERIMENTERS

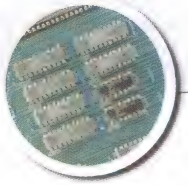
Overvoltage protector for 3-terminal regulators



YOU CAN PROVIDE crowbar overvoltage protection for a three terminal regulator by using its reference terminal bias current to gate-on an SCR crowbar, which in turn blows a fuse in series with the input to the regulator.

If the unregulated input rises too high, the reference current sources a considerable increase in current, gating the SCR on. You'll need to use a sensitive-gate SCR, and choose a resistor value that will provide sufficient bias to trigger the SCR at the desired input voltage. ■





BY ANDREW PALMER

8-Channel IR Transmitter & Receiver

Here's an updated design for a low cost IR transmitter and receiver which allow remote control of as many as eight different channels, over distances of up to about eight metres. Two of the channels have 'toggling' outputs, while the other six can be set for either toggling or momentary operation.

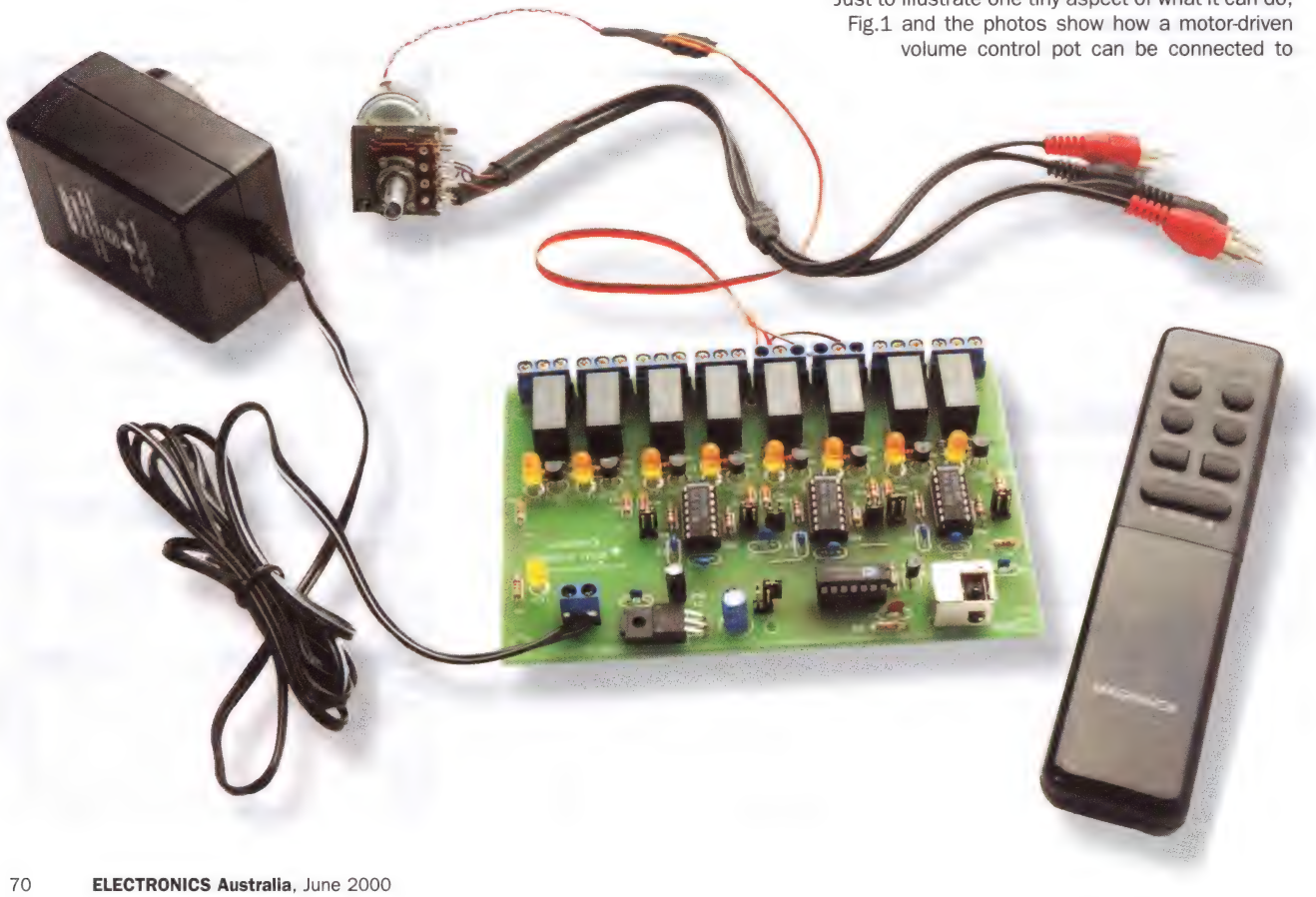
NEED TO SET UP a short range, multi-channel remote control system? This new design might well be what you're looking for. It's an infra-red system, with a range of up to about eight metres and the ability to control as many as eight channels. It could easily be used for mode, source and volume control in a home audio or home theatre system, for controlling a small lighting system or even for selecting various functions in a model railway layout. It's low in cost, too.

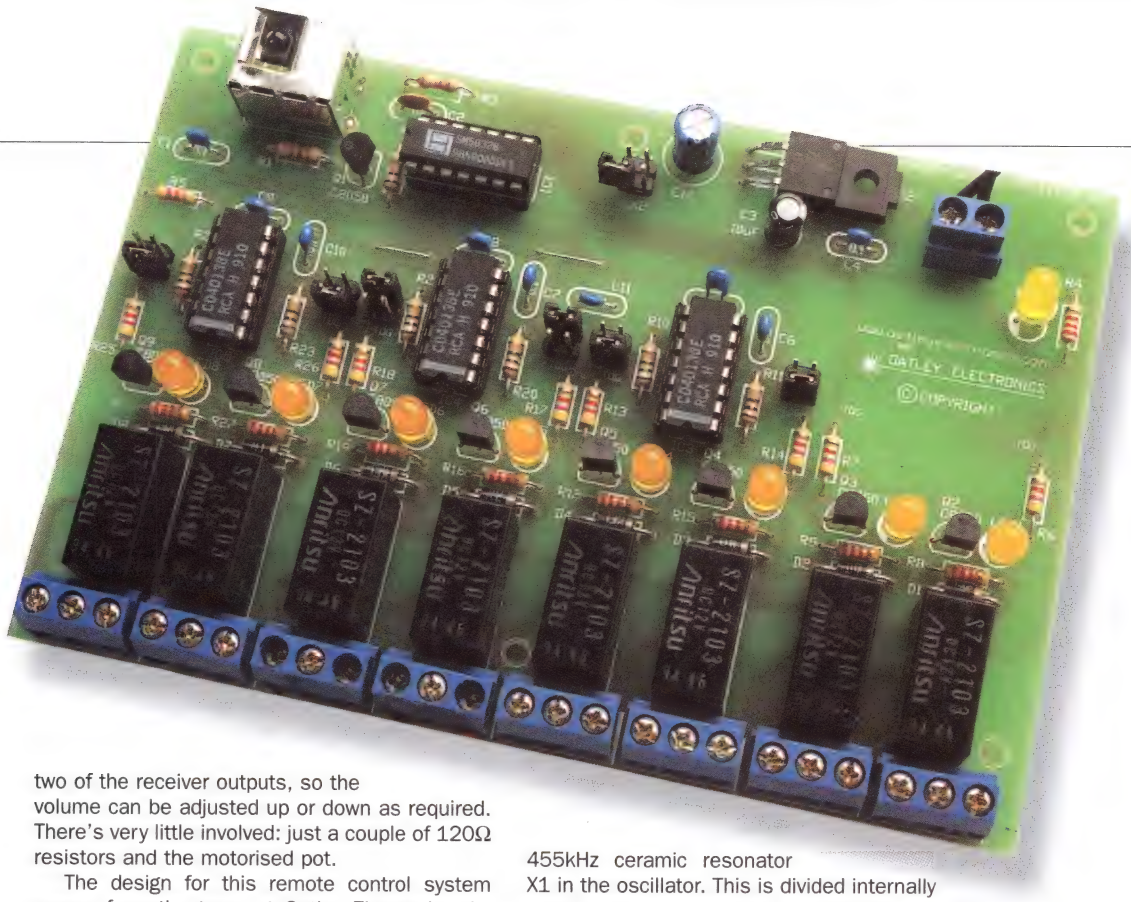
The transmitter is a very neat little unit housed in a recycled commercial remote case. It uses an 8-channel encoder chip, with its clock oscillator based on a ceramic resonator so there's no need for any setting-up adjustments. The matching receiver has eight relay-type outputs, two of which provide toggling or 'press on/press off' operation while the other six can be jumper programmed for either toggling or momentary operation (where the output operates for as long as the transmitter button is pressed).

As a bonus, both transmitter and receiver can be link programmed for four different 'custom code' combinations. This allows you to use up to four different transmitters and receivers together in the same room, without interaction — a total of up to 32 different control functions!

As you can see the system is pretty flexible. Just to illustrate one tiny aspect of what it can do, Fig.1 and the photos show how a motor-driven volume control pot can be connected to

***Below:** On the right is the transmitter, built in a surplus case. In the centre is the completed 8-channel receiver board, with a motorised volume control pot hooked up to show how easy this is...*





Left: *Use this closeup of the receiver as a guide when you're assembling your own board.*

two of the receiver outputs, so the volume can be adjusted up or down as required. There's very little involved: just a couple of 120Ω resistors and the motorised pot.

The design for this remote control system comes from the team at Oatley Electronics, by the way, and kits for the transmitter and receiver combination are available from Oatley at the very reasonable price of only $50 plus packing and postage.

The transmitter

As mentioned earlier the transmitter is based on 'recycling' a commercial IR remote, a compact eight-function Magnavox unit measuring 155 x 35 x 16mm. There are seven control buttons in all, one a long tiling button labelled Volume Up and Down, and the others labelled Tuner, CD, Preset, Standby, Stop and Play.

The Magnavox remote originally used an SAA3010 encoder chip, but the corresponding decoder for this is obsolete and difficult to get operational. So instead, Oatley has designed a new transmitter circuit with a circuit board designed to fit into the Magnavox housing, and using the existing buttons.

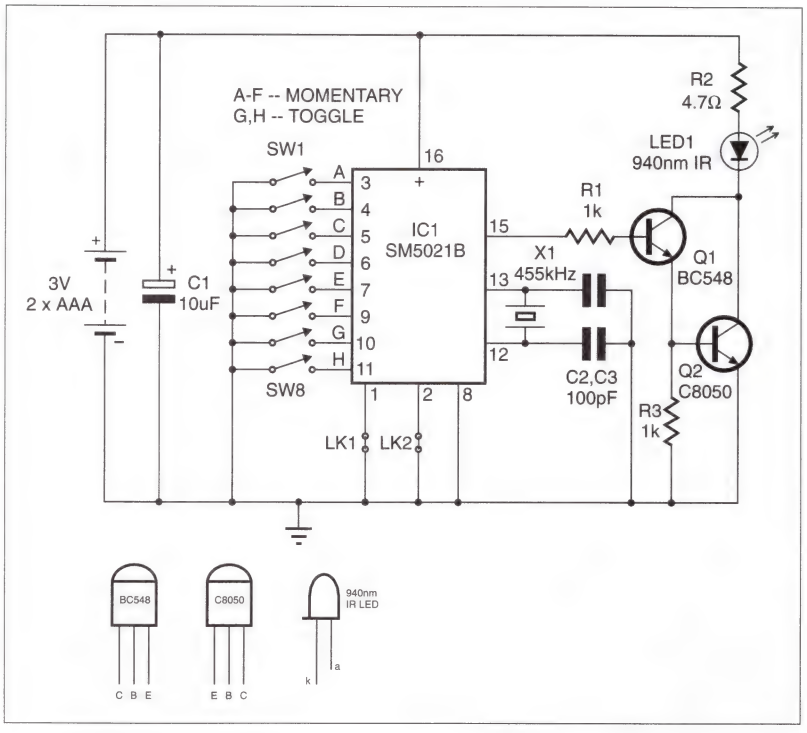
When the Tuner or CD buttons are pressed, these operate one of the latched or toggling outputs on the receiver board. To unlatch the respective output you need to press the same button — making them fine for functions like input source selection, etc. The remaining buttons control outputs on the receiver board that can be programmed for either toggle or momentary operation.

As you can see from the transmitter schematic, there isn't much to it; just an encoder IC and a couple of transistors to drive the IR light emitting diode, LED1. The data codes corresponding to the different control channels are produced by the pushbuttons SW1-8, which each ground one of the chip's input pins.

The SM5021B encoder chip (IC1) uses 455kHz ceramic resonator X1 in the oscillator. This is divided internally by 12, giving near enough to a 38kHz carrier frequency which is gated on and off by the data. The pulse train appears at pin 15 and drives LED1 through the Darlington transistor driver Q1/Q2.

The Darlington pair is functionally the same as a single transistor with a gain equal to the multiple of each transistor's gain. This allows us to switch high currents through the IR LED even

Below: *Here's the schematic for the transmitter. As you can see there isn't much in it.*



PARTS LIST

Transmitter

resistors

R1,3	1k 0.25W 5%
R2	4.7 ohms 0.25W 5%

capacitors

C1	10uF RB electrolytic
C2,3	100pF NP0 ceramic

semiconductors

IC1	SM5021B encoder
Q1	BC548 NPN transistor
Q2	C8050 NPN transistor
LED1	940nm IR LED, 5mm

miscellaneous

X1	455kHz ceramic resonator

Magnavox IR remote case with rubber keypad array; battery clips from original PCB; new PCB 89 x 30mm, coded K065TX; insulated hookup wire for link; two AAA cells.

Receiver

Resistors

All 0.25W 5%:	
R1,6,7, 13,14,17, 18,25,26	4.7k
R2	10k
R3	39k
R4,8,9, 12,15,16, 19,24,27	2.2k
R5	47k
R10,11,20-23	10M

Capacitors

C1,4-11	0.1uF monolithic
C2	1nF ceramic
C3	10uF RB electrolytic
C12	100uF RB electrolytic

Semiconductors

IC1	SM5032B decoder
IC2	7805 regulator
IC3-5	4013 dual flipflop
Q1-9	C8050 NPN transistor
LED1-9	5mm LEDs of suitable colour
D1-8	1N4004 1A diode

Miscellaneous

IRX1	HC312 or PIC 12043 IR receiver
Relay 1-8	Miniature 12V relay, PCB mounting

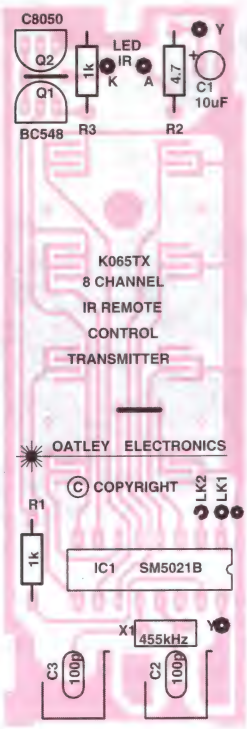
8 x 3-way PC mounting terminal blocks; 1 x 2-way PC mounting terminal block; 4 x 14-pin DIL sockets (for ICs 1, 3-5); 7 x 2-way jumper pin blocks with matching headers; PCB 140 x 94mm, coded K065RX.

Note: PCB designs for both transmitter and receiver are copyright to Oatley Electronics, and will not be available from other firms. However complete kits for both parts of the remote control system are available from Oatley at the following prices:

K065 Transmitter and Receiver.....$50
Plug pack suitable for Receiver .....$ 6

Also available is a motorised dual 50k + 50k volume control pot like that shown in the photo, suitable for use as in Fig.1, for only $9.

