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Enabling Technologies

Ever noticed how some technologies arrive with a bang, but soon die from lack of support? AM Stereo radio and laserdisc video spring to mind — they were a good idea at the time, but somehow they just didn’t catch on. There was nothing wrong with the technologies concerned; their failure to thrive was due to poor marketing, or simply bad timing.

At the other end of the spectrum, we have technologies that don’t particularly grab you when they appear, but you turn around a year later and everyone’s using them...

Colour LCD screens have done just this. They appeared a couple of years ago in some of the more expensive laptops, and were considered a luxury by all except the lucky few who could afford them.

Since then these screens have grown bigger, and brighter, and faster, and cheaper, and — well, now you’ll find them everywhere. Flip-chip assembly units, public assess terminals, stock control systems, even your local supermarket use them as a simple, practical way of conveying information to the user, without all the size, weight and frailness of conventional CRTs.

So the winners in the technology game aren’t necessarily the big noisy inventions — they are far more likely to be the ‘enabling’ technologies that allow you to do things you couldn’t do before. Non-volatile ferrite RAM, flexible polymer displays and cheap and powerful computer imaging are the sorts of things that are going to make a difference in the long term. Look out for them.

Graham Cattley, Editor
Video on your mobile

SAMSUNG have just developed their IMT-2000 wireless service, that provides video at 15-20 frames per second. Video can come from standard video on demand services, or digital cameras can be hooked up to the handset so users can take pictures at any location and send the images wirelessly to wherever they want.

Also shown is a prototype of Samsung’s new TV phone, the details of which are sketchy at best... Try calling Samsung on (02) 9763 9700, but you might have more luck searching their website at www.samsung.com.

3.3 megapixels arrive!

OLYMPUS has introduced the Camedia C-3030 ZOOM compact digital camera. Featuring a 1/1.8 inch CCD with 3.34 million pixels, the new flagship is the series’ first model in the 3-megapixel class.

The C-3030 has a broad range of functions, including many that have won wide acclaim for the earlier C-2020. As well, the 3030 offers added creativity and flexibility; it can record audio input as well as images, and the high-speed Sequence Mode uses new SDRAM - the same kind used in PCs - to shoot SUXGA images (2,048 x 1,536 pixels) at a maximum of 3.1 frames/sec. There are also the convenience and speed of USB connectivity and many other new features.

The C-3030 ZOOM has a 1/1.8 inch CCD with 3.34 million pixels, and a bright Multivariator 3x zoom lens which makes the most of this potential with its large f2.8 aperture. Performance is also enhanced by a range of features including a new iESP AF system, Digital ESP Metering, iESP Auto White Balance and other exclusive innovations. This is also the first Camedia model with an audio recording capability.

Sound can be captured simultaneously with a moving image, or an audio note can be added to a still image. Using BGA technologies, Olympus has developed compact 32MB SDRAM for the C-3030 ZOOM - the key to recording up to five SUXGA images (2,048 x 1,536 pixels) at high speed. Sequence Mode shooting is as fast as 3.1 frames/sec., and Standard Mode recording has been speeded up as well. This response offers extra reassurance that an opportunity will not be missed, even with the increased size of high-quality images.

As well, the new long-life LB-01 (CR-V3) lithium battery packs offer the freedom of lasting 1.5-2 times longer than nickel metal hydride batteries. For further information, contact R. Gunz Photographics on (02) 9935 6800, or email gunzmail@gunzphoto.com.au.
JVC HAS INTRODUCED their new GC-Xl digital still camera. On the outside, this product looks remarkably like a high-grade compact film camera, but it is actually something quite different - not a conventional film camera, and not just a compact digital camera either; inside it features a 3.34 million pixel CCD which delivers high resolution digital still images, including a maximum image size of 2032 x 1536 pixels. Also featured are 3 unique JVC technologies, namely a Mega Pro-Still mode which increases resolution dramatically, NR Pro-Still mode which boosts the signal-to-noise ratio by 9dB, and DR Pro-Still mode which delivers 'latitude' that approaches film quality. And as a substantial bonus, this digital still camera comes with creative functions that go beyond conventional still shooting, including the ability to shoot video clips up to 20 seconds long that make convenient e-mail attachments.

Then there's the built-in Collage function that lets the user add layer upon layer of additional visual elements to create interesting pictures that would usually require a computer with advanced graphics processing software.

For more information, contact JVC on 1800 225 044, or visit www.jvc-australia.com.au.

New 8mm camcorders

HITACHI have announced three new 'made in Japan' 8mm camcorders, positioned to give the budget conscious consumer outstanding performance at reasonable cost. Hitachi also announced that these three analogue camcorders will be followed later in the year with new Digital 8 models, and a unique DVD disk based Camcorder for those wanting direct computer convergence. The new 8 mm cameras feature advanced DSP processing and enhanced Digital features resulting in improved images and ease of use.

The entry level Camcorder model VM-E308E incorporates many of the basic features found in all the new 8mm range. Primarily Hitachi's new 4DQ or 4 point Digital Quality System is designed to offer 8 mm users many of the benefits of DV video at low cost, using the new one-chip Hitachi DSP processor.

The new VM-E368E features a new compact case, long life Li-Ion batteries, 0.1 Lux sensitivity, advanced digital effects and the ability to play back both PAL and PAL 60 recordings. The VM-E568LE boasts all the features of the VM-E368E plus the inclusion of a high-resolution 2.5" LCD, and automatic backlight control depending on ambient conditions.

The top of the range Hitachi VM-H768LE includes a number of technology features that position this Hi8 camera close to that of a high end DV camera at much lower cost. Firstly this new camera features Tape Analyzer, an automatic system that analyses the actual tape being used in the camera and adjusts recording parameters to suit, resulting in an improvement in S/N by up to 20%. However of most interest is the new Tape+ feature that permits 400 line Hi8 resolution while using standard 240 line 8 mm tape, a big cost saving!

These three new 8mm Camcorders are available now with RRP’s of: VM-E368E $819, VM-E568LE $999, VM-H768LE $1,499.

Touchscreen Camcorder

BE A HOLLYWOOD DIRECTOR! Maybe... Sony Electronics VP, Jay Sato, demonstrates how to be your own movie director with Sony’s innovative MD-Discam DCM-1 camcorder. Sony’s disc-based digital camcorder uses a touchscreen LCD for video editing of thumbnail images, allowing you to add titling and special effects to your home video. And you can do it all in the palm of your hand!

For more information, contact Sony on (02) 9878 9712.

Electronics Australia, July 2000
**S-VHS all round**

JVC has applied its new S-VHS-ET technology to its entire line up of analogue camcorder models for 2000. They are introducing a new camcorder line that offers users the picture performance and advanced shooting features in an affordable, compact package.

The range consists of the GR-SX21 which provides high-resolution Super VHS performance, the GR-SXM26 which adds flexibility with a tiltable 2.5-inch LCD monitor and built-in Auto Light, and the GR-SXM46 with its larger 3-inch LCD monitor, 450x Digital Hyper Zoom, Playback Digital Effects and Video Snapshot mode.

All three models offer three different shooting options so the user can choose the one that is most appropriate for the occasion – Super VHS high-band recording for high quality analogue recordings, Super VHS ET for convenient and economical recording of high-resolution S-VHS, and standard VHS to allow direct tape playback (via cassette adapter) on virtually any VHS deck.

For more info, contact JVC on 1800 225 044, or visit www.jvc-australia.com.au.

**New monitors from JBL**

JBL has introduced a new shielded monitor loudspeaker designed specifically for commercial sound applications. The JBL Control 25AV is ideal for both indoor and outdoor applications requiring magnetic shielding, extended frequency response and extremely flat midrange.

A polypropylene woofer cone with JBL’s Weatheredge protects the basket as does a weather resistant dustcap and high impact polystyrene cabinet. The model provides an exceptionally smooth, flat frequency response to 14kHz with even more off-axis performance thanks to a newly designed high frequency horn, steeper sloped crossovers and complex network topology. An improved 70v/100v transformer is selectable by a rear panel switch, and shielded drivers improve flexibility and support video applications. Overload protection has been upgraded with JBL’s SonicGuard providing a wider dB range of limiting, and both the cabinet and grille are paintable to match any decor. JBL’s Control 25AV is distributed by Jands Electronics. For more information please contact Jands on (02) 9582 0909.

**Extreme phone**

PANASONIC has released its new ‘Gigarange Extreme’ cordless phone, with a stylish design, and advanced features that provide excellent overall performance. The new spread spectrum cordless phone features a dual antenna system for extended range and sound clarity, and rubber trim to protect against accidental splashes and minor impacts.

The KXTG2570ALS is available in modern metallic silver and is priced at $449. It features a digital answering machine, call waiting compatibility, 50-station Caller-ID memory and dialler, digital duplex speakerphone, 30-name and number telephone directory, and intercom with two-way paging.

It is equipped with an all-digital answering system that is virtually silent, with no tapes to reset or rewind. A voice prompt guides users through the task of leaving a message, and messages are each stamped with the date and time they were received. All recorded messages are held in flash memory, to survive power interruptions.

The phone incorporates a high-capacity nickel metal hydride (Ni-MH) battery, which offers up to eight-hours talk time and up to 14 days standby. It is available from leading electrical retailers and communications specialists, or contact Panasonic’s Customer Care Centre on 132 600.
Recording, in a flash

MARANTZ has released the first in a new generation of portable field recorders based on Flash RAM hard disk recording media. With the combination of shock resistant recording, internal editing and electronic file transfer the Flash RAM media format ideally lends itself to field recording. Using the Marantz PMD680 a location reporter can now take recordings and interviews on the fly, edit, add dialogue and compile a report then download the file to a laptop for transmission to HQ via a modem.

The new single channel recorder has been designed to make the Flash RAM format easy to use with large transport keys and selectable function buttons like speaker (on/off), record level (ALC/Limiter/Manual) and input (Mic/Telephone/Line) mounted on the top face. The PCMCIA Flash RAM cards achieve up to 80 minutes PCM recording (1.2G) and the PMD680 uses this capacity to provide workstation type facilities to cut, paste and edit a recording using the built-in speaker or headphones to monitor. The choice of uncompressed linear 48kHz 16 bit PCM, or, compressed (with selectable bit rate) 48 kHz MPEG-1 Layer II recordings are converted to an MS-DOS (Broadcast.WAV) compatible file for editing either within the PMD680 or on a computer using a built-in Edit Date List which allows the recording to be arranged in any order without affecting the original recorded material. Editing on a computer can be via an MPEG audio editor, or a .WAV editor for PCM recordings.

Recommended retail price (Incl GST) for the mono PMD680 is $2,995. For more information contact Technical Audio Group, 558 Darling Street, Balmain NSW 2041. Phone (02) 9810 5300. Or visit www.tag.au.com

Telling the time

WITH A VOICE announcement to tell you the time every hour (or if that would drive you nuts, when the button is pressed), the new style Talking Alarm Clock from Dick Smith Electronics is perfect to keep track of time.

This modern looking silver clock has three levels of volume control as well as selectable alarm voices - choose from cuckoo sounds, a rooster crowing or a voice announcement to get you going in the morn-
The Remote of the Gods

HAVE YOU ever felt that the coffee table, once the place for specialised books and magazines and that carefully chosen 'conversation piece', now resembles a market stall for new, used and broken remotes? If so, then Marantz may offer an alternative.