Add $6 to these prices for packing and postage within Australia. Orders should be sent to Oatley Electronics at PO Box 89, Oatley NSW 2223, or by email to sales@oatleyelectronics.com.



***Above:** Transmitter overlay.*

though Dout pin of the IC can only source 5mA. When buttons are not being pressed, pin 15 is low so no current passes through the transistors and LED. The chip itself has negligible current drain too, so the transmitter needs no power switch.

The two links marked LK1 and LK2 are used for custom coding, when it's needed; normally they are left open circuit. The only reason for installing these links is when you want to use more than one of the remotes in the same location, without interaction. In that case, you might for example install LK1 in one transmitter and LK2 in another transmitter. Note however that if you do this, you must ensure that their respective receiver boards have the matching links installed.

Receiver circuit

The receiver is a little more complex than the transmitter, mainly because of the eight different output and relay driver circuits. Otherwise the receiver's 'front end' circuit is almost as simple as the transmitter, thanks to the use of an IR receiver module.

The Oatley receiver board is designed to take either a PIC12043 or HC312 IR receiver module, and either may be supplied in their kit. These devices are almost exactly the same except for their different cases. They contain an IR detector diode, an amplifier tuned to 38kHz, a bandpass filter, an AGC section and a detector circuit. In both cases the output is a digital pulse train identical to that to the modulation applied to the 38KHz carrier at the transmitter, but is of inverted polarity.

Q1 simply inverts this modulation polarity to make it suitable for IC1, the SM5032B decoder chip. This contains an on-chip oscillator for decoding the incoming pulse train, with C1 and R2 the components which set the oscillator frequency. As a result IC1 provides active high digital outputs which corresponds to the buttons pressed on the transmitter.

Regulator IC2 provides a regulated and smoothed +5V supply for the receiver module, Q1 and the SM5032B. The links LK1 and LK2 are again used for custom coding when multiple systems are used in the one area. If the links are fitted, they must match those in their respective transmitter.

The outputs of decoder IC1 can only supply around 1mA, so driver stages must be used to operate the output relays. However there's no real setting up required — just fitting the jumpers to determine whether the six adjustable channels are set for toggling or momentary operation.

Output pins 9 and 10 of the decoder chip are those for the toggling-only channels, controlled by buttons SW7/G and SW8/H on the transmitter. The other outputs (3-8, corresponding to A-F on the transmitter) are those which can be set for either momentary or toggling mode.

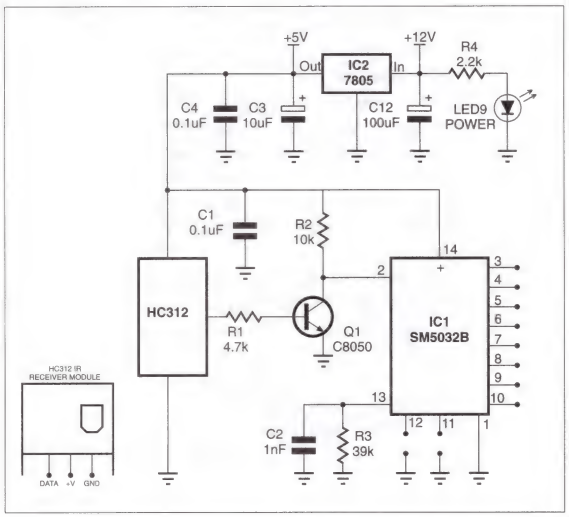
By the way, outputs A to F are multi-key control outputs. This means the SM5032B will decode several different outputs simultaneously if several different buttons are pressed on the transmitter at the same time. (Outputs G and H are single-key only outputs.)

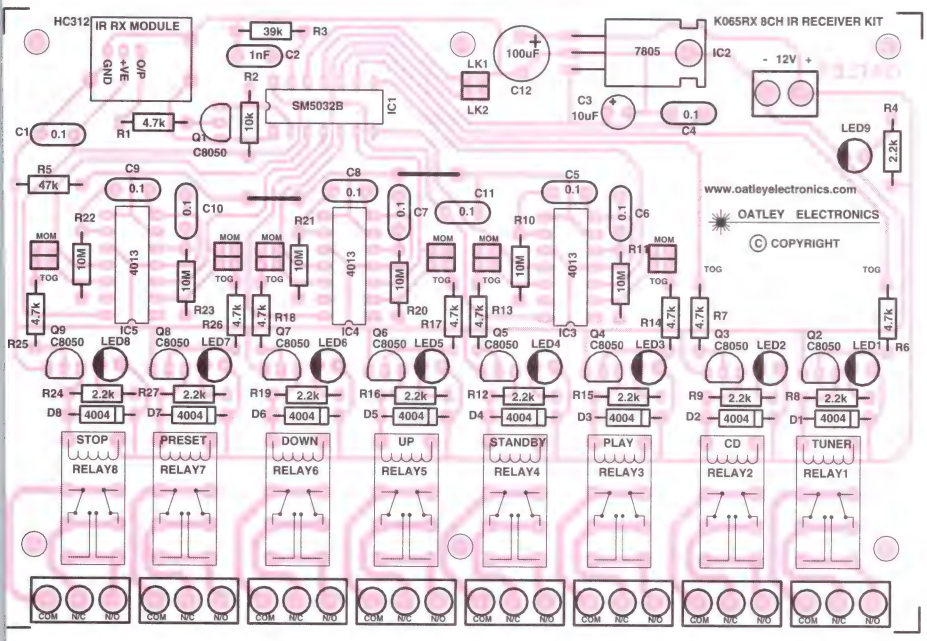
The relay driver stages are very straightforward. Each relay is controlled by a 2SC8050 switching transistor, an indicator LED and series resistor connected across each coil to show when each channel is activated. A reverse-connected 1N4004 diode is also connected across each coil to protect the driver transistor from back-EMF transients.

For the two toggling-only channels, the driver transistor base is driven directly from its IC1 output pin via a 4.7k resistor. In the other channels, which are essentially momentary in operation, there's also a 4013 flip-flop which can be connected between to the two, to provide toggling action.

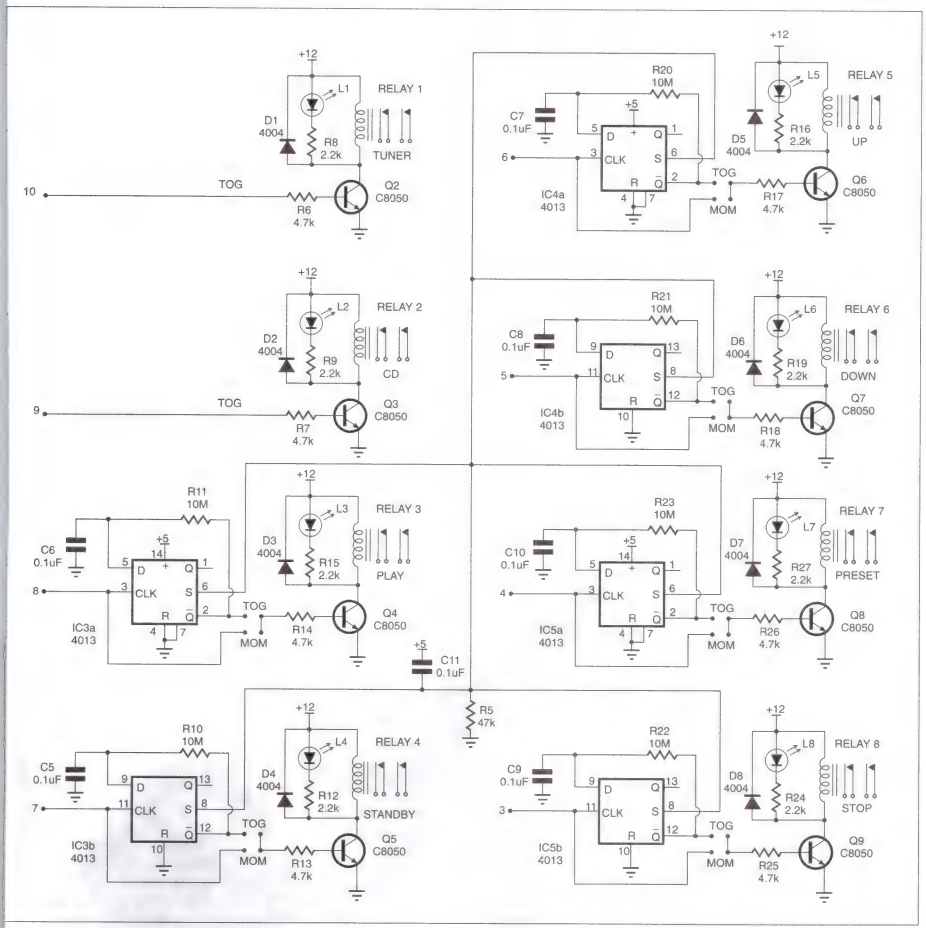
Transmitter assembly

The Magnavox transmitter is supplied in the Oatley kit in fully assembled and operational form, but has to be pulled apart and rebuilt because it won't work with the new receiver.





***Here's** the PCB overlay for the receiver (above), with the two parts of its schematic below and at lower left (facing page).*



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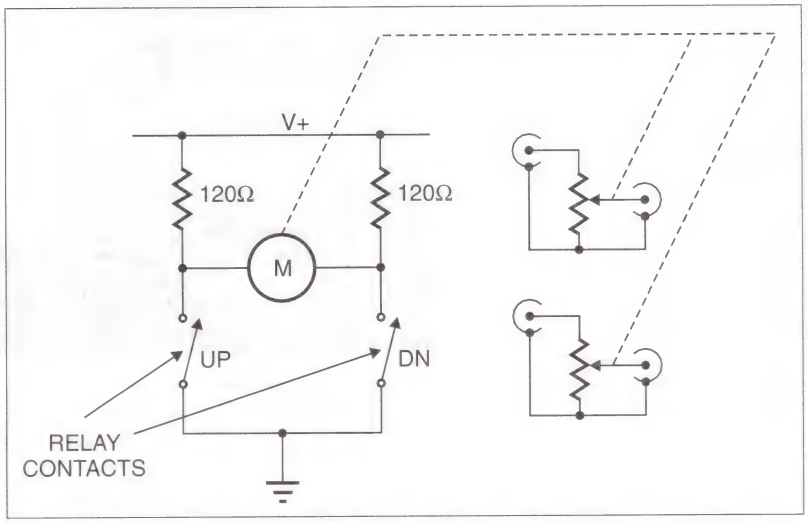


Fig.1: *How easily you can hook up a motorised dual-gang volume control to the receiver board, so the system can provide remote volume control via the Up and Down buttons.*

First you have to pull the transmitter apart by unclipping the case halves. You can do this by inserting a small screwdriver into the case join down the side and *gently* levering it apart. Don't apply too much force, otherwise you will damage the case.

Now lever out the existing PC board with its surface mount encoder chip. Do not lose the rubber keyboard mat, because it mates with the new PC board. Desolder the two battery terminals, which are re-used on the new circuit board. The rest of the board can then be consigned to your junk box.

Now take the new board, and file any nibs on the edges of the PCB down. Use a small square or round file to remove circuit board material up to around the U-shaped notch in the earth track beneath the IR LED.

Check that the PCB fits correctly into the housing before loading it with components. To allow it to fit trim the large protrusion from the bottom of the battery clips with tin snips.

You can now assemble the new transmitter board, which uses the SM5021B encoder chip. Use the photo and PCB overlay diagram as a guide. Note that there is a short wire link between Q1 and Q2, and also a long insulated wire link, which connects between the points marked with a 'Y' (see photo).

If you are going to be using more than one of the transmitters together, you can now also fit wire links for the custom coding, in the LK1 or LK2 positions (the links go to ground). You'll have to configure the links on their receivers the same way, of course. Of course if you're only making one remote system, simply don't fit any custom code links to either the transmitter or receiver.

Receiver assembly

Assembling the receiver board should be very straightforward using the photo and PCB overlay as a guide. Either a PIC12043 or HC312 IR receiver module may be supplied in the Oatley kit, but the board takes either.

The main things to watch when you're assembling the board are to fit the LEDs, diodes, transistors, ICs and electrolytic caps the correct way around, as shown on the overlay. The relays only fit one way around anyway, while the terminal blocks can fit either way.

Note that the Oatley kit includes sockets for the 14-way DIL chips, to minimise the risk of damage due to overheating.

Power for the receiver can come from any suitable source of 12V DC at about 500mA or more. Oatley can supply a suitable plug pack supply at very low cost — see parts list.

The only setting up needed for the receiver board is to fit the Mom/Tog links for the six programmable channels, according to what you want them to do.

Testing, testing

Testing the transmitter on its own is not practical unless you have a camcorder or some sort of video camera, with IR sensing capability. If you do, you can use the camera's viewfinder to see if IR light is emitted when any of the transmitter buttons are pressed. However, while that will check basic transmitter operation, it does not indicate that the buttons control the right receiver outputs.

The way around this is to get the receiver board going first, then use it to check the transmitter.

First connect 12V DC to the receiver board, then check that around +5V is present at pin 3 of IC2 and at pin 14 of IC1. Now aim the transmitter's LED at the receiver's detector window and check that each output LED on the receiver board activates when the relevant transmitter button is pressed. If they do, both the transmitter and receiver are functioning correctly.

Fig.1 shows how a motorised volume control pot can be connected to the Relay 5 and Relay 6 outputs of the receiver, so the pot can be turned up or down using the 'Up' and 'Down' buttons on the transmitter. As you can see it's very easy — but remember to fit the links for both of these relay outputs to the 'Mom' position.

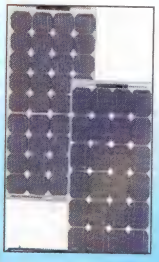
How to use the receiver's other outputs for controlling other functions is left up to you. ■



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Washing machines, **VCRs** and feet...

Our stories this month cover electrical safety, the notorious electrolytic capacitor and the silly things people do with electrical appliances.

THE FIRST ITEM this month comes from Bill Walker, of Lower Templestowe in Victoria. Bill adds to the stories on electrical safety in the February column.

As in the earlier tales, the writer found himself only a hairsbreadth away from shaking hands with the Devil. Here's what Bill has to say...

The article on electrical safety in the February edition prompts me to write about one of my experiences in this genre.

In the mid 70's I had to connect the power cable to my new dishwasher which was wired in brown and blue wire — my first experience with this colour scheme. But, which was active?

Well, since all of the contacts in the machine's control circuitry were wired with blue, I connected the active to the blue.

It was some 10 years later that I was reconnecting the copper water inlet pipe when it brushed against some exposed connectors. There was:

- *A shower of sparks and a bang from under the dishwasher.*
- *A 'phut' from the fuse box.*
- *A scream from my wife.*

I asked her if she was all right. She was — and then I realised that so was I!

The copper pipe had been in contact with the dishwasher frame at the time that it contacted the wiring, thereby causing the fuse to blow. Had the pipe not been touching the frame. I might not be here to tell the story now.

Needless to say, this fault was rectified before the dishwasher was reconnected. However, it is interesting to reflect on how I decided that blue should be active.

For obvious reasons, the switch in mains wiring is usually installed in the active line. However, inside an appliance incorporating a control system, there is good reason to switch the neutral side.

This puts the switching at essentially ground potential, thus allowing the control system circuitry to be at ground potential also. This avoids introducing a 240 volt isolation problem.

This advantage can be even stronger when a three-phase system is being controlled — switching the actives involves three circuits with 415 volts between them!

Thanks for that little item Bill. It reinforces the February stories and emphasises the need to be doubly careful when working with mains power. It's all too easy to 'Think' you've got it right, and it's too late to learn otherwise when you are dead.