They are now attempting to solve the problem by offering a number of Universal Learning Remote Controllers. A Universal Remote Controller gives total control of everything from TVs, VCRs, DVDs, A/V receivers, CD players, cassette decks and tuners.

Marantz's Universal Controllers learn the codes in your existing controller by positioning the sensors nose-to-nose and running through each function in turn. Starting with the RC1200 at $249, this Universal Learning Remote Controller comes with all Marantz codes pre-programmed while at the same time able to learn other controller codes. The RC1200 is compatible with the ultra-high frequency infrared codes favoured by many leading hi-fi and video brands.

The highly acclaimed ergonomically designed RC2000 MKII at $399 offers similar features including an easy to reach LCD readout and a built-in sensor that causes the handset to glow in the dark, to help prevent its getting lost. However it's the RC2000's ability to control up to 10 separate sources and advanced layout design that sets it apart from other controllers.

The $899 Marantz RC5000, however, is so advanced that not only will it learn the codes of any controller on the market, but it also offers the ability to download software from the Internet so you can design your own remote control menus, buttons and layout on your computer. A PC link cable lets you transfer your new designs to the headset.

For further information on these and other Marantz products contact Jamo (Australia) on 1800 242 426.

News from DSE

A LITTLE OVER a year ago a great new high technology robotic kit system called LEGO Mindstorms was launched in Australia. Despite its comparatively high price tag, it has been a great success for Dick Smith Electronics.

For LEGO it has given them the chance to broaden the appeal of their original building blocks concept and bridge the gap between a traditional product and new technology.

Since its worldwide release it has developed a cult following evidenced by its website www.mindstorms.com where enthusiasts regularly post their new inventions, tips, and enter monthly competitions. The kits are designed for anyone aged nine and up and although many people may perceive them to be sophisticated children's toys, I am reliably informed that there are many adults who are great fans of LEGO Mindstorms.

Some fans have become so involved that they have written books that contain a huge amount of detail about the kits and how to get the most out of them. In fact, Dick Smith Electronics sells two such titles. The product began with the LEGO Mindstorms Robotic System which was launched in Australia in May 1999. For those of you who haven't caught up yet, LEGO Mindstorms comprises the traditional LEGO bricks and a microcomputer that can be programmed using a personal computer. A powerful but simple programming language is used to determine how the robot should behave. The program is downloaded to the robot via an infrared transmitter, at which time it is set in motion to react to its environment using special bricks and sensors. The original kits was followed by several expansion kits shortly afterwards.

To capitalise on the success of the Star Wars movie last year a Droid Development Kit was released in September 1999. It allows users to create Droids like R2-D2 or as the website says 'use the Force to create droids of your own'.

The most recent edition to the fold has been the LEGO Mindstorms Discovery Kit that arrived in Dick Smith Electronics stores in March this year. If you're a fan of LEGO Mindstorms, then you'll be pleased to know that LEGO is working on new products to expand the range. Keep an eye out in EA for future releases.
Yepp, it's an MP3 player

THE YEPP is Samsung Electronics latest MP3 player. Based on the popular MP3 audio format, the ultra compact Yepp allows you to download from your favorite music website or transfer music from your CD collection through your PC and play back crystal clear digital audio.

With its small size and lightweight, Yepp is very portable and since there are no moving parts, Yepp does not skip, change pitch or add distortion no matter how extreme your sport. The Yepp has a seven-mode audio equalizer, featuring a 3D audio setting, and a three-line LCD display allows easy navigation through your customized play list. The display can show the name of the track and the artist, as opposed to simply listing the track number.

Samsung has included an advanced voice recording mode so you can record class lectures, meeting notes and personal reminders and then e-mail them to anyone you want. There is also a convenient telephone directory function that can store several hundred contacts.

The YP-E64, which has 64MB of embedded flash memory, has an RRP of US$249.95 while the YP-E32, with 32MB of embedded flash memory, sells for US$169.95. Australian prices are yet to be confirmed. Additional information can be found at www.samsungyepp.com.

Solar power

DICK SMITH ELECTRONICS has added a new solar panel to their extensive range of alternative energy products. The new 1.8 Watt solar panel maintains charge of 12 volt batteries and is suitable for use with cars, tractors, 4WDs, motorcycles or boats. Solar power systems consist of solar modules, rechargeable batteries to store electricity for later use and a control unit, all of which are available at Dick Smith Electronics.

The range is from very small solar modules used primarily by hobbyists and electronics enthusiasts right up to large solar panel installations used for providing power in private homes and small industrial applications. In between there are plenty of mid-sized solar panels used for applications like boat owners who can go away and leave a solar panel hooked up to a battery and know that it will be fully charged any time they need to use it, plus four wheel drive enthusiasts who need power in remote locations where no mains power is available.

The ICP Solar Panel is available from Dick Smith Electronics Australia wide and Dick Smith Electronics Powerhouse stores at Penrith, Bankstown, Moore Park in NSW and Carnegie and Nunawading in Victoria for a retail price of $49.90.

Pioneer

Scratch here for $300 extra VALUE

You'll always win with Pioneer. Firstly because Pioneer are the innovators in audio video technology, and secondly because of this special offer. Pioneer has teamed up with some big names to give you $300 worth of extra value in every Pioneer Lifestyle System, Receiver, DVD, Mini System and CD Recorder box. For example, get $30 off an MP3 Player from MP3.com.au, enjoy bonus rental offers from Blockbuster® and much more. Go on, get scratching. See your Pioneer dealer for details or Freecall 1800 060 852. Offer ends July 31st 2000. www.pioneeraus.com.au
Nortel acquires Photonic Technologies to help build the Optical Internet

NORTEL NETWORKS - ranked number one globally in Optical Internet systems for 1999 - has announced the acquisition of Australian-based Photonic Technologies for nearly US$35.5 million in cash. Nortel Networks already owned approximately one third of the privately held company, which is based in Sydney and regarded a pioneer in strategic optical components.

Photonic Technologies is a world leader in the development of optical component technology for the manipulation and control of the polarisation of light. Photonic Technologies' circulators and dynamic gain flattening filters are critical technologies for high-speed optical networks, and Dense Wavelength Division Multiplexing (D-WDM) networks.

Photonic Technologies' expertise will accelerate Nortel Networks lead as the industry moves from 10 Gigabits per second (Gbps) systems to 40 and 80 Gbps systems. Circulators and dynamic gain flattening filters are key components for next generation 40 and 80 Gigabits per second (Gbps) optical systems.

"This acquisition, coming two years after our initial investment in Photonic Technologies, is an outstanding example of our strategy of scouring the world for leading technologies, and our success at working closely with strategic partners towards shared objectives," said Barbara Callaghan, president, Nortel Networks High Performance Optical Component Solutions.

Photonic Technologies will become part of Nortel Networks' High Performance Optical Component Solutions (HPOCS), the unit recently formed to bring together all Nortel Networks businesses serving optical systems producers with strategic optoelectronic and microelectronic components. HPOCS offers one of the broadest ranges of strategic optical components in the industry and works closely with Nortel Networks Optical Networks to develop the world's leading systems for the Optical Internet.

Founded in 1993 in Sydney, Australia by Ralph Betts and Steven Frisken, Photonic Technologies employs 70 people. Photonic Technologies develops and manufactures at its Sydney facilities, and had revenue last year of US$2.5 million. Photonic Technologies will continue to be led by managing director Betts and technical director Frisken.

"Joining forces with Nortel Networks, the world leader in the Optical Internet, is a logical next step for us after our successful relationship," said Photonic Technologies managing director Ralph Betts. "We are looking forward to the opportunity to demonstrate the power of our pioneering technology on a global scale."

IBM recall on AC adaptors

IBM IS RECALLING AC ADAPTORS that were supplied with some older IBM mobile devices, namely those for the IBM ThinkPad 310 (type 2600 only) and ThinkPad i Series (type 2611 only). No other IBM AC adaptors are part of the recall, and the actual notebook computers are not affected.

Apparently, some of the adaptors have exhibited signs of overheating and may pose fire hazard, but there have been no reports of injuries associated with the suspect adaptors. For further information and to get a replacement adapter, visit the website at www.ibm.com/adaptorrecall.

Sony PDA's hook into the Web

WITH A PROPOSED launch date during this year, Sony is aiming for its new 'Mobile Internet device' to be as popular as its venerable Walkman series of portable music players.

According to the firm's newly appointed president Kunitake Ando, Sony is placing a great deal of emphasis on new mobile wireless devices for tapping into the Internet. While he's no doubt also interested in tapping into the pockets of the mobile-obsessed youth culture in Japan and the US, Ando is aiming to consolidate Sony's business through core products such as the PlayStation game console, their Vaio personal computer and the new mobile personal digital assistants.

Sony plans sell a mobile device based on software it recently licensed from Palm Computing, the early innovators of PDA (Personal Digital Assistant) technology. The Internet-ready mobile systems will use software applications from Palm to transfer e-mail and digital images between users.
Indian Internet makes tracks

ENGINEERS IN INDIA have developed a clever way of bringing the Internet cheaply and quickly to India's vast rural population. Put simply, they plan to use India's extensive railway communications network as the infrastructure to pipe the Internet around the country.

To test the theory, a trial project has been underway where around 40km of railway (including five stations) was been linked, joining the southern Indian towns of Vijayawada and Guntur. All the five stations have Internet 'cybercafe' kiosks for local people who don't own computers, with one station also providing wireless Internet connections for about 15 houses in the surrounding area.

The project is due to conclude about now, and if the technology proves successful, larger railway connection systems will be implemented. The engineering team predicts that around 100,000 homes in 4,000 towns could then be linked to the Internet within two years.

"India is in a unique situation," said one of the project's leaders, Professor Ashok Jhunjhunwala. "We have a railway station, on average, every 8km all over the country. This way, we can bring down the costs significantly," he said. "I'd say the connection cost would come close to affordability for local people."

The key to the bold plan is the idea of using the railway's existing cabling, thereby avoiding the expense and delays involved in laying out a new system.

India's electric train rail network has control and communications cabling which usually has spare lines, so these can be used for connecting modern telecommunications services (such as the Internet) to rural areas.

Both the reliability and bandwidth of this theoretical network will be important questions for the development team though, if the scheme is to go ahead to full capacity.

India's notoriously erratic electricity supply could be one of the main problems. "Many of these places don't get power for more than six to eight hours a day," says Professor Jhunjhunwala. "We need to investigate back up. Perhaps batteries, for example, or solar panels."

The other big challenge is making access to the new system affordable. Professor Jhunjhunwala says that most villagers cannot afford the expense of a personal computer, but many could pay the proposed low connection charges. This is the main reason for basing the system on cybercafe kiosks at train stations.

With India's burgeoning high tech industry opening opportunities for the population, the interest in improved communications - and particularly Internet access - is high.

"A lot of people in rural areas think the Internet is only for people in cities," says Professor Jhunjhunwala. "The villagers don't know very much about it - but they're keen to understand it. There's a strong belief that if you can even get partly educated, your future career is guaranteed."

Inmarsat's $1.4 billion global network

SATELLITE COMMUNICATIONS operator Inmarsat is planning to build three satellites for a new broadband satellite network, dubbed Inmarsat I-3. The new network will provide at least ten times the capacity of Inmarsat's existing I-3 network, reducing costs, and raising access speeds from 64k-bps up to an impressive 432k-bps.

The new network will allow Inmarsat to deliver internet content, LAN/WAN access, email, video, fax and voice to portable devices (notebooks and palm tops) at almost any location in the world.

London-based Inmarsat (www.inmarsat.com) said in a recent statement that by 2003, some 70 percent of traffic on its I-3 network will be data. The I-4 network service is expected to be in operation by 2004.

It's a huge investment. Inmarsat will invest around $700 million in ground stations and support systems, and has awarded a $700 million contract to space consortium Astrium bringing the total cost of the Broadband Global Area Network to $1.4 billion. Nevertheless, the company expects the network to generate revenue in excess of $10 billion during its life cycle.
$4 Million Technology Centre in Wollongong

WOLLONGONG'S new Nortel Networks Technology Centre based at the University of Wollongong was officially opened by Pierre Pettigrew, Canadian Minister for International Trade, and Michael Egan, Treasurer and Minister for State Development, New South Wales State Government.

The centre replaces a smaller Nortel Networks R&D facility at the University, where Canadian-based Nortel Networks has been running R&D programmes at more than ten years. The new centre is three times the size of the older facility and can house up to 160 researchers, engineers and support personnel.

"Last June we had 68 people working in our R&D facility," said J. B. Clarke, director, Nortel Networks Technology Centre. "Now we have 117, and by the end of the year we will reach 160. This reflects the number of major R&D projects we are now able to undertake. Current programs cover wireless access, optical networks, advanced IP (Internet Protocol), telephony and data networks for enterprises."

NSW Treasurer and Minister for State Development Michael Egan welcomed Nortel Networks' continued investment in research and development in Wollongong.

"Nortel Networks is creating high-tech jobs and supporting training that provide a firm footing for the future of the Illawarra region," Egan said. "Nortel Networks and the Wollongong University give life to the region's title as a telecommunications centre for excellence. The NSW Government welcomes Nortel Networks as a great corporate citizen and ally in regional development."

Reg Bird, president, Service Provider Solutions for Nortel Networks in South Asia added "Last year Nortel Networks committed to investing A$150 million (US$84 million) in Australian export and R&D initiatives. Central to that investment was the building of this world-class Wireless Internet research and development facility, which is dedicated to serving our customers in Australia and the Asia Pacific region with innovative mobile services and applications."

Expansion of local R&D is a critical part of Nortel Networks' investment in Australia, which also includes recruitment and driving exports of Australian-made products. Last week, Nortel Networks announced the purchase of Sydney-based Photonic Technologies, a leading manufacturer of Optical Internet components — see story in this section.

Also, in March Nortel Networks announced an agreement with Sydney-based GPC Electronics for manufacture of Nortel Networks' i2004 Internet telephones. The agreement covers production for global markets, with export revenues expected to exceed A$32.57 million (US$20 million) in the first 12 months.

Australian Love Bug connection

THE CASE OF the Love Bug worm virus has been slowly unfolding as authorities zero in on Filipino computer students from the AMA Computer College in Manila, and mainly those connected with members of the de Guzman family.

Members of Grammasoft, an informal company staffed by students that provides software services to small businesses, are very much in the spotlight of the Philippines National Bureau of Investigation (NBI), who are pursuing the case through their anti-fraud and computer crimes division. Grammasoft is regarded by many as a virus writing group, and several members have been summoned for questioning by both the NBI and AMA college officials.

Meanwhile though, independent researchers have been hot on the trail, tracking down the culprits using Usenet, ICQ and IRC message logs, clues in the virus' own source code, plus the code from a similar trojan virus linked with the AMA College, Jean François Gagné, a computer consultant from Montreal, has put forward the theory that the virus code originated in Brisbane. It then made its way to the Philippines before being launched from both Manila and Dar es Salaam in Tanzania at about the same time.

"One thing is for sure, this was not a single launch," said Gagné. "Just like a fire, the spread was too quick." He believes that Manila was launch pad number one, and Tanzania number two.

"The Love Bug" was localized in East Asia, and suddenly it struck Africa, then Europe, and America," he noted.

Swedish computer virus expert Fredrik Bjorck from the University of Stockholm also supports the theory of the Australian connection.

Bjorck says a German student living in Australia created the virus, but may not have meant for things to go this far. 

"(He) is the creator of the virus, but remember that it might not be his intent to distribute it," Bjorck said.

Bjorck certainly has the credentials to give weight to the theory. He and virus experts Richard Smith and Jonathan James were responsible for tracking down the creator of the infamous Melissa worm.

Along with an acerbic attack against "wide open" Microsoft software, incompetence in the IT industry, the media, and "stupid" computer users who open unsolicited email attachments, Australian hacker group founder "Valiant" claims that the more recent 'NewLove' virus variant may have been developed from a benign virus he released.

His "ILOVEYOU"O worm has no destructive payload and designed to demonstrate how another virus could again rapidly spread, in spite of anti-virus systems and users awareness of the dangers of email attachments. Apparently, key aspects of his code appear to have been copied to create the new malicious virus.

Valiant said that releasing a malicious virus is a "relatively lame" thing to do, according to the Wired news service. He then added, "It's the fastest way to get the world's attention to a degree that evidence will be made available to the people who can put you away for a long time. Damaging (other people's computers) gets you locked in a cell with a 300-pound guy named Mary."
RMIT students to use Aussie controller

SPlat CONTROLS, based in Seaford, Victoria, is beginning to tackle the export industry with its Aussie microPLC, the SPlat Controller. The Company has now joined forces with A.V.H. Electrical Engineering, who are donating over $100,000 worth of laser and microPLC equipment and services to the Department of Manufacturing and Mechanical Engineering at RMIT. A considerable part of this donation includes a package of programmable controllers from SPlat Controls.

The donation was formally handed over to the Dean of Engineering Professor Robert Snow by Mr Nick Middendorp, Director of Middendorp Electric Company P/L (the parent company of A.V.H. Electrical Engineering Co) at the new Bundoora campus of RMIT.

David Gibson, Managing Director of SPlat Controls said "we're delighted SPlat controllers will become part of the teaching program of such an important educational institution as RMIT. And we're looking forward to our participation in the part of their fourth year programme that focuses on machinery controls."

He went on to say "our controller is unique, it is straightforward, understandable and easy to use. Even more importantly, it comes with its own software and uses jargon-free programming language. The inbuilt tutorial, and access to further assistance through the Company's web page (www.splatco.com.au) makes this microPLC a true innovation."

Mr Gibson said that SPlat controls are currently being used across a wide variety of industries, from luxury boats through to irrigation systems and air conditioning equipment. He added "it's a perfect controller for future manufacturing and mechanical engineers to be using."

"We are committed to our fully Australian designed and manufactured controller cutting into the huge quantity of imports in this industry. Indeed, we currently have enquiries from overseas which could lead to a healthy export market he said."
**Remote wanted**
We have a Toshiba C2041 colour TV which over many years has been marvelous. It had an early-type remote CT403 based on ultrasomics. The remote has 'had it', and is not now available from Toshiba. So, do any readers have a working remote that they would like to sell, or can anybody tell me what frequencies are used for channel-up, channel-down, on/off, volume and display, or is there someone out there who might be able to repair it?

R Grant, 3770 Moggill Rd., Brisbane Qld 4070

**Plugging on**
Regarding your Item 'Plug Pack Safety' (EA. June 2000): Yes, a cause for some anxiety, undoubtedly — perhaps it's worth taking a domestic inventory of these devices!

My almost immediate reaction: nice little earner for someone, willing to make and market two quite simple devices:
1. A small box with plug one side and socket on other, with a suitable low-current cut-out between, to be inserted between plug-pack and mains socket.
2. We already have multi-socket mains adapters fitted with 10A cut-outs, so why not similar ones with low-current cut-outs; perhaps a 'Deluxe Model' would include adjustability, so that they could be tailored to just the right current for the total devices plugged in — a simple concept which needn't cost much. One point though; the sizes and configurations of the plug-packs vary a lot and it's often difficult to fit them as close to each other as needed on the standard multi-adapters.

See how simple-minded some of your adoring readers are?

Michael Hayman (via email)

**Java gripe**
I saw Tom Moffat's Madhouse gripe (June issue) on the overuse of Java in web pages just one day after having exactly the same problem with a web site. After waiting about two minutes for something to be displayed, I finally just closed the browser, restarted it and browsed elsewhere.

If a website takes more than about a minute to display anything of any substance on my screen, I usually abort the download and never return to that site. Astute website designers will note that this means that most of their fancy (and bandwidth-gobbling) advertising goes completely unseen by me.

A subject related to this is ISP charges in Australia. Despite there being many ISPs in Australia, charges for access to the internet remain quite high here. On my connection, I only get a certain number of hours per month before I have to start paying extra for overtime. I am hardly likely to waste that limited time by waiting for a web site to send me unwanted advertising. If I had unlimited time, at a reasonably low set fee, I would be more likely to put up with the advertisements.

Even when a website only has limited advertising, it is extremely unlikely that I will choose to click on an advertising link, for the reasons already stated. Since many ISPs also host websites which have extensive advertising, perhaps they should rethink their charging strategy. If they do not want to reduce the amount of advertising in their web pages, they should lower their access charges so that their users can afford to stay on-line long enough to read the advertising.

Jason Masters (via email)

**KISS and usage**
I've enjoyed reading May's issue, and have a couple of comments, if I may:

I love hi-tech toys like the best of them, but I've got to say 'right on' - your comments about the sheer 'frilliness' of some of today's gadgets. Too many of today's new products are just answers begging for solutions, or so hopelessly overcomplicated to be unreliable and/or unusable. As The Serviceman noted, there's not enough KISSing going on today...

And in Forum (re. 'political correctness'), unfortunately today's 'proper English' just can't deal with modern approaches to avoiding bias with regard to such pronouns as he and she, so we, as a society, are developing new forms. That's the way it is, and I say to Mr de Pree, "if you don't like it, don't use it" :-)

English is a fluid language, we're each free to modify it as we wish — so long as we get the idea across, we've been successful. (By the
End of the road?
I saved as a kid from the age of eight to buy and, in later life, to subscribe to this magazine in its various forms for around 50 years. Its latest reinvention no longer fulfills my needs. My sincere thanks to those who have preceded you as editor. EA is now sadly just another periodical trying to be all things to all people, and, as I perceive it, bowing to its advertisers in terms of product reviews.

Trevor Wilkey, Adelaide

Big fish, small pond
For many years I have bought EA, mostly for the informative articles and construction projects, but being an electronics engineer I was also interested in the Professional Electronics section.

But alas it seems that the new look has chosen to downplay all these aspects in order to function on more of a 'glossy' type level. It seems that EA is slowly becoming an equipment review magazine, with a few project thrown in for good measure. If I want to get a review on a hi-fi amp I'll buy a hi-fi mag, if I want a review of a digital camera I'll buy a photo mag. I want electronics, so now what do I buy? How long before the Electronics section drops out altogether and we're left with Electronics Australia hifi and AV review Magazine?

Bill Coghill, Sydney NSW

Two thumbs up...
I received my April issue in the mail yesterday and, on flicking through, was most impressed with the new format. The printing is indeed very clear and easy to read and the glossy paper contributes greatly to this. Congratulations.