As for your confusion between brown and blue, I am happy to say that I never had that problem. Since I am partially colour blind, I always had some difficulty selecting between the old colours red and green, particularly the paler shades favoured by some manufacturers. I have had to rely on a meter to pick between them.

The new colour scheme solved the problem for me since brown and blue are at opposite ends of the spectrum, as well as having significantly different brightness levels. I simply assumed that brown is close to red and blue, particularly the darker shade of blue, is nearly black. And of course, the yellow/green earth wire is unmistakable even to someone totally colour blind.

(And before you ask, I never did use the resistor colour code - I used a multimeter! And with TVs, I left the final adjustments until the customer was present — I let them decide when the colour was 'right'.)

Always a troublemaker

Our next story is a rehash of those told over and over in these columns. If we went back through the records, we would probably find that a good 50% of all stories concern this one component, in one or other of its myriad of applications.

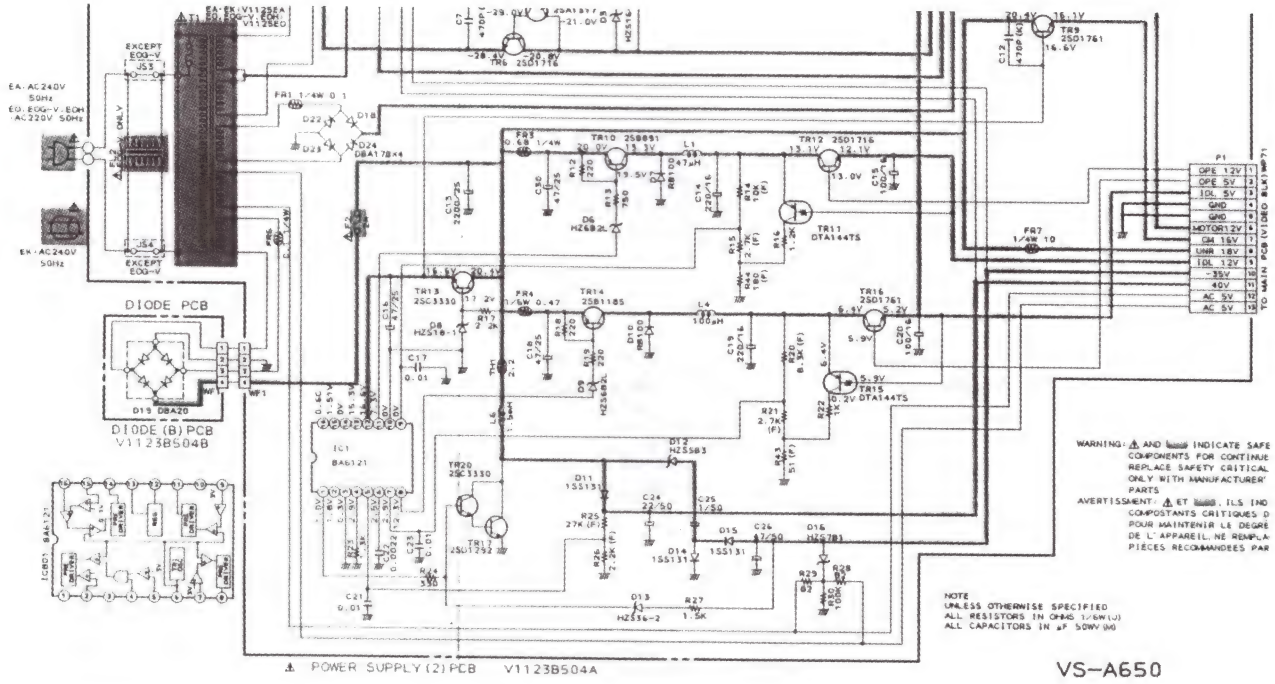
Of course, I am talking about electrolytic capacitors. No other single component can cause as much mayhem in electronic circuits as the humble electro.

This story comes from Darren King, of Pakenham, in Victoria. Like most of us before him, Darren blamed just about everything else before he came to the realisation that electros are always suspect. Here is what he has to say...

I call my story "Those Damn Electrolytics!" and you'll see why ...

The tale of woe concerns my Akai VS-650EA HiFi Stereo Video. EA reviewed this particular model way back in the early 90s and at the time it got a good report.

I bought one on the strength of the review and for quite some time it has proven to be a really good VCR. That is, until early 1998 when it would refuse to rewind tapes. The idler wheel and friction clutch were OK, so suspicion was cast onto the mode switch.



Replacing this cured the fault and everything was fine until late 1998 when more serious problems started to develop.

I must apologise if I digress here slightly, but it will point out how some strange faults started to reveal themselves.

Firstly in September I was connected to a Regional Pay-TV service, with the nice satellite dish on the roof and set-top decoder. The decoder was fed into a 'Video Input' at the rear of my Surround Sound Decoder HiFi (an Onkyo TXSV-717 PRO) so I could have full stereo (and surround) sound.

The Onkyo also switches video signals, so both audio and video signals were fed into it from the Decoder. The VCR is the same deal, being fed into a separate input of the Onkyo, but it also has audio and video output from the Onkyo fed back into the VCR.

The sound then comes out of the HiFi speakers and the video is fed to the TV via a master video output socket on the Onkyo. This setup allows me to record from the Pay-TV decoder to the VCR and proved to work quite well.

Before I got Pay-TV I had the VCR connected to the Onkyo via the same setup as mentioned. The antenna input to the VCR is used in the usual way, but the RF output (which normally goes to a TV) was unused.

All that changed when I got Pay-TV as I thought it would be nice to feed the RF output from the VCR back into the antenna line via a combiner to distribute not only VCR signals, but the Pay-TV signals as well, to other televisions in the house.

This seemed fine in theory and should have worked well. But I had all these wavy black diagonal bars on the other televisions being fed the RF output from the VCR.

Time did not permit doing anything about it so the problem remained. I did prove it was the VCR by trying a borrowed unit (not the same model though) and that cleared the problem.

In early November 1998 the VCR suddenly and without reason shut down while playing a tape. The whole unit just went dead. I immediately unplugged the VCR and left it for a few hours.

When it was plugged back in, the VCR seemed to behave itself until I tried to change television channels. The result was a very snowy picture on all channels and when rewinding or fast-forwarding a tape the channels would disappear altogether.

Closer inspection showed that the front panel display on the VCR was dull and seemed to vary in brightness. This seemed to be like a power supply problem, but again time did not permit chasing the fault, and the VCR still allowed a pre-recorded tape to be played back OK, so the job was left for a rainy day.

In December our suburb had a power failure, and when power was restored the VCR didn't wake up. It was as dead as that day in November and nothing would fix it. Judgement Day had come for the Akai.

A clear spot on the cluttered workbench was made and the covers came off. I thought I may strike it lucky and find a dry joint somewhere on the power supply PCB. But this was not to be.

Next I prodded around the output plug on the supply PCB (P1). Most of the voltage rails were OK except the -35V and +40V lines which showed -1V and +0.5V respectively. These two rails originate from two charge pump configurations consisting of a common oscillator and driver (being IC1 and TR20 & TR17 respectively).

From there they make a positive rail consisting of D11 and C24 with a feedback regulator loop consisting of R25 and R26. The negative rail is a little more complex, being made up of D12, C25, D14, D15, C26, D16, R28/29/30.

It also has a feedback consisting of R27 and D13. The reason why the negative rail is more complex is because it feeds the front panel fluorescent tube and the -35V has to be relative to the AC5V lines which feed the tube's heater. This is per-

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formed by D16, R28/29/30.

Anyway, now I had worked out where the problem was and also the theory of what everything did, it was time to solve the mystery. First stop was across C13 with an oscilloscope.

Why a CRO? Well, when you work with switch-mode supplies long enough you realise how multimeters can give you false readings.

To clarify, if you have a dried out smoothing capacitor a multimeter may show you that your voltage rail may be slightly under-voltage and you may pass this off as satisfactory. However, if you connect a CRO across the voltage rail you will see that there is considerable ripple on the rail which will then catch the offending smoothing capacitor.

I got caught quite a few times before being told the same thing!

Anyway, voltage across C13 was close enough to 20V which was what the schematic said, and no ripple either. Next step was across L6, and this had no voltage at all. I then checked TH1, which proved to be intact.

I then measured pin 1 of IC1 and saw a nice square-wave signal. This only really left the driver transistors, and checking TR17 showed that it was short circuit from Collector to Emitter. This is what robbed L6 of its voltage.

Jubilant, I replaced the transistor and switched the VCR on. My happiness was short lived. Sure, I had voltage across L6 and 'some' voltage on the two rails (-6.5V and +13V) but this was far from correct.

Muttering some choice words I started checking again. I grabbed the CRO and put it on the 40V rail across C24. And guess what? A nice sawtooth waveform! No smoothing whatsoever.

Replacing the capacitor (a 22uF/50V) cured that little problem and I now had exactly 40V. (By the way, before I replaced the capacitor I measured the rail with a multimeter and it read 37.5V, a clear example of how a meter can mislead.)

Measuring the -35V rail still showed that it was still the same. I prodded around for a while and could not find anything wrong. It was a smooth waveform across C26 and nice solid pulses across C25, which looked like some kind of isolating capacitor.

Shrugging it off as being only a problem because I had P1 disconnected, I plugged it back in and switched the VCR on. Well, the negative rail did not change but the VCR was working normally apart from no front panel display.

Thus encouraged I tried again. There are only 11 minor parts which could cause a problem in the negative supply rail and none of them are hard to check. After measuring all the resistors and diodes I then picked on C25 as it was one of those notorious luF 50V types. And that was the problem.

Upon switch on, I had a nice -35V rail and a nice and bright front panel display.

Also just as important the channel presets were nice and clear and did not drift any more. And as a bonus all traces of those black bars on the RF output had vanished.

So it just goes to show how a couple of capacitors, worth maybe a total of a dollar or so, had the potential to cripple a thousand dollar VCR!

Thanks for that story Darren. While faulty electros in VCRs is not uncommon, the range of symptoms that your machine induced is quite unusual.

And the way a simple fault can spread its manifestations throughout the house is something we need to keep in mind. I'm reminded of the situation in our house when SBS first went on air in the UHF band.

My wife would complain periodically about a herringbone pattern that made SBS unwatchable. There was no trouble on the other channels, and SBS was often faultless.

Then one day I realised that she only complained when I was sitting at this computer, writing these stories! In fact, the old BBC Micro has an output on UHF and as chance would have it, almost on Channel 28, that used by SBS.

A simple tweak of the modulator in the computer cured the problem permanently.

(And yes! I still use the 1984 model BBC — it works like a charm. It's keyboard suits me better than those of modern PCs and I find the green screen monitor easier to read.)

A massage from Hong Kong

A month or two back I wrote about my wife's musical socks. Now, in keeping with the theme of pedal extremities, here is another short item from my own workshop.

Almost as silly as the musical sox was the one that came in this morning — a 'Foot Massager' would you believe?

It came about because I am in the process of repairing an Akai CD player and an old Precedent radiogram for a valued, longtime customer.

He called in to pick up the radiogram and in passing, asked if I would look at his son's 'Foot Massager'. It seems the son bought the device in Hong Kong and didn't look at the ratings plate.

He chopped off the two-pin power plug and substituted a standard three pin unit. Then he plugged into the 240V mains and watched as a pretty pink spark lit up the interior of the device.

Needless to say it wouldn't work after that, and it was only then that he turned the machine over and read the ratings plate - 100V AC 50/60 Hz 15W ! So that's how it came to rest on my bench.

My first problem was to open the case. The six fixing screws were located at the bottom of deep recesses in the base. The holes were not only deep but very narrow as well. I really needed a thin shanked Philips driver, but one with a blunt point more suitable for big screws.

In the end I had to find an old driver and grind the shank down by two or three millimetres until it would fit

continued on page 97

... SHE ONLY COMPLAINED WHEN I WAS SITTING AT THIS COMPUTER



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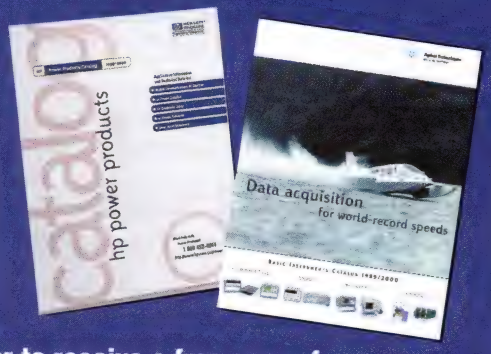
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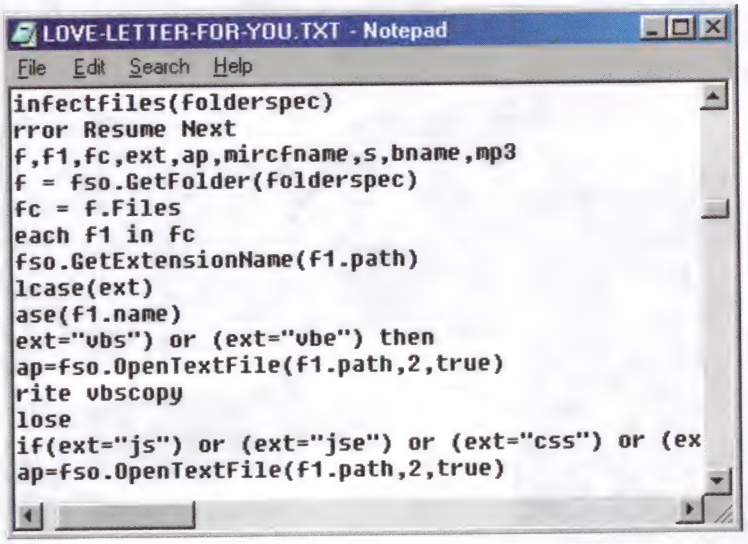
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COMPUTER **CLINIC**

BY JEAN BAPTISTE CATTLEY

Viruses, Worms, and SWATing up on Samba



***Hmmm**, sourcecode for the Lovebug virus — I wonder what happens if I run it...*

WELL, THIS CERTAINLY SEEMS to be the month for viruses...

First up there's the ILOVEYOU virus, which will have blown over by the time you read this. I've just been looking at the code, and from what I can see, it's a vicious little worm. Badly-written, and about as subtle as a brick, it spreads by mailing itself to all the entries in your address book, attempting to replace all your MP3s and JPGs with copies of itself, and adding itself to any existing Windows Scripting Host scripts. It also sets your IE start page to download WIN-BUGFIX.EXE, from some internet site which was doubtless overrun within five minutes after the worm was launched.

For all its crudity, it spread incredibly quickly — within hours of the launch, I had received at least six copies in my mail.

Now, at this point, I'd like to suggest a couple of commonsense measures that would make everyone's life an awful lot easier.

First, the life of a sysadmin would be made so much easier if only people would *stop sending cutesy programs and scripted web pages to each other.* Apart from getting extremely tedious after a while, and taking ages to download when you check your mail, it means that you can't tell the real ones from ones sent automatically by stupid pieces of rubbish such as this.

Secondly, one 'feature' of Windows that Trojan spreaders take advantage of is the 'hide extensions for registered file types' option in Windows Explorer. If you have this turned on, someone can send you a program with its icon set to the default JPG icon. Later when you look through your downloads directory, you see an icon that looks like a picture, and open it all unsuspecting — and get a very nasty surprise indeed.

Some even give the file a double extension, such as MyPic.jpg.exe, which gets displayed as the safe-looking MyPic.jpg - fooled again! To avoid falling for the modern-day three-card trick, open My Computer, go to View | Folder Options | View, and uncheck 'Hide extensions for registered file types'. Now if you get hit, you have only yourself to blame.

If you see I file with a double extension, it's very likely a trick, and should probably be avoided. Oh, and one other thing: TweakUI has an option to turn off arrows on shortcuts — it's appealing, but don't do it. You can choose any extension, any target, and any icon for a shortcut - making it point to something very nasty indeed.