Keep up the good work.

Eric van de Weyer
VK2KUR (via email)
Hiteker AD-600A
DVD, CD-R
& MP3 Player

It's new to the Australian market, it's very aggressively priced and it has quite a few other attractive features as well -- including the ability to play MP3 compressed digital music files. by Jim Rowe

IF YOU'RE STILL in the market for a DVD player (and many are), there's a new model on the local market that you might well want to consider. It's saddled with a rather weird brand name -- Hiteker -- but on the positive side it has so many attractive features and offers such unusual value for money that its name is neither here nor there.

Like many of the latest DVD and CD players, the Hiteker AD-600A is made in China -- in this case by the Jiangsu Hongtu High Technology Company. I've never heard of them before, but I gather that virtually the same player is being sold in the USA as the Apex AD-600A, and very similar models are sold elsewhere carrying the brand names Sampo, Norika, Raite, Monyka and Oldata. And whatever the name they've created quite a stir, wherever they've appeared...

THERE'S A SPECIAL 'BONUS FEATURE' I CAN'T TALK MUCH ABOUT...
But what's so special about this player, I hear you ask? Well, for a start it offers pretty surprising value for money, even as a DVD and video CD player. For example it offers not only composite and S-video outputs but the higher-quality component video (Y/Cb/Cr) outputs as well. That's something that few if any other low-end players offer.

On the sound side, like most DVD players it has a mix-down decoder for listening to Dolby Digital, MPEG2 or PCM tracks in stereo, or for external Pro-Logic surround decoding. But it's also DTS compatible, so you can hook an external decoder up to the coaxial S/P-DIF digital bitstream output for full surround decoding of DTS tracks as well as Dolby Digital. (There's no optical S/P-DIF output, though - only coaxial.)

As well as DVDs and video CDs it also play ordinary audio CDs, very nicely. All of which is quite impressive, considering that it carries the lowest RRP of any DVD player currently available: only $499.

There's more...

But that's not all, as it happens. The AD-600A also uses a laser with a wavelength of 650nm, allowing it to play CD-R discs as well. This is something that many players twice and three times its price often won't do.

Even better, its decoder knows how to handle MPEG1/Layer3 ultra compressed audio files - also known as MP3 files, and currently the subject of a lot of controversy because of their availability over the internet. So if you burn a CD-R with hours of favourite MP3 files (from your favourite CDs, for example), the AD-600 will play them quite happily from the disc. That's quite a bonus, in anyone's terms.

There's no stereo headphone jack for private listening, but on the other hand there are a pair of microphone jacks with matching volume controls, to allow the player to be used for karaoke.

Last but not least, the AD-600 offers a special bonus feature that I can't talk much about, apart from mentioning its existence. This is the ability to be set to play DVDs from virtually any region, simply by pressing a few keys on the remote control to access a 'secret' configuration menu. (Nudge, wink...)

Physically the AD-600A may not be all that prepossessing, but 'clean and functional' are the adjectives that spring to mind, and that's no bad thing. It's in a plain black case, with a moulded plastic front panel finished in gloss black, broken only by a central ruby-coloured panel over the blue fluoro type display. There are six lozenge-shaped buttons at the right-hand end for the main control functions, and just the mains switch and karaoke mic jacks and controls at the left-hand end. The overall dimensions are 430 x 300 x 81mm, and it weighs 3.3kg.

Inside, the build quality appears to be quite respectable and at least on a par with most sub-
$1000 players. The transport itself seems to be made in Korea.

The remote control is reasonably large in area (195 x 64mm), but is fairly slim in thickness – only 16mm including buttons. This makes it quite comfortable to hold, although there are no less than 50 buttons, which some users may find a bit intimidating. It's really not too bad, though. Some of the buttons are also very handy, like volume Up/Down, picture Zoom, Slow play (1/2, 1/4 and 1/8), Fast play (2X, 4X, 6X and 8X) and a group associated with karaoke mode such as Echo +/-, Key +/-, Vocal Assist and Surround.

In fact the only really unusual aspect of the remote, apart from all the functions it offers, is that the key called 'Menu' on most DVD remotes is here called 'DVD Digest'.

**Checking it out**

Local distributor FreNEtiC sent us a sample of the AD-600A, so we could give it a workout and evaluation.

First off, I ran the usual tests with instruments and test CDs, to check its basic audio performance. And the results were quite respectable, albeit not spectacular. The frequency response measured within +0.1dB/-3.0dB from 8Hz to 20kHz, with channel balance within 0.15dB and crosstalk at -81dB down. The fade to noise test showed linear output down to below -80dB, with a signal to noise ratio and dynam-
ic range of better than 94db. The total harmonic distortion (THD) measured 0.013% at 1kHz, and was below 0.06% right up to 16kHz. At higher frequencies the apparent readings rose (to 0.6% at 20kHz), but this was due to alias components rather than true distortion. (A fairly common problem.)

The square wave tests showed a commendably low level of overshoot (2-3%), with only a small amount of well-damped symmetrical ringing – a result significantly better than average. The impulse response was also above average.

Next I tried connecting the Hitteker up to my Sony VPL-CS1 projector, using the component video outputs, and checked the video performance using the test patterns on the Video Essentials DVD/71 Test disc. Here the horizontal resolution proved to be a little over 450 lines, corresponding to a whisker over 5.5MHz. There was a small amount of video noise evident though, and the colour resolution seemed a tad soft.

On the other hand there were no visible colour artifacts on the Snell and Wilcox ‘moving Fresnel zone plate’ pattern, showing that there’s very low level of colour/luminance crosstalk. This was also the case when I re-checked using the S-video output, which in fact turned out to deliver almost the same resolution.

So the basic video performance of the AD-600A seems to be quite respectable, like the audio performance.

At this stage I tried connecting up the player’s analog audio outputs to my home theatre amp system, and trying it out with reference scenes from a variety of movie DVDs. I also tried watching a couple of complete movies (over a period of a week or so), to get a good ‘feel’ for its overall performance.

My reactions were that the AD-600A makes a very acceptable movie player. It did have a bit of trouble achieving correct lip-sync with a ‘tricky’ disc like Lost In Space, though, and I note that one or two of the US websites dealing with the Apex version have user reports suggesting that it may have trouble playing certain discs – specifically those using ‘seamless branching’. Region 1 discs such as Stargate: SE, The Abyss and Stuart Little were given as examples.

In practice
When I tried playing a few scenes from a few representative Region 1 discs, though, the AD-600A played them all with no problems. I also tried playing a video CD, by the way, and the performance was again fine. So although it’s possible that the player may have a few problems with a small percentage of discs, overall it seems to acquit itself rather well.

Finally, I decided to try the Hiteker’s ability to play MP3 music files. For this I prepared a CD-R disc with a collection of MP3 file tracks, prepared from some of my reference CDs using Diamond Cut Millennium to record the tracks to hard disk as WAV files, a freeware program called Dionysus to compress them down to MP3 format, and finally Adaptec’s Easy CD Creator to write them to CD (as a data-format disc, by the way).

When I played these tracks on the AD-600A and via my home theatre amp/speaker system, the results were frankly much better than I expected. I really haven’t been too impressed with most of the MP3 files I’ve heard to date, but these tracks sounded quite good – and surprisingly close to the original CD tracks they were derived from. I’m not sure if this was due mainly to the compression performance of Dionysus (it was the first time I’ve used it), the fact that they were only compressed down to 128kb/s (i.e., not too drastically), or what.

But whatever the reason, it certainly showed that the Hiteker AD-600A happily plays MP3 files recorded on a data CD-R, and is capable of delivering very impressive sound from them. Which is not bad, for a feature that is barely mentioned in the manual, and by the look of it seems to be something of an afterthought.

So there it is. Despite the Hiteker’s very low price, oddball name and hitherto unknown maker, it seems to be quite a respectable performer and offers a surprising number of unusual features. You’d like a player that handles almost everything except MD and laserdiscs, with ‘hidden’ features like multi region and MP3 play thrown in for good measure, it’s well worth considering.

**SUMMARY**

- An aggressively priced DVD/CD player that also plays CD-R discs and MP3 compressed music files.

**PROS**

- Very good picture and sound quality; component video outputs as well as S-video and composite; good reproduction from MP3 files; easily set for multi-region play.

**CONS**

- Some suggestions that it has problems playing certain discs, with either sound synch or ‘seamless branching’.

**HPR**

- $499

**AVAILABLE**

- FreNETic, 83 Glebe Point Road, Glebe 2037; phone 9660 3388 or email to info@frenetic.com.au.

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**The square wave response was significantly better than average, as you can see. A very respectable performer!**
Denon DVD-1500
Denon’s New Baby

The Denon marque is usually associated with high-end AV products, designed for those who don’t need to compromise when it comes to balancing performance against cost. But Denon has now produced a new DVD player for the rest of us — offering a high standard of performance at a much more affordable mid-market price.

by Jim Rowe

When I had the opportunity to review Denon’s top of the line DVD-5000 DVD/CD/HDCD player for last November’s issue of EA, its performance turned out to be outstanding. The audio reproduction in particular almost blew me away, with virtually perfect square wave and impulse response — thanks to the player’s proprietary AL24 DSP decoding technology.

Mind you, this is the kind of performance you’d expect from a player costing a cool $4735, too. But it was certainly an exemplary player, and one that fully justified Denon’s boast for it as a ‘player for discerning audiophiles’. As long as they’re well heeled, that is!

There’s no doubt then that Denon can make an outstanding DVD player, especially when price is of secondary concern. And the same applies to their up-market digital AV surround sound amplifiers, of course, like the superb AVC-A10SE I reviewed more recently for the May 2000 issue.

But a month or so ago, Denon also announced a new DVD player which was clearly pitched at a much lower price level than the DVD-5000. In Australia the DVD-1500 carries an RRP of only $999 – less than a quarter that of its bigger brother, and firmly in the middle of the range for DVD players designed for the cost- and value-conscious mass market.

On the basis of this earlier experience with Denon products, I was very interested in getting hold of a review sample of the DVD-1500 as soon as I could, to see how it compared with not only its up-market brother but also (and more importantly) other players down at its own price level. Here’s what I found...

Upstart little brother
There’s at least a strong family resemblance between the DVD-1500 and its much higher priced sibling. It has the same very clean styling, with a ‘champagne gold’ satin brushed front panel and the rest of the case in matching ‘warm grey’ fine wrinkle finish. The front panel is again also machined out of high-grade aluminium extrusion, with moulded end pieces.

Although the 1500 is smaller (434 x 281 x 102mm) and considerably lighter than the 5000 (only 4.2kg vs 16.5kg), it’s still quite solidly made. And while the build...
quality is inevitably of a lower standard, in a product selling for 78% less, the 1500 is still well above average for the sub-$1200 category. Both inside and out it's clearly a cut above the usual effort sporting a plastic front panel and lightweight metal case.

The player's transport is apparently a new proprietary design, with an improved disc loading mechanism and enhanced digital tracking servo. It also has the capability of reading the disc at twice normal speed, which allows it to flip back and re-read a track if disturbed by bumps or other shocks – the picture and sound data is read out meanwhile at constant speed from the replay buffer, to keep playback undisturbed.