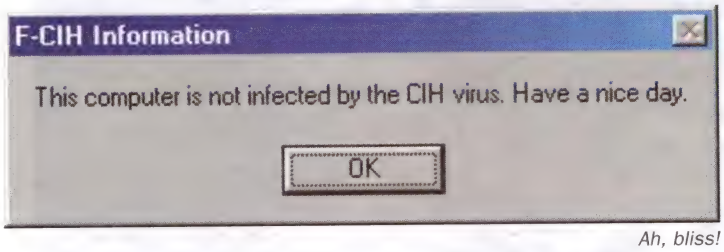
Bit by the bug...

Of course, no sane person with a modicum of intelligence could *ever* catch a virus, I just don't know how anyone could be so stu... *ahem*. OK, so I'm an idiot.

Just a few days back, my 98 box bluescreened. No biggie, it's a Microsoft OS after all, let's just reboot here... DISK BOOT FAILURE, INSERT SYSTEM DISK AND PRESS ENTER.

Uh-oh. This charming message means the BIOS can't read any boot information from the drive — I assumed a hardware problem, let it cool down, reseated the cables... Nothing. There was only one conclusion — my master boot record was history. So, a quick go with FDISK /MBR, and still no luck... My partition table had gone the way of all flesh as well.

After verbally removing the paint from surrounding surfaces, and thanking any passing deities that I keep all my files on a Linux fileserver/Internet gateway, I went and got myself a copy of MRECOVER.EXE from **http://members.xoom.com/monirdomain/**. This life-saving (and free!) utility will search through your drive and rebuild your partition table from scratch, bringing your system back to life. (Another stroke of amazing luck was that I had decided to try out FAT32 on this machine — if I had been using FAT16, I wouldn't have been able to recover the first partition at all. Guess I'll stick with it from now on...)



Ah, bliss!

MRECOVER worked perfectly, restoring my system to perfect health — for about half an hour, when my system died again, just the same.

After getting the family to hide all the sharp objects in the house, I returned to my system, and threw a virus checker at it as soon as I was able... And the results weren't pretty. My machine was crawling with the CIH virus, and it was the 26th of April — CIH's annual activation day. (It was on this date that the nuclear reactor at Chernobyl caught fire)

I've mentioned CIH before, but in case you missed it, it's one of the nastier bugs out there. Instead of simply prepending itself to programs, as most Trojans do, it actually hides *inside* files, taking advantage of the incredibly silly EXE file format that Windows uses.

Basically put, Windows programs consist of discrete sections of code, all tacked together into one file. If the length of a section comes to less than a nice round number, it's padded out with zeros — and this is where CIH hides. Thus it can infect files without affecting their length — a sneaky way of bypassing many virus protection schemes. The payload is pure evil, too — it wipes out your partition table and boot sector, and trashes your primary DOS partition pretty much beyond repair, if it's FAT16.

If that's not bad enough, it also attempts to upgrade your motherboard's flash BIOS — with zeros. If successful, this makes your whole motherboard unbootable, and often the only practical solution is to throw it away and buy a new board. Charmed, I'm sure...

Not all virus checkers will pick up CIH; I recommend F-Prot, from **www.f-secure.com/cih**. They also have a small and simple tool that will detect whether CIH is in memory — much faster than a full file scan.

If you want a quicker, dirtier solution, go to Start | Find | Files or folders, and search for *.EXE, containing the text TTIT or TATUNG. If any of the returned files also contain the text CIH, then you're most likely infected, and the 30-day trial version of F-Prot is the way to go.

The sledgehammer approach

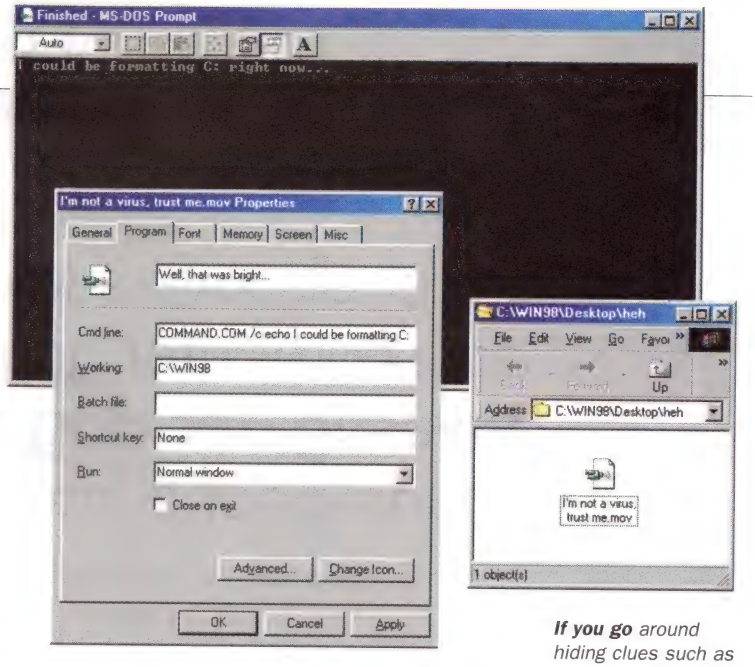
After resuscitating my system, and checking every single file on my server (scanning 15GB of files over a 10Mb network is not a five minute job...) the poor thing was still very, very sick for some reason. So after backing up my mail (about the only important data I keep on my machine — Outlook Express is not happy about keeping mail on a network drive) it was time to put it out of its misery.

I downloaded ZapDisk from **www.websmithing.com/zapdisk.htm.** Zapdisk is a tiny freeware utility that simply and quite irrevocably writes zeroes to the first few tracks of your hard drive, completely obliterating all boot and partition information — often the only way to disinfect, in the case of some really nasty viruses, and is also handy if you can't de-partition your drive after installing Linux or NT.

From there, it was a matter of about two hours or so to bring my system back from the dead, with a fresh install, hardware drivers up and software installed... I love having a fileserver!

Swooning over Samba

I'm currently running Redhat 6.2 on a little pizza-box style Dell P166 with just 32MB of RAM, and it's as smooth as anything. It sits there with just an Ethernet connection and modem, serving files and acting as an Internet gateway for my other computers.



***If you go** around hiding clues such as arrows and extensions, you'll get your fingers burnt. Don't do it.*

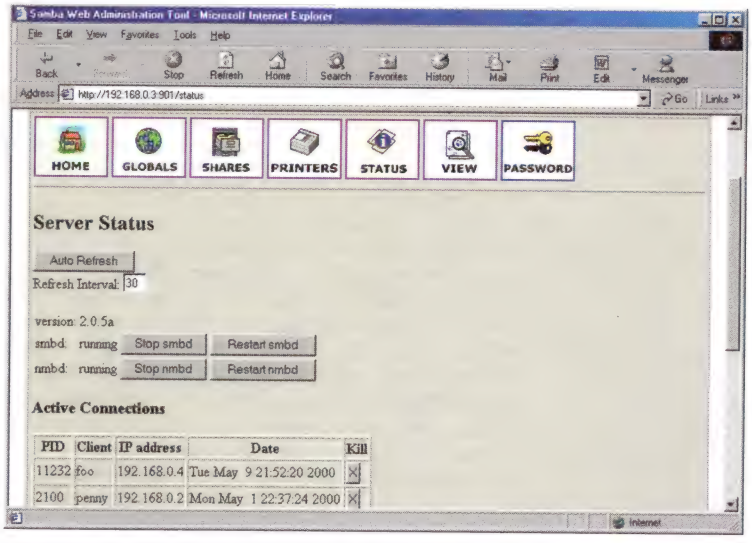
Setting up Samba filesharing was a piece of cake thanks to SWAT, the Samba Web Administration Tool, a very nice web interface that lets you run the whole thing from the comfort of your browser. Setting it up for internet sharing was a five-minute job, too, consisting of three commands pasted from the IPCHAINS-HOWTO file, and running wvdial, a very nice little PPP dialing utility that automatically configures your modem, dials, and intelligently negotiates the login and password prompts for you.

The only component I've had to add has been the (free, of course) ipmasqadm utility, so that I can run a few applications on my 98 box that require incoming connections. (a webserver for instance, or IRC file transfers).

Unlike Sygate under NT, which needed restarting occasionally, Linux with IP masquerading is rock-solid, simple, configurable, and free. It runs on hardware that would reduce NT to an arthritic crawl, and you can use ALL the administration tools remotely — unlike NT, which is a serious pain to fiddle with over the net.

I'll be doing an in-depth look at Redhat 6.2 any time now, so stay tuned...■

***The remote** administration in Linux means you can keep your server in a cupboard, and never have to plug in a monitor... Nice.*





INFORMATION **CENTRE**

BY PETER PHILLIPS

Peter discovers speakers that double as a computer games joystick, **investigates dog zappers**, looks at sound-phone interfaces, and more...

Apart from the speakers mentioned in the heading, we also look at interfacing the audio from a PC to the phone line, and at producing a 60Hz drive source for an American motor driven clock. And you might like our rather Irish What?? question.

I'VE JUST RETURNED from a short and hectic trip to the US. While there (amongst many other things) I visited a company called Porrazzo Strategic Technologies, which is developing a flat panel speaker that can also be a microphone, an antenna and a computer joystick! I don't have any photos as I didn't take a camera, but the company's website is **www.porrazzo.com** if you want more information. It's quite a substantial site, and even includes a video you can download.

Basically, the speaker looks like a conventional flat panel speaker (eg Magnaplanar), except it comprises a printed circuit pattern on a flexible substrate. Porrazzo calls this type of a speaker an *advanced membrane transducer*, or AMT. The magnetic field is provided by an array of magnets arranged as a grid and placed close to the membrane. Perhaps the major features of these units are their small overall thickness (10mm or so) and the potential to make them in a range of shapes. For example, the company is planning to make speakers that fit in the sunvisors of a car, and already has a demonstration tee shirt with speakers woven into the cloth. I'm not kidding folks: when touched, this shirt croaked like a frog.

I heard the largest speakers currently being developed by Porrazzo, and I was very impressed by the clean and well defined sound. However, like most panel speakers, quite a bit of audio power is needed, and I observed distortion on transient notes (such as a recording of piano music). But the company is not looking only at the hifi market, and I also heard smaller versions such as those intended for use with a computer. Again a clean sound, but the smaller the unit the higher the lower cut-off point (read the need for a subwoofer).

During the demonstration, I was shown an antenna comprising a printed circuit pattern of an array of interconnected hexagons (a type of fractal design according to the engineer). The board measured around 120 x 200mm, and was connected as the antenna to a hand-held CB radio. The engineer demonstrating the effectiveness of this antenna no doubt enjoyed seeing how people reacted when he put the antenna inside a metal filing cabinet, with no apparent reduction in its sensitivity. You'll read quite a bit about the *planar antenna* on the company's website, including some of its uses.

Perhaps the most interesting aspect of the demonstration was the "three-axis joystick" application of the Porrazzo membrane speakers. Although only a simple demonstration, it showed that an object on a computer screen could be moved through a three dimensional plane by simply waving your hands in front of two AMT speakers. I gathered that the system uses ultrasonics, with the speakers emitting an ultrasonic wave that's reflected by your hands. Because the speakers also act as microphones, they produce an output voltage that depends on the position of your hands. There's more to it, but that's the basic idea.

According to Porrazzo, the AMT technology is world changing stuff, as it has so many possibilities. Certainly it's impressive, but at this stage most of it is still under development. However speaker production is supposedly starting in October of this year, although prices will initially be around $1200 per speaker. Costs will come down over time, so perhaps your next computer speaker system might have the Porrazzo logo.

And finally, before I hand the column over to reader letters, here's a beaut hint to make a long flight pass more quickly: get yourself a set of noise cancelling headphones. I bought a pair (Aiwa brand) in San Franciso for US$50, and was amazed at how effective they are at cancelling the very high background noise in a 747-400. Suddenly I could hear the movie sound track, and enjoy CDs on my portable CD player.

Noise cancelling headphones have microphones that pick up the background sound. This sound is amplified, inverted (180° phase shift), then applied to the headphones, giving excellent cancellation of lower frequencies. Don't confuse these with noise "reducing" headphones which are simply earphones built into ear plugs.

Sound-phone interfacing

In the March column a reader (Brian Hancock) asked about sending a computer generated voice message over the phone during an otherwise conventional phone conversation. Two readers have replied with suggestions on how to do this, although the first method might be trickier than it sounds.

Regarding getting a PC's audio onto a telephone line, my Australian made modem (Auslinx Redback)

has an answering machine function which 'plays' a voice greeting after answering an incoming call. That is effectively what your reader wanted: the ability to present audio stored on a PC as audio on a telephone line. Of course the triggers are different, but the basic components and functions are already there, and what's more they are operating through approved interfaces.

To be able to control the connection of the modem across an established telephone connection and to start and stop the audio would require special software, which a modem manufacturer might be able to help with. It could be made simpler if the telephone call was handled by a modem such as mine, which also has a telephone emulation facility. (Graham Goeby, email)

Modems these days have lots of bells and whistles, as yours appears to Graham. My modem has a voice facility, but I don't think you can talk over it while it's 'talking'. However, perhaps there are modems out there that allow a computer to send a voice message during a phone conversation. Adapting a voice modem that doesn't have this facility might however be more involved that just software. Still, it's a good thought Graham, and the right type of modem might just be available.

The next letter is more detailed and shows how to connect an isolation transformer so it does not load the line, thereby allowing you to send PC audio over the line during a conversation. However, please note that this is for reader information only, as it's still illegal to connect non-approved devices to the telephone system.

Modern telephones comprise a single large IC containing all the required electronics. The minimum supply voltage is 10V at 25mA, suggesting a DC input resistance of 400 ohms. The Commander Music on Hold (CMH) interface contains an isolation transformer which has a typical DC resistance of 32 ohms on the plug side winding. When connected in parallel with a phone, the low resistance of the interface shunts most of the line current, causing the terminal voltage to drop to around 3V, which explains why the telephone goes dead: there's not enough voltage to operate its integrated circuit.

When the CMH interface is connected, its isolation transformer is likely to be magnetically saturated, preventing passage of audio from a PC to the telephone. As well, the telephone line will be permanently looped, or busy. However there's a way around this.

The saturation problem can be eliminated by connecting a capacitor in series with the plug side winding on the isolation transformer, thus blocking DC current flow. This capacitor must not be polarised, and should have a working voltage of at least 250V AC.

However, this doesn't solve the problem of loading, as the impedance offered by the transformer and capacitor is still low enough to shunt incoming ring tones (preventing phones from ringing properly), and to attenuate incoming and outgoing speech. A bridging interface across a phone line should have a minimum impedance of 5k, which can be achieved by careful selection of the series capacitance and resistive pads connected between the phone lines and the isolation transformer. The circuit is in Fig.1.

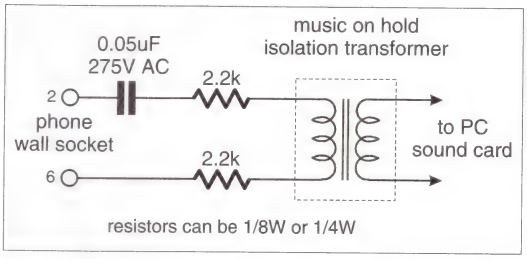


***Fig.1** shows how to send audio over the phone line during a conversation. If you actually use it though, you'll be up for a fine of over $10,000...*

This circuit is not approved and its use on the PSTN could result in legal action by the Australian Communications Authority (ACA) with subsequent fines. (Robin Frost, Mitchell Park, SA)

Thanks Robin for this information. I assume the series resistors (2.2k each) don't attenuate speech too greatly, and that you've tried this circuit. If so, it seems a simple way of mixing two signals onto phone lines. Pity it's illegal, although I can't see what possible harm it could do, given that the approved isolation transformer is still connected and the added circuitry, if anything, gives additional isolation.