There's no indication of the pickup laser's wavelength in the specification, but whatever it is the player can read CD-R audio discs as well as standard pressed DVDs and CDs (including Video CDs). This in itself is a feature not found on all that many of the current breed of DVD players.

The front panel has a larger than usual array of control buttons, including a large oval four-way tilting button and small nearby Select button which can be used for menu selection. As a result many of the player's normal operating functions can be controlled with equal ease from either the front panel or the remote – another nice feature.

It's around the back, though, that you find the next pleasant surprise: a set of component video (Y/Cb/Cr) outputs, in addition to the usual S-video and composite video outs. As component video is the 'native format' used to record the digital images on DVDs, this means that if you have a projector or big-screen TV with component video inputs, you'll be able to achieve the absolute maximum picture quality that the DVD-1500 and a DVD are capable of providing (which is very impressive, as I'll explain shortly).

On the audio side, the 1500 is like the 5000 and still doesn't include a built-in multichannel decoder, for either Dolby Digital or DTS. Nor does it include the special AL24 processing system which gives the 5000 its superlative audio performance. However like most mid-range players it does provide a good basic stereo mix-
down decoder, capable of giving good results with either a standard stereo/AV stereo TV, or analog-type surround sound from a home theatre system or AV receiver fitted with Pro-Logic or similar decoding.

 Needless to say like most players in this part of the market it also provides S/P-DIF bitstream output via both optical and co-axial sockets, to drive an external digital surround sound decoder. And these outputs are compatible with the digital signals from both Dolby Digital and DTS tracks, as well as linear PCM signals from CDs - so you have a wide choice when it comes to external digital decoding.

The built-in mixdown stereo decoder does offer a dynamic range compression feature for Dolby Digital tracks, though. This is designed so that when enabled it reduces the range of these tracks, allowing you to follow all of the dialogue without having to have the volume up too far. Great for those who want to watch movies in the wee hours, without disturbing other family members or the neighbours!

Other features of the DVD-1500 include a 10-bit video DAC, for optimum video conversion; a 24bit/96kHz sigma-delta audio DAC, for high quality reproduction of DVD sound; a 24-bit/96kHz PCM digital audio output capability; a friendly on-screen setup system; and a front-panel headphone socket with dedicated volume control.

The player comes with a fairly compact remote control, providing a full array of control buttons - including one marked NTSC/PAL, which can be used to manually over-ride the player’s response to a DVD’s video format. It also comes with mains cord, a triple videopius-stereo-audio interconnecting lead, and a multi-lingual user manual in A4 landscape format.

\begin{quote}
\textbf{THE MIXDOWN DECODER HAS OPTIONAL DYNAMIC RANGE COMPRESSION...}
\end{quote}

What we found

First of all, I checked out the sample DVD-1500 with the instruments and the usual reference test CDs, to evaluate its basic audio performance. While it was understandably not as spectacular as the DVD-5000, the results were still very impressive.

For example the frequency response measured flat within +0dB/-0.5dB from 10Hz to 20kHz, and was only 2.5dB down at 4Hz and 21kHz. The channel balance was also within 0.5dB at all frequencies in this range, while the channel crosstalk was better than -96dB - virtually perfect as far as CDs are concerned.

Similarly the fade to noise tracks showed that replay linearity was virtually ruler flat down to below -90dB, while the dynamic range was actually just on 116dB — with a signal to noise ratio of 123dB. These are again very good results, although not as good as the DVD-5000 — and I should mention that I was only able to obtain them by running the DVD-1500 through a 1:1 mains isolating transformer.

With the player plugged directly into the mains, the output noise level was somewhat higher: almost 20dB higher. This seemed to be due to some sort of virtual earth loop being set up around the player and the measuring instruments, despite the fact that like many players the DVD-1500 is double insulated and unearthed. I can only assume that the RFi filtering components in its switch-mode power supply are somehow involved.

The measured THD (total harmonic distortion) was only 0.007% at 1kHz, and was well below 0.04% over the range from 4kHz to 19kHz. It was higher at 20kHz due to alias components, but this is essentially of
The impulse response of the DVD-1500 didn't compare with the exemplary performance of its big brother either, but that's understandable. It was still above average though, with only a modest amount of well-damped symmetrical ringing and initial overshoot level on square waves of around 1.3%.

In short, the measurements showed that the DVD-1500 delivers above-average audio performance for this class of DVD player - and far better than an awful lot of CD players.

Encouraged by this result, I connected the player up to my home theatre system for some subjective checks with both music CDs and reference DVDs.

**Solid performance**

Playing the usual familiar tracks from my reference CDs, there was an immediate positive response to the sound quality. The overall tonal response was rich but very well balanced, with warm bass and clean, transparent highs. The stereo imaging was also very well defined and stable. In short, a definite 'thumbs up'.

With the player's component video outputs connected to my recently acquired Sony VPL SC1 LCD projector (throwing a picture of about 140cm diagonal), I next tried checking out the image decoding of the DVD-1500 using the test patterns on the Video Essentials DVD Volume 1 disc. The results were again very impressive: horizontal resolution was clearly over 450 lines, corresponding to a luminance bandwidth of at least 5.75MHz, and the colour resolution was well above average too. There was no colour fringing or other artifacts on the Snell & Wilcox 'moving Fresnel zone plates' pattern, either, as you'd hope - showing a very low level of chroma crosstalk.

Just for the record I also made the same checks with an S-video cable linking the player and projector instead of the component video cable, and the results were almost as good. The main difference was a slight reduction in apparent image brightness and colour saturation/resolution.

Finally I tried playing reference scenes from a variety of movie DVDs, selected to check both image and sound decoding. I didn't have a Dolby Digital decoder available at the time, so I fed the player's fader down stereo outputs to my Pro-Logic TV set decoder. Needless to say I also swung back to the component video cable, too.

The results were very impressive. Even though I was only using analog surround decoding, the surround sound field was surprisingly clean and well defined, and I wasn't really aware of being deprived. And the picture quality was really excellent, with rich colours, very low noise level, good detail resolution and no hint of blocking artifacts on scenes with very fast rendering.

The player did seem a tad slow in its initial recognition of discs, but on the other hand there was no extended pause or hesitation at the layer change, as you can get with many players.

I did notice a sound-sync problem with one or two discs, though. It was irritatingly obvious when playing the 5.1 channel track on Lost in Space, for example. But this happens with a few players, and may be due to flaky encoding on these discs: it mightn't be fair to blame the Denon's decoder.

On the whole, my reaction to the Denon DVD-1500 is that it's very well made and a particularly solid performer in the under-$1000 category. The picture performance is excellent and in fact about as good as you'll get from any current DVD player, while the sound performance is also well above average.

It would have been even better if Denon had been able to build a 5.1-channel DD decoder, of course. But even as it stands, if you want to get genuine 'up-market' performance at an affordable price, I can't think of a better choice.

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**SUMMARY**

- A mid-priced DVD video and CD player offering very good basic performance.

**KEY FEATURES**

- Competitively priced at $999.
- 2X drive system.
- Component video outputs.
- Excellent picture quality plus component video (Y/Cb/Cr) outputs.
- Input selector.
- Audio compression for late-night viewing.
- Plays CD-R audio discs.
- A built-in Dolby Digital 5.1 decoder would have been especially nice at this price level.
- Possible decoder weakness in maintaining sound-picture sync on some discs.

**RPP**

- $999

**AVAILABLE**

- Denon AV stockists, or contact AWA Audio Products by calling 1800 642 922 or (02) 9669 3477, or email to info@audioproducts.com.

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**PERFORMANCE: DENON DVD-1500**

The player's fader down stereo outputs to my Pro-Logic TV set decoder. 

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**PRODUCT REVIEW**

The DENON DVD-1500 DVD player represents Denon's commitment to the consumer as its 'big brother', the player's square wave response is still above average.
From Pong to Pokemon and beyond...

IT'S PLAY

Frequent Flyers close up those notebooks, Road Warriors put away their Palm Pilots, and cyber-caffeine fiends unplug that cable modem; it's time to take a serious look at the addictively fun side of technology — that is, the

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Fancy making your own audio CDs? Pioneer's new PDR-509 makes it very easy to record from either analog or digital sources. It makes high quality recordings and can even record and play on re-useable CD-RW discs. by Jim Rowe

NOW THAT CD PLAYERS are almost ubiquitous, compact discs make an excellent medium for high quality audio recording — they're digital, very durable, widely playable and relatively cheap. This makes a quick recording, and in any case it can be quite a hassle lugging your computer to a concert venue or other location...

That's where CD recorders like Pioneer's PDR-509...
academic interest only.

Needless to say the square wave and impulse response of the DVD-1500 didn't compare with the exemplary performance of its big brother either, but that's understandable. It was still above average though, with only a modest amount of well-damped symmetrical ringing and initial overshoot level on square waves of around 13%.

In short, the measurements showed that the DVD-1500 delivers above-average audio performance for this class of DVD player – and far better than an awful lot of CD players.

Encouraged by this result, I connected the player up to my home theatre system for some subjective checks with both music CDs and reference DVDs.

Solid performance

Playing the usual familiar tracks from my reference CDs, there was an immediate positive response to the sound quality. The overall tonal response was rich but very well balanced, with warm bass and clean, transparent highs. The stereo imaging was also very well defined and stable. In short, a definite 'thumbs up'.

With the player's component video outputs connected to my recently acquired Sony VPL-SC1 LCD projector (throwing a picture of about 140cm diagonal), I next tried checking out the image decoding of the DVD-1500 using the test patterns on the Video Essentials DVD1 0711 disc. The results were again very impressive: horizontal resolution was clearly over 450 lines, corresponding to a luminance bandwidth of at least 5.75MHz, and the colour resolution was well above average too. There was no colour fringing or other artifacts on the Snell & Wilcox 'moving Fresnel zone plate' pattern, either, as you'd hope – showing a very low level of chroma crosstalk.

Just for the record I also made the same checks with an S-video cable linking the player and projector instead of the component video cable, and the results were almost as good. The main difference was a slight reduction in apparent image brightness and colour saturation/resolution.

Finally I tried playing reference scenes from a variety of movie DVDs, selected to check both image and sound decoding. I didn't have a Dolby Digital decoder available at the time, so I fed the player's mix-down stereo outputs to my Pro-Logic type decoder.

Needless to say I also swung back to the component video cable, too.

The results were very impressive. Even though I was only using analog surround decoding, the surround sound field was surprisingly clean and well defined, and I wasn't really aware of being deprived. And the picture quality was really excellent, with rich colours, very low noise level, good detail resolution and no hint of blocking artifacts on scenes with very fast rendering.

The player did seem a tad slow in its initial recognition of discs, but on the other hand there was no extended pause or hesitation at the layer change, as you can get with many players.

I did notice a sound-sync problem with one or two discs, though. It was irritatingly obvious when playing the 5.1-channel track on Lost in Space, for example. But this happens with a few players, and may be due to flaky encoding on these discs; it mightn't be fair to blame the Denon's decoder.

On the whole, my reaction to the Denon DVD-1500 is that it's very well made and a particularly solid performer in the under-$1000 category. The picture performance is excellent and in fact about as good as you'll get from any current DVD player, while the sound performance is also well above average.

It would have been even better if Denon had been able to build in a 5.1-channel DD decoder, of course. But even as it stands, if you want to get genuine 'up-market' performance at an affordable price, I can't think of a better choice.

Although not as good as its 'big brother', the player's square wave response is still above average.

SUMMARY

- A mid-priced DVD video and CD player offering very good basic performance.

KEY FEATURES

- Competitively priced at $999.
- 2X drive system.
- Component video outputs.

PROS

- Excellent picture quality plus component video (Y/Cb/Cr) outputs.
- Allows its full realisation.
- 2X drive system.
- Gives improved picture and sound stability.
- Audio compression for late-night viewing.
- Plays CD-R audio discs.

CONS

- A built-in Dolby Digital 5.1 decoder would have been especially nice at this price level.
- Possible decoder weakness in maintaining sound-picture sync on some discs.

RP

$999

AVAILABLE

- Denon AV stockists, or contact AWA Audio Products by calling 1800 642 922 or (02) 9669 3477, or email to info@audioproducts.com.au.
Cover Story

From Pong to Pokemon and beyond...

IT'S PLAY

Frequent Flyers close up those notebooks. Road Warriors put away their Palm Pilots, and cyber-caffeine fiends unplug that cable modem; it's time to take a serious look at the addictively fun side of technology — that is, the world of video game consoles. By Mike Wilcox
IT SEEMED that in the beginning, the typical person drawn to these silicon filled boxes of chips and bits was no more than your average adolescent male, though it's a completely different story today. As we welcome in a brand new century, along with it comes the promise of the most sophisticated and realistic video gaming experience ever.

Traditionally, video game consoles had been designed with one aim in mind, to bring the action of arcade entertainment into the home. The arcade game pioneers of the eighties, such as Atari and Sega, realised the home market potential of their coin munching monsters, and were soon developing scaled down family friendly versions of their table top and upright giants. These offered people the chance to enjoy their favourite games from the comfort of their own homes. From the paddle bat and bouncing ball basics of Pong, and the wireframe graphics of classics such as Battlezone and Asteroids, right up to the infamous Space Invaders and Pac Man, these early icons of computer games helped pave the way to what is now one of the highest grossing forms of electronic entertainment in the world today.

The corporate struggle for global dominance over the console market through the 80s and 90s saw the leader's baton changing hands several times. This was mainly due to the progressive development of new technology, that offered consumers new and improved consoles and the promise of bigger and better looking games. These advances were nowhere near as frequent as the leaps and bounds of PC technology (which manages to double in computing power every 18 months), as games consoles only pass these milestones around every five years.

The 70s and 80s played host to consoles with first generation technology dominated by 8 bit and 16 bit processors, then with the 80s and 90s came the introduction of 32-bit and 64-bit machines. It's only been in the past five to six years that the technology available has offered games developers the sort of hardware to create real time 3D effects, multiplayer options and the kind of mass storage required for graphically intensive games.

ELECTRONICS Australia, July 2000 27
From bedroom to boardroom

That's not the only move taking place. As their popularity continues to grow, games consoles have made a beeline from bedroom floors, through boardroom doors. The type of stakes now up for grabs well exceed many current forms of electronic entertainment, which has all sorts of major corporations reaching for a slice of the annual $8 billion pie.

At last count, Sony's PlayStation console had made it into over 70,000,000 homes worldwide since its launch in the mid 90s, making it the biggest selling console to date. Hardware of course is only half the story; as the actual games themselves are the real pot of gold, with the average gamer owning anywhere from 10 - 30 games per console.

The turn of the century has also helped mark another significant change, with the introduction of the next generation in video game consoles. All major hardware developers, including Sega, Nintendo, Sony, and wait for it, new kid on the block, Microsoft, have all confirmed development of consoles featuring 128 bit technology.

Sega in the lead

The race has already started, with Japanese company Sega sticking to their mission statement of being the first to offer the latest in cutting edge technology. Their console, the Dreamcast was released locally in October last year, and like every other new console, was available in Japan well before it ever arrived on our shores. The company really needed this head start on its competitors to try and regain ground in the community after the failure of its previous two systems. The obvious disadvantage to making this move is that they've now laid all the cards on the table, giving their competition the chance to do a full autopsy on their hardware, see the markets response to its features, and make any required adjustments to their own technology.

Next out of the gates was Sony with their 'not so creatively named' - PlayStation 2, which hit Japanese stores in early March this year, with the expected release date for the rest of the world in late October. It broke all previous sales records for its first day on sale, exceeding 800,000 units (it took six months to sell that many of the original console), so we can expect ridiculous sales figures the day it launches worldwide.

The other two consoles, Nintendo's 'Dolphin' (still a working title), and Microsoft's recently announced 'Xbox', are both not expected until after the second half of 2001. Although the specifications for both these machines have been readily available since their announcements, any further details regarding exact design, full features, and software titles are not being confirmed at this stage.

Dream on

Currently, all that's on offer locally is Sega's Dreamcast. So let's take a closer look under the hood of this console first. At the centre of the engine room is a custom designed RISC CPU, specifically developed for Sega by Hitachi, that utilises a unique liquid cooling system. This 200MHz chip can execute multiple tasks in the same clock cycle, giving it three times the performance of a Pentium II 450 CPU. This speed is also made possible through the use of other custom designed chips.
A Basic Guide to Colour TV & VCRs

By David Botto

AN IN-DEPTH LOOK AT THE OPERATION OF BOTH COLOUR TV RECEIVERS & VIDEO RECORDERS

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that handle some of the other number crunching chores, such as 3D graphics, audio and communications. The graphics chip was created through a partnership with NEC and Videologic, and is capable of rendering three million polygons per second, utilising just 8MB of RAM.

The remaining 18MB of RAM is divided into 16MB for main operations, and just 2MB for audio. The 32-bit audio processor can handle 64 independent channels of sound at CD quality.

Ok, so up to here it's been a stock standard upgrade path, with faster this, and bigger that; now for the new technology. For starters, the console takes advantage of a custom designed 12-speed GD ROM drive, with a 1GB storage capacity. Not only was this introduced to offer more space for game and audio data, but it was also developed as a way to combat the rampant software piracy problem in the computer games industry.

The next revolutionary feature is the inclusion of a built-in 33.6k modem, which is completely detachable, for future upgrades to cable/fibre optic services. This feature struck a few hurdles locally, and wasn't available until a few months after the console was released, however the Internet service is readily available now, and an online gaming service is well into development, and just around the corner.

The console comes with the option for 4 players to plug controllers straight into the front of it, and also features a standard USB (Universal Serial Bus) port that supports a range of accessories, such as keyboard, mouse, digital camera and Zip drive.

See? It's got CE

The other point of interest is the console's exclusive use of an enhanced version of Microsoft's Windows CE operating system, including special support for DirectX and OpenGL graphics libraries. This is not to say that you ever see a 'standard desktop' environment, as every game disc also contains a full operating system, or at least the parts it requires for the game.

A key advantage to running on this platform is that games being developed for the PC platform only require minimal reprogramming to be able to run on Dreamcast, unlike the expensive and time consuming process of having to rebuild (or 'port') the same game to run on other video games consoles. This alone has resulted in there being a healthy number of games available for the system from the start. And as any gamer will quickly tell you, it's not about the technology, it's about the games.

The Dreamcast launched locally at just under $400, which included the unit, one controller, and no games. At the recent E3 expo in Los Angeles, it was announced there would be a number of new add-ons for the Dreamcast including a DVD drive, an Ethernet card, a microphone and a detachable MP3 player.

Sony's PS2

Moving onto Sony's latest newborn, PlayStation 2 (or the PS2, as it's more commonly known). To say the Japanese launch in March was a media spectacle would be an understatement. Diehard fans camped outside stores for days before its release, and games web sites all over the world offered 24-hour coverage leading up the moment the stores opened for trade. It has been front cover news on most games magazines, and has even gained national TV news coverage.

So what exactly have Sony done with this new offering that should cause such interest and excitement? For starters, it looks nothing like a games console. Featured in a stylish black slim box, it shows no signs of being a child's toy, and looks more like a high-end, front-loading CD player.

However, under the bonnet it's a whole different bag of marbles. At the centre of all things techie is a 300MHz CPU, co-developed with Toshiba. This 128-bit chip features a concept called 'Emotion Synthesis' which they claim allows the system to simulate not just how the images look, but how the characters and objects in a game think, act and behave. Together with the graphics synthesiser, it's capable of displaying 66 million polygons a second, which nothing to be sneezed at (or you would miss the odd million polygons flying by...).

Another major drawcard with the PS2 is that it doubles as a standard DVD player, so not only can users expect to watch movies through the console, but game data would also be able to take advantage of the massive storage facility of the DVD format. Arguably though, the console's biggest selling point will be its backward compatibility with the original PlayStation games, so the 70 million existing owners can continue to use their current collection of games, without having to hold onto the old console.

Along with this feature, all original peripherals and memory cards will work, although improved controllers have been developed for use with it as well. While the console doesn't include a modem, Sony has big plans...
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The Xbox again, this time rendering an office scene. Note the picture on the wall – that’s the Microsoft team circa 1977.

The Xbox again, this time rendering an office scene. Note the picture on the wall – that’s the Microsoft team circa 1977.

**POLYGON POWER**

- **Nintendo 64**: Around 150,000 polygons per second
- **PlayStation**: Around 360,000 polygons per second
- **Dreamcast**: Around three million polygons per second
- **Project Dolphin**: "As fast as our friends at Sony have," says a wry Nintendo Chairman Howard Lincoln.
- **PlayStation 2**: Around 66 million polygons per second
- **Xbox**: Possibly 300 million polygons per second

**IN NUMBERS, THAT MEANS A POSSIBLE 300 MILLION POLYGONS/SEC...**

For the future of online gaming, and it’s only a matter of time before one is available. Other add-ons include a MultiTap (enabling up to four-player action), a hard drive, IR remote control (for those movies), even a headset and voice-recognition system. Connection to the console is possible through USB, IEEE 1394 (identified as ‘i-Link’ by Sony) and PCMCIA PC card interfaces.

**What’s just out of reach then?**

Nintendo were basically forced into making first noises about their 128-bit offering the day after Sony made their official announcement on the PS2 in early March 1999, although in true company style they initially remained tight lipped on any details regarding its specifications. Not even an official name has been given to the console, only the codename 'Dolphin'.

Since then, the key hardware specifications have been released, and also the companies behind the technology. The console’s 400MHz CPU, dubbed the 'Gekko' processor, is being manufactured by IBM, and is an extension of the IBM PowerPC architecture. Other companies with a hand in the hardware are ArtX (owned by ATI), NEC, MoSys, Factor 5 and Matsushita who will be providing the DVD technology.

That’s right, DVD. Nintendo have finally moved on from their cartridge-based architecture. But as an interesting spin, there are plans for two different versions of Dolphin. A Nintendo-released base unit that doesn’t support DVD movie playback, and then a Matsushita-branded version of the Dolphin console with DVD, planned for release initially in Japan.

This machine will feature full DVD playback, but will be more expensive. Nintendo’s reasoning for this is they are marketing the console first and foremost as a videogame machine. To this end, the console is expected to be very cheap and mass-market friendly. Apart from the rumours of a modem being available, there’s been no further information made public, however Nintendo have announced they will be unveiling a Dolphin in playable form at Nintendo’s Spaceworld show in August.