60Hz source

Harking back to March again, here's some reader responses to the problem posed by John McKean regarding a 60Hz power source for a motor driven clock.

The IC used in the 1976 50Hz Clock Driver circuit is an SLC5411AT.CT and is probably no longer available. It does not appear in the latest Dick Smith catalog. A circuit that might work is one designed by Mark Curtis and presented in the Circuit and Design Ideas section of the July 1975 issue. It uses bog standard 74xx logic ICs, but will need a 1.2MHz crystal instead of the 1MHz device shown in the circuit. (Reg Leahy, Shepparton, Vic)

I haven't reproduced the circuit here, but if John McKean is reading this, and you think you can get a 1.2MHz crystal, then write to our secretary asking for a copy of page 79 of the July 1975 issue. This circuit only produces a TTL output, so it will need a power stage to drive a motor. Thanks for finding this circuit Reg, your database must be better than mine. Here's the next letter on this topic:

I checked out the July 1976 edition you mentioned, and the 50Hz clock drive described there is not relevant. Why not use the July 1998 240V Variable Frequency Drive? Its 50 and 67.5Hz output could be easily adjusted and with the load of the clock, an alternative 18 volt reversed stepdown toroidal transformer would give close to the required 110 volt output. (Graham Goeby, email)

This project seems ideal for the purpose Graham. The frequencies are adjustable and the power output of the device is 14W, so when driving a clock motor, it's not a draft horse doing a donkey's job. The designer of the project claims the frequency stability is good, and given that its intended purpose is to drive a turntable motor, I guess stability is an issue the designer had to tackle. It's difficult to say what the long term stability is like,

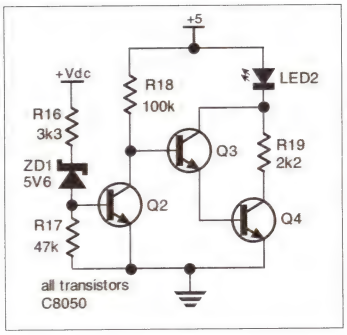


Fig.2: *The low voltage section of the phone call screener project presented last February. Does it cut in at 8.5V, or at just under 5V?*

but it could be good enough, and at least the clock will be running. Just don't use it for time critical situations, like when to catch the train.

The final reader response suggests an IC that gives a 60Hz output:

Regarding the 60Hz problem. I seem to recall the MM5369 as having both 50Hz and 60Hz outputs. It might have been selectable on the chip, or perhaps there were two types available. I don't know if these ICs are still around, but they required a readily available US colour burst crystal (3.57985MHz). (Eric van de Weyer VK2KUR, email)

I don't recall this IC type Eric, although I'm sure there are still ICs of this type available. Unfortunately you have to go beyond the hobby shops. Farnell and Radio Spares are likely to have something. However, I've cut Eric off, as he has more to say, but this time on a different topic.

Solid state bed lamp switch

In March a reader asked about adapting a $10 Wonder circuit (Sound Operated Trigger) so it could switch a bed light. I explained the need for a relay, and described how to go about connecting the relay and using it to switch the lamp. But there is another way...

A simple solution would be to use a solid state relay to do the job. Many of those available have an input range from 3 to 30V DC. A resistor could be placed in the circuit to replace the original relay, with the solid state relay input connected across the resistor. These relays take very little current and the input is fully isolated from both output and ground. An example is catalog number SY-4080 from Jaycar.

Incidentally there are 5V and 6V relays about with contacts rated for 240V AC, but they are not as easy to get as 12V relays. (Eric)

A solid state relay (SSR) is certainly more elegant Eric. However, the input device in a typical solid state relay is a LED, meaning it takes probably 5mA or so to trigger the solid state switch. Therefore, I doubt if it would work by simply connecting it in parallel with an existing load resistor. Instead, it might need to be connected as the actual load, perhaps with a series current limiting resistor. Another point is the cost of an SSR, which is a lot more than a conventional relay.

Phone call screener error

The following letter points out what appears to be a minor error in the description of the Phone Call Screener project published in the February 2000 issue.

While browsing through the Phone Call Screener article, I was puzzled by the claim that the low voltage indicator circuit will cut in at approximately 8.5V, whereas the zener diode is a 5.6V type.

To convince myself I assembled the circuit as shown, except for using higher gain transistors. Sure enough, the threshold point was just under 5V, when the zener leakage current started to increase. You have probably been told about this by other readers, but just in case... (Charles Borger, Pascoe Vale, Vic)

While writing the article for this project, I took measurements from the prototype built by Oatley Electronics, including the voltage when the low voltage indicator operates. I measured 8.5V, which is the voltage I gave in the article. You say you've measured 5V, but I'm not sure if you've got it right Charles.

The circuit concerned is shown in Fig.2. When the supply voltage is high enough to keep the zener diode conducting, the LED indicator is off. When this voltage falls sufficiently, the zener won't conduct, turning off Q2. This causes Q3 and Q4 to turn on, turning on the LED.

You mention a switching point when the "zener leakage current started to increase", when in fact the reverse is the case. The indicator will switch on only when the zener current has *fallen* to virtually zero. Did you use two voltages: one to supply the circuit and another representing the DC supply voltage? Of course, the actual switching point will depend on the zener diode, which is why I said 8.5V (or so). In theory it must be higher than 6.2V (5.6 + 0.6).

Dog 'zapper'

Anyone who visits the country will soon notice that many vehicles sport a device to scare away kangaroos and other animals that tend to wander the roads at night. But, according to the following letter, sourcing such a device is rather difficult.

I am looking for a dog zapper — one of those high frequency sound machines, inaudible to humans but apparently offensive to dogs. It should have a range of about 100 metres, which in the country or anywhere with a large block is typical of what you need. So I'm looking for either a ready made item, or preferably the instructions on how to build one, or how to beef up a weak one.

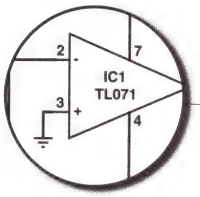
What frequencies does it need? My PC will generate up to 37kHz — is this enough? And what kind of speakers do I need? Not being able to hear the sound output, I don't know if my ordinary speakers are handling it. Perhaps I need piezo speakers. I'll much appreciate any help you can give. (David Hawcroft, Katherine, NT)

I'm surprised you can't buy such a device in your part of the world David, as in my country travels I've seen lots of vehicles fitted with commercial ultrasonic animal repellers. However, I recommend you contact Oatley Electronics (see advert on back inside cover) who have a kit for just what you want. The Oatley Electronics device incorporates high power piezo speakers in a resonant circuit, tuned to around 20kHz. Unlike other similar devices, it doesn't make clicking sounds, and is virtually silent in operation.

I've tested a few of these devices, with some interesting results. It seems that dogs respond to the

continued on page 97

I'M NOT KIDDING FOLKS: WHEN TOUCHED, THIS SHIRT CROAKED LIKE A FROG.



DARREN YATES

Opamp cookbook – 4

This month, **Darren Yates** continues building up your opamp circuit folder in the last of this series.

A COUPLE OF months ago, we talked briefly about some of the limitations and tricks of using opamps in audio circuits.

As with any other component, the way in which you lay out audio circuits can make just as much of a contribution to the overall circuit performance as the components themselves.

While I don't propose to open this can of worms for the moment, in general, most opamp audio circuits are fairly easy to get working and working well.

One thing I would suggest as a tip to keep in mind is stay away from quad opamp packages when you're designing your audio circuits. I know they work out cheaper per opamp but you can sometimes run into problems with cross-coupling distortion, particularly when you have large output voltage swings.

With the pins so close together, some of that large voltage swing can be induced into another opamp circuit and introduce distortion. It also has to do with PC tracks acting like inductors and coupling the signal around the circuit. I had that happen once before - I changed the circuit to using dual opamp packages and the problem disappeared.

OK, enough rabbitting on... let's get stuck into some circuits.

Baxandall tone control – circuit 1

This first circuit has become almost universal in the audio world and is named after its inventor, British audio guru, Peter (P.J.) Baxandall who designed this back in the 1950s if my memory is correct.

Obviously, he wouldn't have had a TL072 or LM833 handy back then, but his basic negative-feedback tone control circuit has found its longevity through its simplicity and effectiveness.

This version of the circuit relies on just one opamp, however you would most likely include a buffer amp before and probably one after as well, depending on where the output is headed. The circuit gives around 20dB of boost and cut at 20Hz and 20kHz respectively, with the mid-range centred on 1kHz.

If there is a problem with this particular circuit, it's the fact that it uses the opamp in its inverting mode of operation.

That creates two problems...

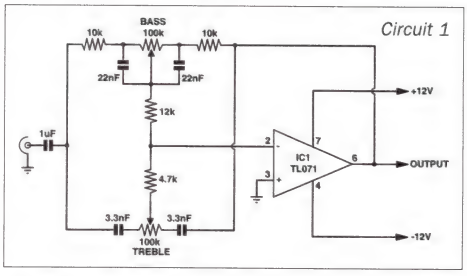
Firstly, the output is now out-of-phase with the input, so you'd need another inverting stage to right the signal back up again.

Secondly, opamps tend to produce more noise operating in this mode than they do in their non-inverting mode, therefore reducing the signal-to-noise ratio (SNR).

That said, the circuit works like a ripper.

The only thing to remember is that when you build this circuit, don't forget to earth the pots themselves. If you don't, you'll induce hum into the audio whenever you touch them.

The simple way to do this is to use some tinned copper wire and solder it to the backs of the pots and then connect the other end to the circuit ground or zero-volt rail. You'll need to scratch off the enamel on the pots and tin them with some solder first, but once the solder takes you should be right.



The basic circuit is two variable filters — one a high-pass and the other a low-pass.

The high-pass (treble) consists of 3.3nF caps and 100k pot, while the opposite side is the low-pass (bass) section. The amount of negative feedback — which really is what the two pots do — determines the overall bass/treble gain.

With the pots wound towards the outputs maximum negative feedback is applied to the audio signal, which produces a cut in signal of around 20dB. Wind the pots towards the input and you get minimum negative feedback and therefore maximum gain (boost)

Have a play around with it and even change some of the components and see what you end up with.

PWM motor speed control – circuit 2

I have to admit being a real steam train fan.

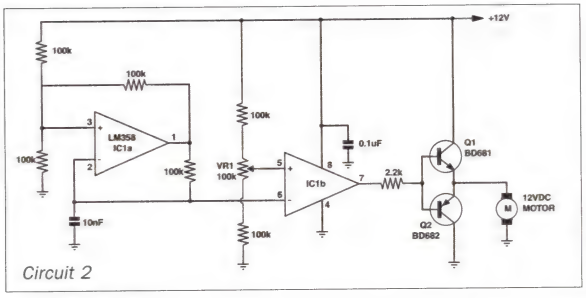
And while there's not much left in the way of real steam trains running around Australian rails, most of us with the steam bug can still live out our fantasies in miniature.

Back when I was a kid, I had an electric model train set.

The power supply was a big 12V 3A supply controlled by a basic rheostat that simply wound up the DC applied to the rails. Pretty simple, but the problem was my HO-scale locos would 'jump-start' from the station, giving the passengers whiplash for their trouble.

This circuit here is nothing new but it's an easy way to overcome that problem, and it relies on a circuit technique known as pulse-width modulation (PWM).

It uses two opamps from a single LM358, where the first opamp is a triangle waveform generator while the second acts as a simple comparator.



Circuit 2

When I say "triangle", IC1a is really just a Schmitt trigger square wave oscillator but instead of using the square wave output, we pinch the triangle-like waveform off the timing capacitor. This is then fed into the inverting input of IC1b.

So where does the PWM come into things?

Well, it's not obvious but the comparator action on the triangle waveform actually produces a PWM output.

Note that the triangle waveform varies from one-third to two-thirds of the supply rail voltage, by virtue of the three 100k resistors forming the positive feedback around IC1a. The 100k feedback resistor produces a hysteresis level of one-third of the supply rail.

This is also the reason why the 100k speed control pot VR1 on IC1b has two 100k resistors on each end — this limits the control voltage to one-third and two-thirds of the supply rail, respectively.

With VR1 centrally positioned the incoming triangle waveform ramps up and down, so the inverting input spends half the time above the non-inverting input and half the time below it.

If you looked at the output of IC1b, you'd see a perfect square wave — we say this has a 50 percent duty cycle — half the time, it's high; the other half, it's low.

If you then wound the pot so that the wiper was towards circuit-ground, the voltage at the inverting input would spend more time above the non-inverting input, resulting in the output being high for a shorter time. The opposite occurs if we wind the pot wiper towards the supply rail.

So in effect, what we are doing is varying the pulse width — or to use the vernacular — we're modulating it.

However, that doesn't explain how we can use it to control a model train.

Standard electric motors are slow old things - they don't respond instantly to changes in voltage. But this is great because that's exactly what this circuit relies on.

What we haven't said so far is that the oscillating frequency is reasonable high — in the order of 1kHz. The motor doesn't have a hope of trying to turn on and off and the rate of the oscillating frequency, but what it does do is *integrate* that pulse waveform.

Without going into the mathematics, that integration enables the motor to rotate very slowly, even though we're hitting it with short, fast bursts of 12VDC In fact, PWM is the ideal way to gain slow-speed control over your model trains.

Just one thing — notice we haven't included a reversing switch? I'll leave that for you to figure out. Hint: it's not difficult - a DPDT (double-pole, double throw) switch should do the trick.

All aboarrrd!

Guitar fuzz – circuit 3

Ever since Jimi Hendrix stepped onto a stage, guitarists everywhere have tried to emulate his sound. While distortion sounds horrific on just about any other musical instrument, it can really bring an electric guitar alive.

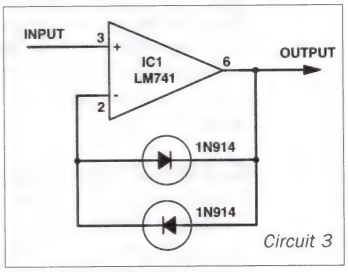
This is definitely one circuit I suggest you judiciously muck around with and change the components on, as everyone has their own idea of what constitutes real 'classic' fuzz.

In the attempt the keep things really simple, this circuit is little more than a single opamp amplifier with one key distinction — and that's the back-to-back diodes in the negative feedback loop.

These diodes limit the signal, rounding the peaks and adding in second- and third-order harmonic distortion. They also limit the signal amplitude to 700mV, which is enough to feed into a next stage amp.

Yes, it's simple and it works best when you feed it with a large (more than 1V) signal, but try increasing the gain by adding a negative feedback resistor network in series with the diodes.

How it works is simple; regardless of the signal input, the output feeds back via the diodes, which clip the positive and negative ends of the signal to the diode's forward voltage drop of 0.7V.



Circuit 3

This circuit is also ideal when you want to limit the signal amplitude of an input source but distortion isn't a problem. It's also useful for 'squaring up' an input signal as well.

In fact, even op amps not known for their ideal audio qualities — such as the LM358, 741 or 324 — would be ideal in this situation.

1kHz sinewave oscillator – circuit 4

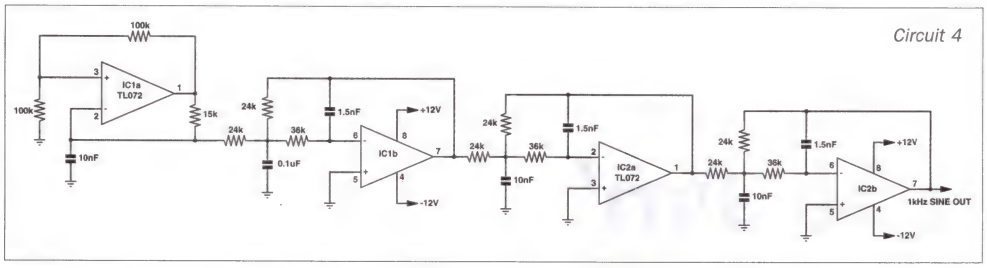
Sinewave oscillators are tricky things to get working well, since the idea of *stable* oscillation is almost against the Murphy's Law No. 2 — "Whatever you don't want to oscillate, will and vice versa".

Well as they say, there's more than one way to skin a cat.

Rather than worry about amplitude stabilisation and ensuring just the right amount of positive feedback, why not just blast the daylights out of an oscillator and clean up the signal afterwards?

Well, that's exactly what this circuit does.

IC1a is our triangle wave oscillator from circuit 2. The only difference here is that we're running the



Circuit 4

circuit from a dual supply rather than a single supply rail, so we can drop the 100k resistor from the supply rail to pin 3.

IC1b, IC2a and IC2b form what's called a sixth-order low-pass Butterworth 1kHz filter.

Analog filters are the stuff university courses are made of and rather than go into all the detail here, there are plenty of technical books available that give you all the necessary theory, mathematical formulas and frequency response curves to design your own filters.

Looking at the circuit, the waveform from IC1a is a 1kHz triangle wave of sorts.

Now, you can mathematically describe any waveform as the sum of the fundamental and harmonic components. For example, the 1kHz signal we're generating here is mostly 1kHz but it also has varying harmonic components of that 1kHz; that is, 2kHz, 4kHz, 8kHz and so on.

This concoction of a waveform is then fed through our 1kHz filter like dirty clothes through a washing machine. The filter is especially designed to allow frequencies of 1kHz or lower to pass through but attenuate anything higher at the rate of 36dB per octave.

The '36dB' figure comes from the fact that each op amp forms a second-order filter. You get 6dB per order, so multiply 6dB by six orders and you get 36dB per octave.

This 36dB per octave rate means the first octave above our 1kHz frequency — namely the 2kHz component — will be 36dB down in amplitude on the input signal. The 4kHz component will then be 72dB down, the 8kHz, 108dB down and so on.

It's important to note here that the 1kHz fundamental component (the bit we want) will be 3dB down at the output compared with the input — that's known as the 3dB point of the filter.

By the time you see the signal at the output, much of the harmonics has been reduced to a point where you have a pretty decent sine wave to show off. While it's not perfect, it's certainly a good deal better than the triangle-like wave we started with.

Your CD player uses digital filtering techniques to ensure none of the 44.1kHz sampling frequency appears in the audio you hear in your headphones or speakers.

In most hobby applications, high-order filters are not common but when they are needed, good quality opamps such as the TL072 used here make the ideal tools to do the job.

Full-wave voltage doubler – circuit 5

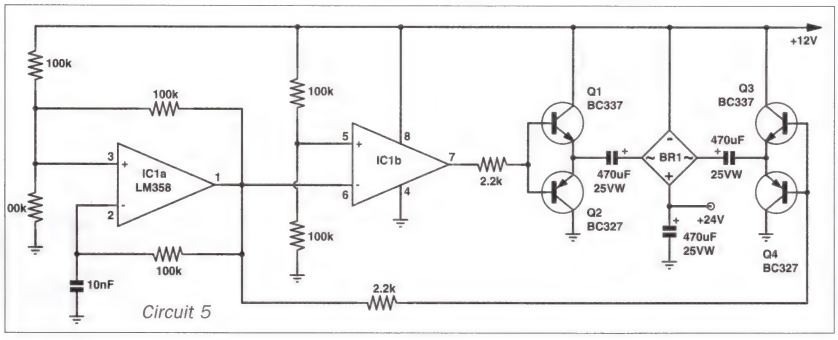
This last circuit could be built using a number of different components — not necessarily opamps, but it works well and is another unusual way of involving opamps in your circuit design.

Again, we use a single LM358 dual opamp package with IC1a set up as a square wave oscillator and IC1b as a basic comparator.

Hopefully you can see that the outputs of both op amps are out of phase. With each output driving a BC327/337 transistor buffer pair, the final outputs are then connected to a full-wave bridge rectifier via two capacitors. The negative end of the rectifier is connected to the 12VDC supply rail.

What happens here is that the output capacitors are each in turn charged to 12V when the transistor outputs are low, via the current flow from the positive rail through the

continued on page 97



Circuit 5

P.C.B. Makers!

If you need:

- P.C.B. High Speed Drill
- P.C.B. Material - Negative or Positive acting
- Light Box - Single or Double Sided, Large or Small
- Etch tank - Bubble or Circulating, Large or Small
- Electronic Components and Equipment for TAFEs, Colleges and Schools
- FREE ADVICE ON ANY OF OUR PRODUCTS FROM DEDICATED PEOPLE WITH HANDS-ON EXPERIENCE
- Prompt and Economical Delivery

NEW

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BY ROGER JOHNSON

Building an old classic: 'Little Jim'

If you have the power supply I described last month up and running, how about trying your hand at building another simple project with a strong vintage radio flavour? It's a classic *Radio & Hobbies* receiver design from the late 1930s — the 'Little Jim' one valver.

THE FIRST TIME that the Little Jim design appeared was in a May 1938 issue of this magazine's distant ancestor, *Wireless Weekly*. A cheap, reliable and easy to construct little receiver for headphone use, it was made for listening to the then-new direct broadcasts of the 1938 tour of England by the Australian cricketers. The idea was to remove each of the headphones from the headband, and place one under each pillow so that two people could listen in bed. I suppose this wasn't necessary if 'mum' wasn't a cricket fan...

As you can see from Fig.1, the original circuit used a type 6A6 class 'B' dual triode as a regenerative detector, R-C coupled to one stage of audio. The HT was from a 45 volt light-duty battery built into the cabinet, and the consumption was so slight that the battery deterioration resulted in only slightly less than shelf life. The valve heater was powered by a low current 6.3V transformer.

A full battery version was later described using a type 1J6-G or type 19, in which the filaments were powered by a 'No.6 Bell Battery' (a large 1.5V dry cell approximately 200mm in height and 50mm in diameter, with a prolonged life) and HT by the same light-duty 45V battery. With this version both batteries were contained within the cabinet.



A completed *Little Jim made using 'breadboard' construction and with a 'GT' type octal valve.*

Essentially the same two versions of the Little Jim design were republished in the first two issues of *Radio & Hobbies* (April and May 1939), with later versions in 1941, 1946 and 1953. These covered both all-battery and battery-electric versions.

Little Jim anew

The guidance notes that follow are aimed mainly at 'first timers' to valve radio, who probably have a good knowledge of modern solid state electronics but are unfamiliar with steam-age valve technology. You might be a keen hobbyist, or perhaps even a serviceman or woman, technician or engineer who is daily poring over micro chips and undertaking complex system repairs.

This project would be quite a change, and relaxing. It has no systems and no PCBs at all; it's very much a simple component-based project, with point to point wiring and no test gear needed except perhaps a multimeter. You *will* require a few hand skills and initiatives, though, in building a cabinet and winding a coil.

Where possible, new components will be described for those unfortunate not to have a vintage radio junkbox. Where appropriate, sources of supply for new components will be given.

Strict departure from the original design is not only tolerated — it's encouraged! An insistence on authenticity is likely to make things very heavy going, and act as a disincentive.

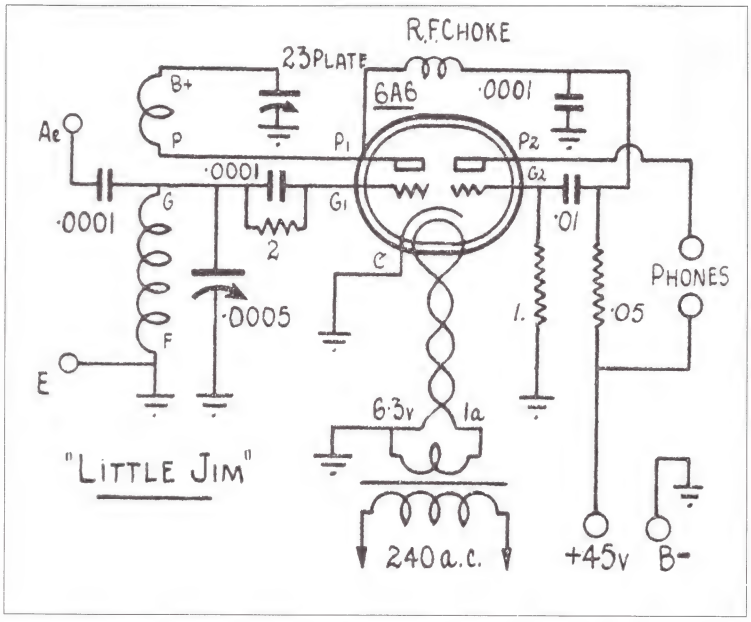
In fact the circuit we're going to use is not the original of Fig.1, but a revised version as shown in Fig.2, which is designed to overcome some anticipated component problems. It's still very similar, though, and essentially the same set adapted to use the components available nowadays.

The RF coil

The heart of a regenerative detector like this is a properly constructed coil, for which you need a former. Reproduction 'paxolin' formers are available from Brian Smith's Workshop, of 12 Mansfield St., Rockhampton Qld (phone 07 4927 1272) for only a few dollars. Otherwise you can use PVC plumbers' pipe of 30mm outside diameter, or any suitable material of 30mm OD. In the set shown in the photo, the coil is wound on an inverted pill container. The cap makes a very useful mounting base!

Enamelled winding wire is available in small quantities from the major supply houses. Here are details of the coil itself and its connections:

The primary is wound from 15 to 20 turns of 0.25mm enamelled wire. The secondary is 110 turns and the regeneration (reaction) winding 35 turns, both wound with the same wire. All windings are close-wound in the same direction, with each winding a single layer and the spacing between windings 5mm. The total length of the three windings will therefore occupy approximately 52mm of the length of the former (5mm



The circuit *of the original Little Jim, in Wireless Weekly for May 27, 1938 and Radio & Hobbies for April 1939.*

+ 5mm space + 28mm + 5mm space + 9mm).

To make the coil, start about 10mm in from the end of the former. Mark out the space occupied by the windings and their spacing using a square and a scribe, and then using a 1/16" or finer drill bit, drill two holes at the start and finish of each winding — in the direction of the winding and about 3 - 4mm apart. That will be 12 holes in all.

To make each winding, first allow a length of 100mm or so for the start connection, and pass this length in a loop through the two holes at the start of that winding. The free end should pass inside the former. This secures the wire against slippage. Now wind on the required number of turns with the wire still on your spool, and terminate the winding at the end in the same way as at the start, allowing 100mm as before to make the connection lead.

When you've wound all three windings in this way, drill corresponding holes around the base of the former, and loop two or three turns around the rim. Other connecting wires can then be passed through the little hole, and the coil wire can be soldered to them.

It's important to make the external wiring fairly solid, as wiring that is able to dangle or flop about in the breeze can have a de-tuning effect or affect reaction stability.

Other components

Now for some comments about the remaining components:

Tuning gang: Unfortunately, the small 160pF types available for use in solid state radios are unsuitable for this coil. A conventional air dielectric single gang of 15-364pF or so is required, and these are available from Brian Smith as referred to above. Otherwise, an older dual-gang unit salvaged from a junked radio is about the only option — just ignore one gang. If you're using such a capacitor, though, be aware that most had 3/8" shafts — you may have to find a 3/8" to 1/4" reduction coupling, in order to fit a standard knob.

The valve: A twin triode is required. If possible, opt for a larger octal type, such as the single ended type 6SN7-GT or 12AH7-GT. For those unfamiliar with valves, types 6SL7-GT, 6C8-G and 6F8-G are other octal based twin triodes, and the other alternatives are the nine-pin 12AU7/12AT7/12AX7. Of course anyone contemplating using the full resources of the power supply described last month may also try a type 1J6-G or the older type 19, if they have one!

Power Supply: The power supply described last month could easily be used. However, a single 12.6V transformer rated at 500mA can be used to power a 12AU7 or similar, with the winding also used with a voltage multiplier to obtain the 45V HT, as shown in the circuit. Note that a 6SN7 or 6SL7 cannot be used in this configuration because it draws 0.6A of heater current and exceeds the transformer rating; you'd need to use a transformer with a centre-tapped 1A winding. Alternatively, you could try going back to the original scheme (more or less): connecting five 9V batteries in series for the HT and using a small 6.3V/1A transformer for the heater, all inside the cabinet.

Reaction control: Conventional 'miniature' continuously variable 100pF capacitors are now extinct, and although a tuning capacitor may be salvaged from a junked radio chassis, a reaction capacitor will be much harder to find. That's why the circuit has been modified to use a different approach. Here the amount of energy fed back by the reaction winding is governed by varying the gain of the valve. This is achieved by varying the anode voltage of the valve, using the 50k pot. By the way that 100pF fixed capacitor bypassing the B+ end of the reaction winding to ground is vital; the regeneration probably won't work correctly without it. See if you can work out why!

Headphones: A pair of old high impedance phones can be used, if you have them. Otherwise, the low impedance variety that are used with stereos and personal cassette players and the like can be used if a suitable transformer is used. Miniature audio transformers for transistor radios are available which would do the job; but as this is very much a valve radio you might prefer to use one of the larger transformers available from the major suppliers for $5-6. In the set pictured, the output transformer is actually a 12.6V/150mA mains transformer — because it's cheaper, and works well enough in this application.

The cabinet

The cabinet for the set shown has been made by gluing and lap jointing 13mm 'hobbywood' (MDF). A panel size 220mm high x 280mm wide will allow plenty of height if a small sub-chassis is used, even with a tall 'G' type tube, and the width allows for pleasing proportions. The depth can be 150 to 220mm to allow for batteries or an inbuilt power supply if used.

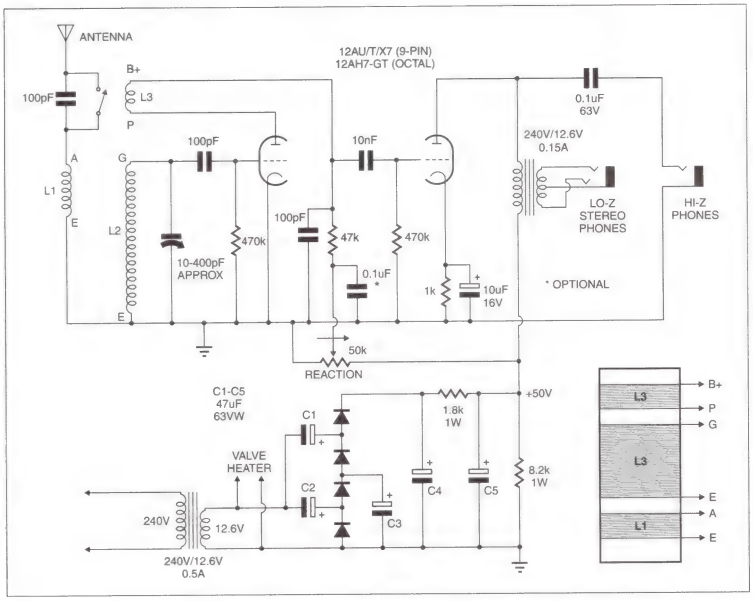
When marking out the cabinet pieces, be sure to allow for the thickness of the material. For a small fee, most larger hardware stores will cut the pieces to size using a radial arm or docking saw. This ensures a uniform and straight cut that readily allows a glued lap joint.

The pieces can then be glued using PVA glue and fine nails. (Although some of the rubbish served up as nails these days will curl up at the very sight of



A couple *of neatly finished cabinets, made from lap-jointed and glued 13mm MDF and covered in thin vinyl.*

VINTAGE RADIO



The circuit *is modified a bit, to make it easier to build using components available nowadays.*

a hammer!) Once completed, if you are really keen, it can be covered in thin vinyl material for a neat, professional and attractive appearance. The choice of the final finish is left up to you.