And last, but by no means least, the black sheep in the paddock, and newcomer to this battle for console supremacy, Microsoft have only just recently confirmed months of rumours with their intention to release a 128bit console.

**X marks the box**

Microsoft have had no problem from the start with a name, in fact in the few short months that they’ve officially acknowledged it, they’ve already changed the name. Originally called the X-box, it is now simply referred to as the Xbox (be careful not to get the two confused, OK?).

Another more important specification to change is the main CPU. Originally it was announced that the console would feature an Intel PIII 600MHz chip, but this has already been increased to 733MHz (and something tells me that in the period of time before its release, this figure is set to change further).

Graphic hardware is being developed by Nvidia, and is said to be three generations faster than the current chips. In numbers, that means a possible 300 million polygons/sec. as compared with PS2’s 66 million, and Dreamcast’s three million. The console will have...
64MB of shared memory, offering developers the choice to delegate where the memory should go within RAM and VRAM.

The console will have full DVD support comparable to most players on the market today. Storage comes in the way of an 8GB hard disk as well as an 8MB removable memory card. Other features include HDTV support, broadband connectivity, while a modem will be a future upgrade option. Microsoft have been quick to defend any rumours that the console is simply a scaled back PC, and support this by stating they have no plans for it to connect to a standard PC or even be used as a means to access the Internet. And although a mouse and keyboard will be available, they will not come bundled with the console.

Unsurprisingly, the system uses a Windows 2000 kernel, a pared down system that has been streamlined specifically for games. The release date in the U.S. is around September 2001, and should cost somewhere in the US$300 range.

Well, there you have the latest developments in the world of video gaming. An overwhelming fact to come from these new findings is that these ‘next-generation’ consoles are no longer being designed to be tucked away under kid’s beds, and never used for anything other than games. They are more likely to sit alongside the TV to be enjoyed by all.

And on a final note it is worth mentioning, that no matter which company releases the more superior hardware, ultimately it’s the software titles and the people behind them that will win this battle for the successful platform. The shine soon wears off any brand new games system, and all that’s left to keep it afloat are quality games that provide both value for money, and bring out the best in the technology available.

On a personal note, I think the DVD hardware industry is in for a real shock, if they don’t react quickly to this new technology, as long gone are the days when a $1500 player looked like a good value purchase... ■

### SPECIFICATIONS

<table>
<thead>
<tr>
<th></th>
<th>Xbox</th>
<th>PlayStation 2</th>
</tr>
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<tbody>
<tr>
<td>CPU</td>
<td>600MHz Intel</td>
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<td>Graphics Processor</td>
<td>300MHz custom-designed X-Chip, developed by Microsoft and nVidia</td>
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STOP PRESS!

PlayStation 2 Australian launch date set.
Sony have just announced that PlayStation 2 will be released in Australia simultaneously with other European and American territories on 26 October 2000.
The announcement was made at the world’s largest electronic trade show, E3 in LA, and put an end to speculation that the release dates would slip until early 2001.
Around one million machines will be shipped out to both North American and European territories at launch, with 3 million promised for both by the end of its financial year 2001, depending on demand in each region. The only bad news is that the Australian price tag for the new console is yet to be confirmed...
Pioneer's PDR-509 CD Audio Recorder

Fancy making your own audio CDs? Pioneer's new PDR-509 makes it very easy to record from either analog or digital sources. It makes high quality recordings and can even record and play on re-useable CD-RW discs. by Jim Rowe

NOW THAT CD PLAYERS are almost ubiquitous, compact discs make an excellent medium for high quality audio recording - they're digital, very durable, widely playable and relatively cheap. This gives them big advantages over tape-based media like DAT, or even the more specialised MiniDiscs.

You can of course record your own CDs with a PC, if it's fitted with a CD recording drive and has the appropriate software. However not everyone has a PC, and in any case this approach can be a bit involved; generally you first have to record to hard disc, and then 'burn' a disc when you're happy with the tracks. It's all a bit off-putting for people who just want to make a quick recording, and in any case it can be quite a hassle lugging your computer to a concert venue or other location...

That's where CD recorders like Pioneer's PDR-509 come in. They're fully self-contained audio CD recorders, and more or less the digital equivalent of a conventional tape deck. They'll record audio directly to a blank CD-R, and produce a finished disc which can be played back immediately on virtually any standard CD player (and many DVD players as well). In most cases they'll also play both commercial and home recorded CDs as well, just like a standard player. All of which makes them quite attractive for people who just want to make audio CDs, and as easily as possible.
Pioneer's recorder

In the case of the PDR-509, it will record in stereo from both conventional line-level analog sources like tape decks or radio tuners, and also LPCM digital sources like CD, DAT, MD and DCC players, or even satellite receivers. For digital recording it even includes a sample-rate converter, to convert signals with 32kS/s or 48kS/s sampling to the 44.1kS/s rate used for CDs – and it will even record from an HDCD and DTS encoded bitstream.

Needless to say, it provides both digital inputs and outputs as well as the familiar analog stereo inputs and outputs. And the digital ports are provided in both co-axial and optical formats, so you have a great deal of flexibility for interconnections. You can use an optical connection from your CD or DVD player to make a digital copy of a CD, for example, or use a co-axial link to feed the PDR-506's digital output into a DAT or MD recorder.

On the analog side, the PDR-509 uses Pioneer's Hi-bit Legato Link Conversion on playback, to give what is effectively 24-bit dynamic range and an extended frequency response. I haven't been able to find any real technical information on this, but it seems to use DSP to perform digital interpolation on the 16-bit samples to convert them into 24 bits, with oversampling to allow the use of a less drastic anti-aliasing filter. It's a bit like Denon's AL24 technology, I suspect.

The PDR-509 records on both CD-R and CD-RW blanks, by the way, so you can make both write-once and rewritable recordings. But there are a couple of catches – one being that it'll only record on the special 'audio' versions of both kinds of discs, not the standard and widely available type used in PC disc writers. The 'audio' type carry a pricing premium which includes a royalty to the commercial music industry, on the assumption that they'll often be used to...
Not surprisingly there’s more inside than with a CD player, too.

At lower right is the replay response for a 1kHz square wave - very nice indeed.

Not surprisingly there’s more inside than with a CD player, too.

The other catch applies to the CD-RW discs, which generally can’t be played on most existing CD players. So they’re best regarded as being playable only on the CD recorder itself.

I should perhaps also add that the PDR-509 will basically only record from LPCM (linear PCM) audio bit-streams like those from CDs, plus those from DTS encoded audio CDs and HDCDs (High Definition Compatible Digital discs). Presumably it only records the latter in 16-bit samples rather than 20-bit, though. It won’t record from bit-streams with Dolby Digital (AC-3) or MPEG encoding either, so you can’t record CD-i, video CDs or data CD-ROMs.

There are no inbuilt microphone preamps or mixing facilities, either; just line level inputs, essentially. So for live recording you’ll need a separate mixer or console.

On the other hand features of the PDR-509 do include both analog and digital recording level controls; smooth automatic digital fade-in and fade-out, using a button on the remote control; a recording mute button, to give either four-second or extended periods or silence; the ability to make synchronised recordings of digital bit-streams, when you’re copying a CD for example; simple finalisation of discs after recording, to write the TOC (table of contents) and ready them for playing on a standard CD player; a built-in stereo level meter, on the fluorescent display; and a stereo headphone jack, with its own volume control.

By the way the PDR-509 implements the SCMS (Serial Copy Management System), which generally allows you to make only a first-generation digital copy from a copy-protected digital source. It will refuse to make further digital copies, although you can of course make further copies using the analog inputs.

Physically it’s quite compact, and very similar in size and appearance to a standard CD player. It measures 420 x 300 x 105mm, and weighs a modest 3.9kg. The case is finished in Henry Ford’s basic black, with a nicely moulded plastic front panel and a main chassis pressed from 1mm steel sheet. The steel top cover has a fine black wrinkle finish.

The player normally comes with matching remote control, mains cord, two analog stereo leads and a short TOSlink type optical cable. There’s also a user manual written in English, Spanish and Chinese.

Perfect recordings?
Pioneer Electronics Australia kindly provided a sample PDR-509 for us to evaluate, plus some blank audio CD-R discs. I was therefore able to give the unit quite a thorough workout.

First of all I hooked it up to the instruments and checked its replay performance, using the usual test CDs. These showed a replay frequency response that was flat within +/-0.15dB between 20Hz and 15kHz, and drooping smoothly at each end to be only 2dB down at 4Hz and 2.3dB down at 20kHz. Channel balance was within 0.01dB. The replay signal to noise ratio measured 118dB with a dynamic range of 109dB, and the fade-to-noise test showed a linear response down to -90dB. All of which is very good, of course.

The THD (total harmonic distortion) measured 0.0035% at 1kHz, and in fact over most of the range up to 8kHz. It then had an apparent gradual rise, very small at first (0.055% at 10kHz) but reaching 2% at...
16kHz and 10% at 20kHz. However, inspection of the meter output on a scope showed it to be aliasing components, not true distortion; so it's probably not of great significance. Presumably it's a result of the slower than usual LP filter rolloff.

On the other hand, the benefit of that filter characteristic, and the Hi-bit Legato Link Conversion, became apparent in the square wave and impulse reproduction. Here the performance was excellent, with very modest overshoot (8%) plus very little ringing at all; not quite up to the performance delivered by Denon's AL24 system, but very credible nonetheless.

Next I tried testing the PDR-509's ability to make digital recordings. For this test I hooked its optical digital input up to the corresponding output of my Kenwood DVF-5010 DVD player, and used the pair to make digital copies of two of my test CDs. The resulting discs were then played back on the PDR-509 to give an accurate measure of its overall digital record-playback performance.

As you'd hope, the results were virtually identical with those from replay only, in all respects. Even the square wave and impulse response plots were indistinguishable from the replay only plots, showing that the digital recording operation is essentially 'perfect'.

Thus encouraged, I moved to the next testing phase: making an analog recording, to check the full A-to-D recording function as well as the replay chain.

For this I recorded a test disc from scratch, using the PDR-509's analog inputs driven by either a low-distortion audio generator or my PC-driven Arb/Function generator, to produce a series of frequency response, THD and squarewave/impulse test tracks. These were then played back to measure the overall analog-to-analog performance.

The results were again very impressive. The overall response measured flat within +0/-0.3dB from 10Hz to 15kHz, rolling off smoothly at the top end to -2.9dB at 20kHz. Channel balance was within 0.2dB, with the crosstalk at close to -90dB.

The THD measured only 0.006% at 1kHz, and was in fact less than 0.007% over most of the range, rising at the top end in the same way as the replay only response. And the overall squarewave and impulse response plots were almost as good as those for replay only, with only a little more overshoot and a small amount of well damped symmetrical ringing.

In short, the PDR-509 came through the tests with a clear indication that it was capable of very high quality recording, even using the analog inputs.

So I then moved on again, and used the last blank audio CD-R to record music tracks from both CDs and LPs, using the analog inputs. Then I hooked up the recorder to my amplifier system, and listened to both the tracks from this disc and those from some of my reference CDs, to get a subjective 'feel' for the PDR-509's performance.

The results were very satisfying, too. The sound from both the disc recorded on the unit and from commercial discs was clean and well balanced, with a stable and well-defined stereo image.