For the panel, a piece of 4mm three-ply is a good choice but if a scrap of sheet aluminium can be pressed into service, so much the better (an earthed metal panel will help make the set easier to adjust and more stable). After it has been drilled, give it a fine sand, and paint it either gray or black with spray paint suitable for timber. Follow the instruction on the can — some require an undercoat, some do not.

The use and fashioning of a subchassis is optional, and is left entirely to the constructor.

Construction

It is probably easiest to use the old fashioned baseboard method of construction. This means that the panel is screwed to a baseboard that fits inside the cabinet, and the sides of the panel are then screwed to the front of the cabinet walls. A larger layout is easier to work with. Most of the larger components (tuning capacitor, coil base, transformers etc.) can be secured to the baseboard with 13mm wood screws.

You will have to use a little ingenuity, but mark out the position of the tuning gang, and make a hole in the front panel for the shaft. If the panel is from three-ply, use if possible a 'dowelling bit' — these bits have edge cutters on them so that the timber is not torn away by the passage of the bit through it. Otherwise if it's an aluminium panel, use a hole punch.

Mark out the position for the reaction control so that they are symmetrical. Next mark out the position for the Aerial, Earth and headphone terminals. Mark out the position for the switches and phone jacks (if used) too, keeping their positions symmetrical.

On the baseboard, mount the valve socket on pillars or spacers that are readily available. Remember that when looking at the socket from above, the corresponding pin numbers are a mirror image of the valve base — in other words the numbering and direction are reversed from that shown in the valve data books.

The wiring should not prove too difficult, even for a novice.

Operation

Thoroughly check the wiring, and if all seems OK you should be ready to try the set out.

Connect an antenna of 10 or 12 feet of wire, with the end thrown out the window. If you are using a mains supply, use the green/yellow earth lead for the earth connection. (This can be internally connected to B-.) Connect the voltages from whatever source, and then the 'phones.

Advance the reaction control for a higher voltage on the anode, and slowly tune the capacitor. If the coil has been connected properly, you should hear a whistle and plop as the tuning capacitor is advanced, particularly toward the high frequency end. In this condition the detector is oscillating. You may or may not hear music — but you should be able to find the stations by the heterodyne whistles.

When you tune in a strong station, retard the reaction control until just below the point of oscillation. The programme should be heard quite well.

With this type of set, tuning becomes a process involving both the tuning capacitor and reaction control. Each time you tune a station the reaction control needs to be re-adjusted for optimum reception — which is generally just short of oscillation.

Should the set fail to work at all, check the coil connections, the wiring and voltages in that order. The problems simply cannot be too great. For example if the reaction control doesn't seem to work, the signals are weak and tuning is very broad, it's almost certain that the connections for the reaction winding have been inadvertently reversed.

If you have difficulty in separating stations at the top end, reduce the antenna coupling by removing three or four turns from the 'E' end of the antenna coil (primary). On the other hand if the reaction is too severe (i.e., it's hard to adjust the set just short of oscillation), remove a few turns in a like manner from that winding.

In the circuit of Fig.2, a small switch is shown which shorts out a series antenna coupling capacitor. When this capacitor is in circuit (i.e., NOT shorted) it reduces antenna loading; this assists in separating the stations at the top of the band, yet allows adequate coupling for the lower frequencies.

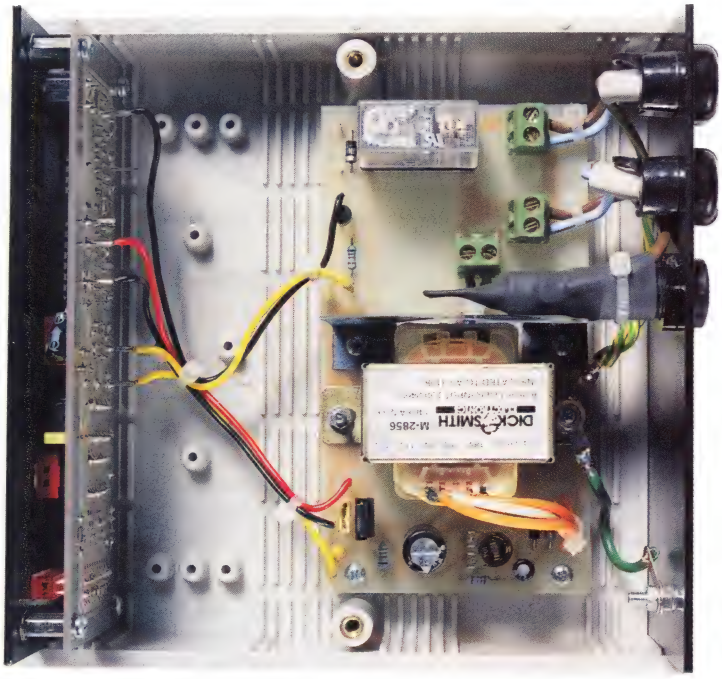
In closing, one of the fun things with simple receivers of this type is the opportunity for experimenting to get the best results. There's an interplay between signal strength, antenna length, antenna coupling and reaction adjustment. Different locations will have different requirements for best results.

The results will probably amaze you. Firstly, there's the way the detector portion will work with merely 5V or so of HT; and secondly, the set's ability to pull in stations. In Adelaide, some of the regionals can be heard on about five feet of antenna, and the locals are heard with no antenna at all!

Good luck, and most important of all, have fun. ■

Build it now!
Mains Monitor kit

EA's Mains Monitor project from the June 1999 issue could save you a small fortune in repair bills for motor-driven appliances in particular, so the price of a kit would be a sound investment. At $99, **Rob Evans** thinks DSE's Mains Monitor kit is well worth a look.



EA'S MAINS MONITOR has been a popular project for folks living in areas where the mains supply voltage has a habit of wandering around or dropping out. Brownouts and short-term failures in the 240V mains can create havoc for motor-driven appliances and even those based on switchmode power supplies.

The Mains Monitor is a dab hand at dealing with this type of recalcitrant mains supply; as implied in its name, the Mains Monitor continuously monitors the incoming mains level, then switches off its 240V outlet when the mains voltage becomes unacceptably high or low. You can set the acceptable voltage range via an 8-way DIP switch on its front panel, which also offers a 4-way DIP switch to set the time taken for the circuit to restore power (after the mains has returned to the acceptable voltage range of course).

It also offers a 10-way LED bargraph to display the incoming mains voltage in five-volt steps, so you get a real-time view of how the level varies, plus an 'event memory' feature which is activated whenever the unit has turned off the mains outlet. This changes the 'output on' LED from a continuous to a flashing mode, so that you can tell an event has occurred even if you were out having a quick lemonade at the time. The Monitor unit also has a mains hi/low LED to show when the voltage is outside the acceptable band, along with a front panel reset button to clear the event memory.

As we've found with other EA projects developed into kits by DSE their version of the Mains Monitor kit has well been put together, with the emphasis on component quality, documentation and safety. Their kit department have taken a great deal of extra effort to make the assembly instructions (originally from EA) easy to follow, through the use of additional a diagrams and photos showing details of the construction process. In fact the kit manual runs to ten A4 pages, which is, ahem, somewhat more than original EA article.

DSE have also taken a very thorough approach on the hardware side, with the accent again being on safety. The kit offers metal front and rear box panels (with silk-screened artwork), extra grounding points and a sheet of elephanthide (love that word!) insulating material which installs between the power transformer and mains fuse. To make sure unit goes together smoothly and looks neat when it's finished, they've also included a generous array of cable ties, spacers, lock washer, extra nuts, and all the gubbins you need without dipping into your hardware box.

I've no hesitation in recommending DSE's kit version of the Mains Monitor project. They've done a nice job of producing a professional looking unit that has added safety features and a very comprehensive assembly manual, but they have kept the kit price down to a reasonable $99. You can track down a DSE Mains Monitor kit at your nearest Dick Smith Electronics store, or through their website at **www.dse.com.au**. ■





BY OWEN BISHOP

Urgent alert

Our homes these days are full of so many beeps, warbles and screeches that it's almost impossible to pick out one particular signal from the din. So here is yet another contribution to electronic harassment, but one that we hope will stand out from all the others. Use it as a door alert or as a calling sound for an invalid or elderly person. It can make over twenty different noises and they all sound pretty urgent. It's fun to play with the possibilities.

PARTS LIST

resistors
(metal film 1% or 5%, 0.25 W)

R1	470k
R2	47k
R3	56k

capacitors

C1	1nF MKT polyester (or use a Greencap)

semiconductors

IC1	4011 CMOS quad 2-input NAND gate
IC2	4020 CMOS 14-stage binary counter/divider
Q1	BC548 NPN transistor (100mA)
Q2	BC337 NPN transistor (500mA)

miscellaneous

S1	Push-to-make push-button
LS1	27mm mini speaker, 8 ohms

Stripboard 38mm x 63mm (14 strips x 24 holes), 1mm terminal pins (5), 14-pin IC socket, 16-pin IC socket, small plastic enclosure.

A CONTINUOUS TONE is easily lost among all the everyday noises of the home or office. To really call attention, we need to make the tone intermittent. That is to say, it goes beep-beep-beep-... and so on. This one goes a stage further. It is intermittently intermittent! In other words, it can be made to go beep-beep-beep (pause) beep-beep-beep (pause) beep-beep-beep... and so on. This is even more attention getting, which is why we have called it the Urgent Alert. However, not all of its sounds are compelling. It has a few laid back warbles in its repertoire.

How it works

The basic sound is a 1kHz tone, generated by an oscillator made up of two 4011 CMOS NAND gates (IC1a and d) each with their inputs wired together so that they act as inverters — see Fig.1. The direct connection between gates a and d ensures that when the output of IC1a is high the output of IC1d is low, and the other way about. If the output from gate a goes high, current flowing through R2 charges C1. The other side of C1 is low because it is connected to the output from gate d.

Eventually the voltage across C1 exceeds the halfway voltage (1.5V) and then counts as a high input to gate a. This makes the output of gate a go low, and that of gate d go high. The voltage across C1 is reversed, so C1 gradually discharges, and then re-charges in the opposite direction. After a while the voltage at the input of gate a has fallen below the halfway voltage and the output of gate a goes high again. The cycle repeats indefinitely at a rate depending on the values of C1 and R2 (around 1kHz). The output is taken from gate d, and R1 is included in the circuit to square up the waveform.

Pin	9	7	5	4	6	13	12	14	15	1
Freq	512	64	32	16	8	4	2	1	0.5	0.25

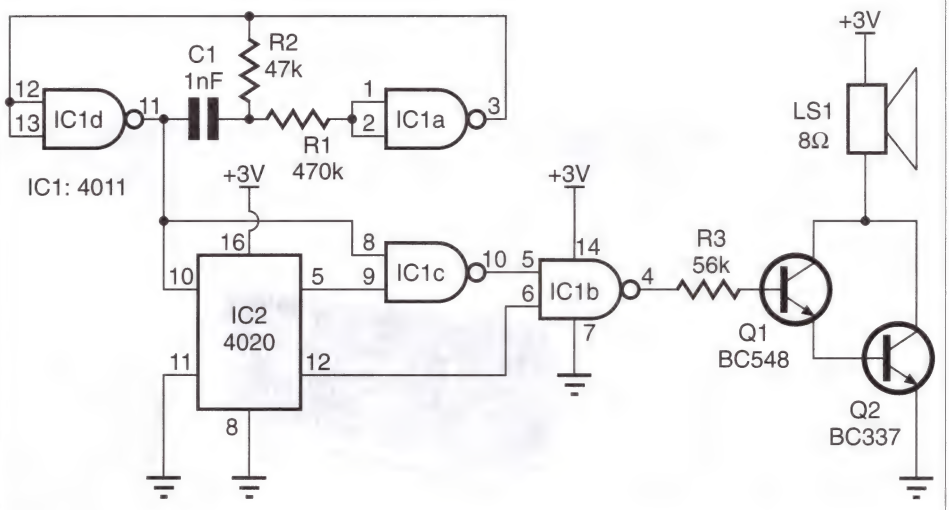
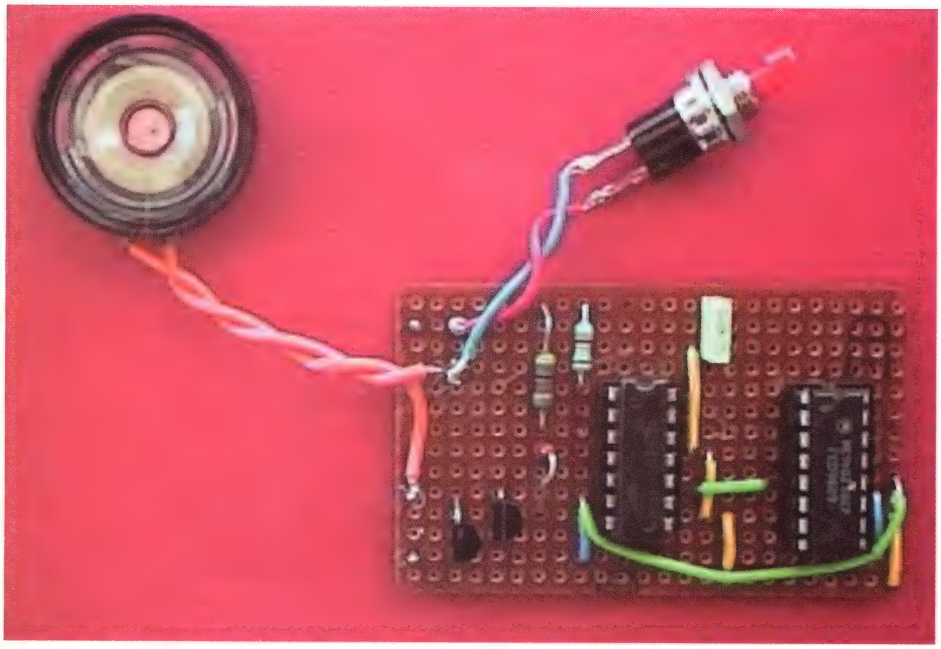


Fig.1

To keep the circuit compact, we are operating it on only 3V, which is the minimum voltage for CMOS. It needs only a pair of AAA cells in a battery box. Nevertheless, it produces a really loud noise.

The 1kHz signal goes to IC2 (a 4020), which is a 14-stage divider chain, except that outputs from stages 2 and 3 are not provided. The frequencies (in Hz) obtainable from the pins are shown in the table above the circuit

Outputs from pins 2 and 3 are too slow to be of use in this project. Using the table, it can be seen that in Fig.1, the output from stage 5 (32Hz) is mixed with the 1kHz signal by gate c. This turns the 1kHz on and off rather quickly. The chopped signal is then mixed with the signal from pin 12, which is 2Hz. The overall effect is a warbling sound. However, this is not the only sound you can get, as we will explain later.



Darlington pair

The loudspeaker has an impeadance of 8 ohms, which means that the peak AC current through it is about 375mA and the volume of sound is high. It takes more than a single transistor to drive the speaker. If we had just a single transistor and, given a typical current gain of 100, the base current would have to be 3.75mA, which is more than a CMOS output can source when working at 3V. This is why we use a Darlington pair, consisting of Q1 and Q2. Only a small current is fed to Q1, through the high resistance of R3. The current through Q1 is a hundred times greater and is fed to the base of Q2. This amplifies the current a further hundred times.

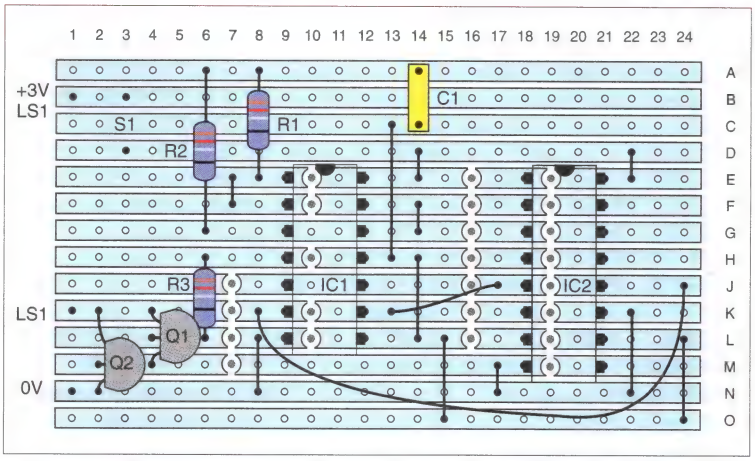
Given that each transistor has a current gain of 100, the gain of the pair is 10000. Therefore, the Darlington pair needs to draw only 37.5uA from the gate, to switch a current of 375mA through the speaker. This is well within the gate's capability. Note that Q1 is an ordinary BC546, rated to pass up to 100mA, but Q2 is a BC337, which is capable of passing 800mA. You could replace Q1 and Q2 with a single device, like the MPSA13, which has both transistors ready-connected in the same package. This is not always easy to obtain. The MPSA13 is rated to switch 500mA, but the MPSA14, which is similar, can take only 300mA so it may burn out if used in this project.

Construction

To obtain the maximum volume from the speaker, it must be firmly mounted behind a circular aperture cut in the enclosure. Before you start building work out exactly where this aperture must be cut. With such a small speaker, it can be fixed inside the aperture after coating its rim with clear adhesive. If you think the speaker needs some protection, then, instead of cutting one large aperture, drill an array of holes, 2 or 3 millimetres in diameter to provide a loudspeaker grille.

We have kept the board and other components small so you should have no difficulty in finding a plastic box big enough to house it. The board is about the same size and shape as a battery box for two AAA cells. The battery box could be fixed to the underside of the board, using double-sided sticky tape.

If you have a breadboard, it is a good idea to assemble the circuit on this to begin with. Then you can experiment with the connections between the counter (IC2) and the logic (IC1). The output going to pin 9 of IC1 should be the one of higher frequency. Pins 9, 7, or 6 can be used instead of pin 5. The output to pin 6 of IC1 can be from pin 13, 14, 15, and 1 instead of from pin 12. Of course, there is no reason why you cannot swap the connections around and obtain a few interesting effects. Connecting pin 12 of IC2 to pin 6 of IC1 (as in Fig.1) but then connecting the lower frequency of pin 14 to pin 9 gave us a sophisticated syncopated beat!



***This circuit** will stand a lot of experimentation before you find the sound that's right for you, so your final wiring may not match that shown in Fig.2 above.*

After you have exhausted all these possibilities, what about substituting a 4001 (quad NOR gate) or even a 4030 (quad XOR gate) for the 4011. The gates of the three ICs all have the same pinout, so there is no need to alter the wiring, but the logic of the circuit is completely changed.

Once you have decided on the connections, it takes little time to complete the construction. Remember to cut through the copper strips where indicated in Fig.2. However, note that there are two locations under IC1 where the strips are not cut. Note also that the collector terminal of Q1 is bent out slightly to bring it to the same copper strip as the collector terminal of Q2. If you are trying to keep costs down you can use any 8-ohm speaker (or even one of higher impedance) in place of the one specified. ■

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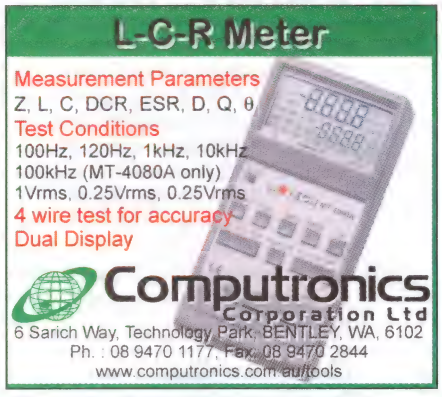
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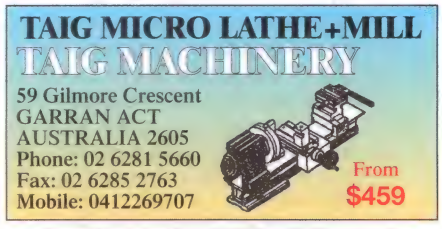
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SERVICEMAN

continued from page 78

into the holes. After that the job was dead easy.

A large part of the interior was occupied by the massage roller, driven by a substantial DC motor. The AC input went through a fuse, a full wave rectifier and a forward/reverse switch. That's all there was to it. (Note! No electros - Bewdy!)

Needless to say, the fuse was blown and fortunately, the bridge diodes were undamaged. A new fuse and the machine was up and running. Some people just don't deserve their luck!

The was only one problem — replacing the fuse. To save costs, the manufacturer had dispensed with the usual fuse holder. Instead, short wires were soldered between the ends of the fuse and the PCB track.

The wires were so short that soldering one end instantly unsoldered the other. I finally used a couple of centimetres of new wire to extend the fuse above the PCB. This gave me time to solder the wire to the track, before the heat ran up the wire and unsoldered the fuse!

All that remained was to advise the owner to get a 240/110V transformer before he tries to use his massager again.

Well, that's all for this month. We'll see what we can come up with next time. ■



INFORMATION CENTRE

continued from page 86

ultrasonic sound only in certain circumstances. For example, I coaxed two neighbourhood dogs into my loungeroom, and after they'd settled down, I blasted them with the ultrasonic sound. Apart from an occasional wagging tail, it seemed to have no effect.

However, when either dog was barking its head off (outside), it responded to the ultrasonic sound almost instantly. So it seems the animal's state of excitement has a bearing on how it responds to a powerful ultrasonic sound. I assume kangaroos and other wild life respond to ultrasonic sound because they're on full alert as they travel across the country.

Incidentally, to test if a piezo speaker is outputting an inaudible sound, hold another piezo speaker near it, so it acts as a microphone. Connect this speaker to a 'scope and you'll soon see what's going on.

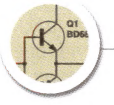
What??

Our question this month is from Bob Hurley (Vic). It's an original question, which goes like this (or does it?):

Mary-Anne was born on 1st January 1958. At her birthday party in 1999, it was found that Marianne had the same birthday, although her age was different. An electronic technician who was also at the birthday, worked out that two years previously Mary-Anne was three times the age that Marianne was when Mary-Anne was the same age that Marianne was when Mary-Anne celebrated her 39th birthday. How old will Marianne be as she watches the Sydney Olympics?

Answer to May

Whistle into the microphone. Yes, a human whistle (depending on the whistler) produces a pure sine wave. Try it sometime. ■



EXPERIMENTING WITH ELECTRONICS

continued from page 89

bridge rectifier and the output transistors.

When each output in turn goes high, the capacitors can't just instantly change their voltage so the action of the output transistors going from 0 to 12V pushes the caps from 12 to 24V, and this is then dumped into the 470uF output reservoir capacitor.

You can use just about any bridge rectifier provided you keep the voltage and current within specifications. The oscillating frequency of IC1a is also important.

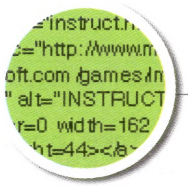
These rectifiers are generally only designed for mains frequency — 50Hz. That said, you should be able to run them up to 1kHz at low power without too many problems but with less efficiency.

While I've managed to draw 20mA from the output in the past, I've never really pushed it to see just what I could get out of it.

I'll leave that as an exercise for you, however here are a couple of tips: the current you can draw from it plus the size of the ripple voltage are both set by the size of the output and reservoir caps. As with most circuits of this type, the bigger those caps are, the better — within practical reason.

And that's where we'll leave opamps for the time being.

Next month, we're going to start a new series on transistors, looking at how they work, how to tell which transistor is right for your design, and of course, plenty of useful circuits. ■



WEB WATCH

BY DARREN YATES

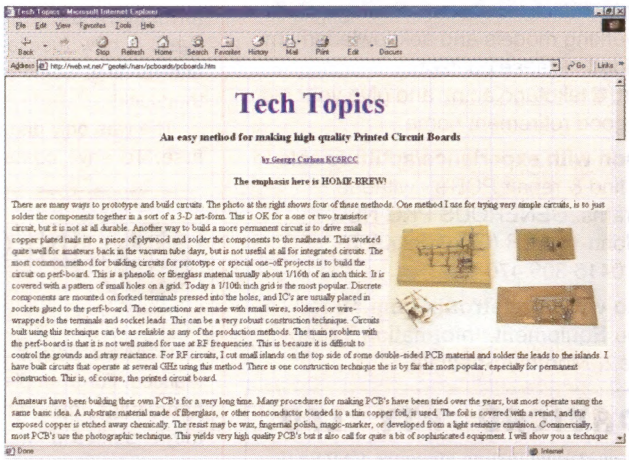
Cookbooks, cross references and CROs.

PCs ARE GENERALLY big, clumsy, bulky bits of electronics but they are the most under-utilised piece of test equipment most of us have access to. While many electronics-related sites seem to be little more than virtual catalogues, there are still some quite good resources on the Internet well worth exploring.

One is the University of Alberta's Circuit Cookbook Archive (**http://www.ee.ualberta.ca/~charro/cookbook/**). Here, you'll find audio and computer projects including some circuits that turn the humble parallel port into just about whatever you want. Universities are still a hotbed of design activity so it's worth trawling around seeing who's up to what.

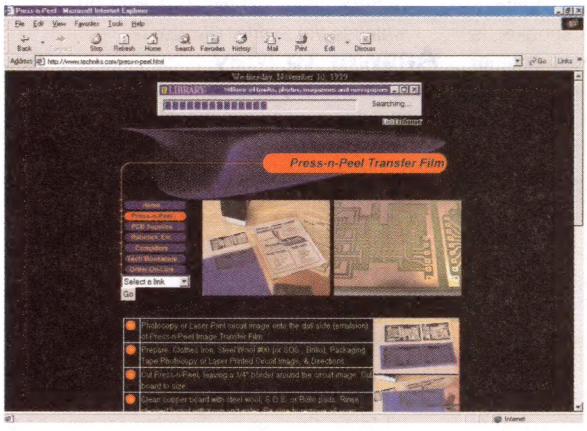
MORE SOFTWARE this month... If you're having trouble finding out just what type of chip you picked up in that last batch of treasure/junk you bought surplus, why not try this demo download of the Semiconductor Cross-Reference Library?

The real dollar-ware version has over 500,000 devices listed but this demo version still isn't too bad with 47,000 parts listed. It's a two-part download (I hate that) but should take less than ten minutes. If it finds the chip, it will give you a brief description to help you on your way. Point your web browser to **http://www. electronic-repair.com/ free.htm**.



PLENTY OF INTERNET sites are little more than glitzy froth and bubble, full of flashing lights and dancing girls but nothing of any substance. Every now and then you come across a rough diamond, which is exactly what this next site is.

I have to say Kazuhiro Sunamura's home page doesn't look like anything special and in fact, it looks a little confusing at first, but when you get the hang of it there are plenty of jewels here for the viewing. There are over 130 projects, and some are completely intriguing such as turning your CRO into a TV and then, turning your TV into a CRO. There's enough stuff in this site to keep you busy for hours, so if you have a lazy Saturday afternoon ahead of you, head over to **http://www.intio.or.jp /jf10zl/**.



DOES ANYONE REMEMBER how to make your own circuit boards? 20 years ago, you could smell those horrible Ferric Chloride odours wafting from almost every second backyard shed. Thankfully, Ammonium Persulphate has come to our aid but there are so few hobbyists left making their own boards it may be too late... Too late? We'll fix that! Point your browser to **http://web.wt.net/~geotek/nars/pcboards/pcboards.htm** and find out how using a laser printer, you can create your own high-quality printed circuit boards for your projects.

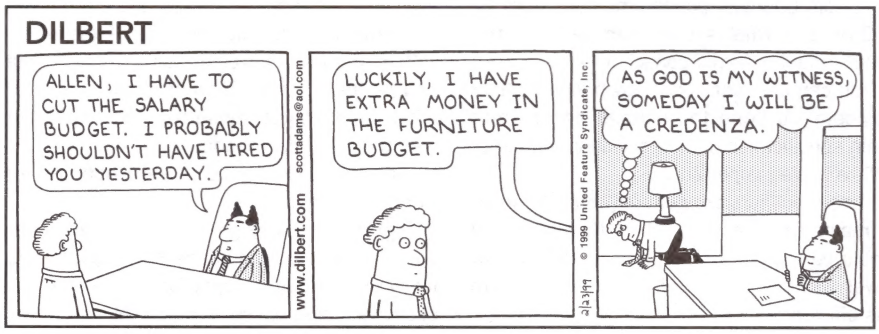
This bloke uses a special plastic-backed film designed for this process called Press-n-Peel. The only problem is that you have to order it in from the US. The nuts and bolts of it are you print your circuit board pattern on the material, reverse-side up, iron it on to your blank clean copper board, etch it and you have your printed circuit board all ready to drill and solder.

I'd ditch the Ferric Chloride he uses and go for the Ammonium Persulphate (it doesn't smell anywhere near as bad) but this is well worth a read at least.

It's amazing what you find — when you look... This Press-n-Peel stuff looks to be pretty good. It's made by Techniks in the US. You can order it on-line for $US100 for 100 A4-size sheets. It's certainly cheaper than Riston and far less messy than using Electrolube or other spray-on photo resist materials.

If anyone has used this stuff before, I'd be interested to hear how you found it. Drop me an email at dyates@pnc.com.au.

Oh yeah, you can find the Press-n-Peel web site at **http://www.techniks.com /press-n-peel.html**. ■



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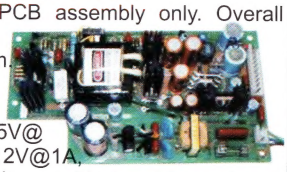


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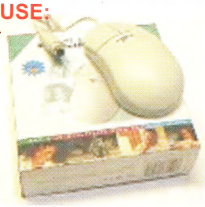
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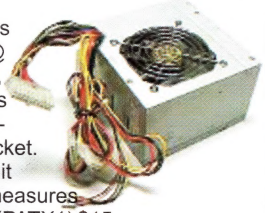
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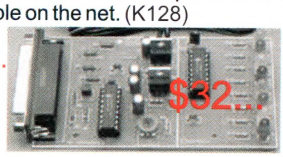
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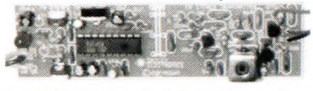
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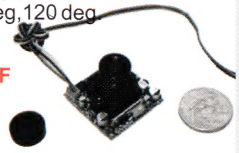


STEREO FM TRANSMITTER KIT: This kit accepts a stereo line input from any source and will transmit it on the FM Radio band between 88-108MHz. This kit is based around the BA1404 FM modulator IC. The transmitter in this IC is not very stable in terms of frequency so our kit uses our FM Transmitter MKII for the transmitter section. It operates from 6-12V DC and draws 8mA @ 9V. 25 x 65mm PCB size. PCB plus all on-board components, plus battery connector and 2 electret microphones: (K94) $25



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pinhole (60deg.), 92 deg,120 deg add $10 for 150 deg.



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Best Buys Home Theatre

"A new benchmark in excellence in every criteria: construction, design, finish, innovation."
Best Buys Home Theatre '97' 98'

"Highly and unreservedly recommended."
Best Buys Home Theatre

"... In value for money stakes or even sound for dollar stakes for that matter, they're nigh on impossible to beat."
Australian Hi-Fi

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