Overall, then, my findings are that the Pioneer PDR-509 is an excellent performer in both a CD recorder and player. For those who just want to record and play audio CDs, it would make a very appropriate choice, and good value for money at the quoted RRP of $999.

**For comparison,** here's the overall analog record-playback performance:

**SUMMARY**
- A consumer-type audio CD recorder and player.

**KEY FEATURES**
- Records on both standard CD-R and rewritable CD-RW blanks.
- Analogue or direct digital recording.
- Sample rate converter: 32kHz/s or 48kHz/s to 44.1kHz/s.
- Pioneer's Hi-bit Legato Link Conversion for playback.

**PROS**
- Both optical and co-axial digital inputs and outputs, as well as analog stereo.
- Excellent audio performance, thanks to Pioneer's Hi-bit Legato Link Conversion.
- Only records on special 'audio' CD-R and CD-RW discs.
- No inbuilt mic preamps or mixing will record a DTS bitstream as well as LPCM, but not Dolby Digital.

**CONS**
- Pioneer AV dealers, or contact Pioneer Electronics Australia on 1800 338 439.
Synchrotron X-Rays
Unveil Magnet Secrets

Those new ultra high capacity hard disk drives for computers have only been made possible by a new understanding of what's inside magnetic materials. Now researchers at the Lawrence Berkeley National Laboratory in California have used high energy X-rays from their synchrotron-based Advanced Light Source facility to reveal some of the deepest secrets of antiferromagnetic thin films, a key part of modern disk drive read heads.

**THE PEEM2 MICROSCOPE** is a new X-ray spectromicroscopy facility at the ALS, located in Berkeley, California. A couple of months ago it produced the first images of the domain structure of an antiferromagnetic thin film. The high-resolution images reveal that the alignment of tiny magnetic domains in lanthanum iron oxide, each only a few hundred nanometres (billionths of a metre) in size, corresponds to a particular orientation of the material's crystals. This and other findings hold promise for the fabrication of improved magnetic devices like the heads of computer hard disk drives.

PEEM2 was built under a joint Corporate Research and Development Agreement between the IBM Corporation and Berkeley Lab, in collaboration with Arizona State University. Researchers from the ALS, from IBM Corporation's research centres in San Jose, California and Zurich, Switzerland, and from the University of Neuchatel and Arizona State University reported their achievement in the journal *Science*.

"A modern read head uses layers of very thin films with different magnetic properties", explains Andreas Scholl, a member of the Experimental Systems Group at the ALS led by Howard Padmore. "As the head passes over the hard disk, these layers sense the orientation of the domains on the disk and cause the head's electrical resistance to change in response."

When the head's ferromagnetic layers share the same magnetic orientation, there is less electrical resistance than when they are magnetically opposed. In order for one layer to switch independently of another, however, one must be 'pinned' by an underlying antiferromagnetic layer, which is insensitive to applied magnetic fields.

There are many different materials with ferromagnetic and antiferromagnetic properties, "but read heads are constructed from these on a trial-and-error basis", says Joachim Stohr of the IBM Almaden Research Center in San Jose. "Nobody really knows the mechanism that couples the ferromagnet to the antiferromagnet."

To study magnetic materials in microscopic detail, the researchers needed a tool with very high spatial resolution – and one that was sensitive to the orientation of magnetic and antiferromagnetic domains, sensitive to surfaces and interfaces, and could distinguish one kind of atom from another.

"The only method that can do all this is photoelectron emission microscopy – PEEM – using an intense beam of monochromatic X-rays from a synchrotron light source like the ALS", says Simone Anders, leader of the team that built the PEEM2.

A bright beam of X rays focused on a sample in the PEEM2 causes it to emit electrons, which the microscope focuses into an image with a spatial resolution approaching 20 nanometres. The energy of the illuminating beam can be tuned to pick out specific elements – for example, iron emits electrons with most intensity when the photons in the beam have an energy of about 710eV (electron volts).

The soft X-ray beam can be polarized circularly or linearly. Circular polarization is used to image ferromagnetic materials, whose domains have their magnetic spins aligned in the same direction. To image antiferromagnetic domains, in which spins are aligned opposite to each other, linear polarization is needed.

When the electrical axis (E-vector) of the linearly
Polarized light is parallel to the spin axis in a domain, the beam excites electron emission which shows up brightly on the PEEM2 image; where spins are arranged at right angles to the polarized light’s E-vector, the domain shows up as a dark spot. The magnetic structure of the surface can be deduced from these images.

"Without samples in which the size and the orientation of the magnetic domains are precisely controlled, we could not have obtained these images", Anders says of the crystals, which were made by Jean-Pierre Locquet’s group at IBM’s Zurich Research Laboratory. "The excellent quality of the Zurich samples was essential to the success of the project."

Locquet says "We originally developed this process to grow high-temperature superconductors". Using molecular beam epitaxy, single layers of lanthanum oxide and iron oxide were deposited one after the other to build up the compound.

The samples were gradually heated to make sure the images were really due to magnetism and not some other feature of the thin film. The Niel temperature (like the Curie temperature of other magnetic materials) is the temperature at which antiferromagnetic materials lose magnetism. When the thin film sample was heated in PEEM2, image contrast indeed vanished – and returned again as the sample cooled – but whereas in bulk the Niel temperature of lanthanum iron oxide is 740K (Kelvins), in the sample it was only 670K.

"We think that what lowers the Niel temperature of our lanthanum iron oxide sample is structural deformation", says Jin Won Seo of the University of Neuchatel. "It’s a film only 40nm (nanometres) thick, laid on a substrate of strontium titanium oxide. When an epitaxial thin film of one material is laid onto a substrate of a different material, it’s almost impossible to get the two crystal lattices to match perfectly, and atoms get pushed out of place – which modifies magnetic properties."

**Compared images**

Perhaps the most remarkable finding of all came when Seo compared the PEEM2 images of magnetic domains with her transmission electron microscope images of the same sample, acquired at IBM’s Zurich laboratory. The crystal structure of lanthanum iron oxide (perovskite structure) has a long axis, which lay in the plane of the thin-film sample along two directions at right angles. Both the size and orientation of the sample’s crystal domains coincided with its magnetic domains, showing that they are closely correlated.

Jean Fompeyrine of the Zurich laboratory remarks that this is not only interesting science in its own right, but "it shows us how we can build materials that control the size and orientation of magnetic domains. This understanding will then allow us to develop better read heads."

The next step is to study the interface between ferromagnetic and antiferromagnetic materials.

Lanthanum iron oxide is an antiferromagnetic material whose domain structure is large enough to be resolved by the PEEM2, but it is not the material used in technological devices. Eric Fullerton of IBM’s Almaden Research Center explains that "In current read head devices, more common antiferromagnets like nickel oxide and iron-manganese are used."

To study those materials will require higher resolution, however. "Which is why PEEM3 is already under way", says the ALS’s Simone Anders. Compared to the 20nm-resolution of PEEM2, "this improved photo-electron emission microscope will have two-nanometre spatial resolution."
Shonky electrotherapy devices: two steps forward, but a long way to go...

There have been some interesting developments in this area since I prepared the update that appeared in the April column. The ACCC has finally been able to jump on a couple of the firms making irresponsible claims, while the principal of another firm has sent the magazine a long email complaining that I'm being 'unscientific' in describing these products as 'shonky', and expressing doubt that they work...

TO SAVE SPACE, I'M not proposing to give you a long preamble here recapping on what we've presented about 'alternative electrotherapy' devices in previous columns. I'll have to assume that you've either read them already, or that you'll go back and read them if you're really interested. The main ones were in January, February, April, May, June, July, August and December 1998, January and April 1999, and the April issue this year.

You could summarise, I think, by saying that we've found most of the claims made for these devices so suspect that they evaporate as soon as they're revealed in any technical or scientific light. Which would make them laughable, if there wasn't such concern about desperately ill people continuing to be misled by them, and steered dangerously away from conventional medicine.

Anyway, let's start with a bit of good news. Since I prepared the April column, the Australian Competition and Consumer Commission or 'ACCC' has announced success in bringing to book two different firms selling and promoting these devices. The firms concerned are Listen Systems Pty Ltd and Vital Earth Company Pty Ltd - the former for its 'electrodermal screening' products that purport to diagnose all kinds of ailments, and the latter for its products making use of the claimed antibiotic action of colloidal silver.

Here's the guts of the first ACCC release, dated 26 April 2000:

PROMOTER OF ALTERNATIVE THERAPY DEVICES GIVES UNDERTAKINGS
Consumers misled by claims about alternative health therapy devices will receive refunds after Australian Competition and Consumer Commission action. Listen Systems Pty Ltd and its director Mr Stephen John Alexander have given undertakings to the Federal Court of Australia.

Listen Systems Pty Ltd markets alternative therapy systems known as the 'EQ4 Quick Check' and the 'EQ4 Computerised Electrodermal Screening'. Representations published on the Internet at http://www.listensystem.com.au included:

- that Computerised Electrodermal Screening can measure allergic reactions to samples of specific food, pollen and other substances; and
- that these systems can imprint appropriate frequencies to create individually designed isopathic remedies;

Listen Systems Pty Ltd has given undertakings to the Federal Court that it:

- will not make representations including those set out above;
- will provide refunds until 30 June 2000 to persons who may have been misled into purchasing the 'EQ4 Quick Check' and the 'EQ4 Computerised Electrodermal Screening' system; and
- will display a corrective advertisement at the Internet site which had contained the representations.

Listen Systems Pty Ltd's director Mr Alexander also gave an undertaking not to aid or abet or be directly or indirectly knowingly concerned in the publication of advertisements or promotional material containing representations concerning the EQ4 Quick Check and the EQ4 Computerised Electrodermal Screening systems, as set out above. Mr Alexander also gave an undertaking to attend a trade practices seminar to ensure future compliance with Part V of the Trade Practices Act 1974.

'The ACCC is concerned about the significant number of misleading or deceptive claims made being made about miracle, 'quick fix' product and so on in the health area', ACCC Chairman Professor Allan Fels said today.

And while we're at it here's the second ACCC release, dated 8 May 2000:

REFUNDS FOR BUYERS OF ALTERNATIVE HEALTH THERAPY DEVICES
Consumers misled by claims about alternative health therapy devices marketed as the 'Vital Silver 3000 Zapper', the 'Vital Silver 2000 Automatic' and the 'Vital Silver 2000' will receive refunds after Australian Competition and Consumer Commission action.

The Federal Court of Australia has made declarations that Vital Earth Company Pty Limited and its director Mr Darryl John Jones breached the misleading and deceptive conduct provisions of the Trade Practices Act 1974.
The Federal Court has granted injunctions against Vital Earth Company Pty Limited:
- requiring it to stop making representations including those set out below;
- requiring it to provide refunds until 17 July 2000 to persons who may have been misled into purchasing 'Vital Silver 3000 Zapper', the 'Vital Silver 2000 Automatic' or the 'Vital Silver 2000';
- requiring it to forward a letter to each person who has purchased or agreed to purchase the 'Vital Silver 3000 Zapper', the 'Vital Silver 2000 Automatic' or the 'Vital Silver 2000', correcting the false or misleading or deceptive representations made by Vital Earth Company Pty Limited; and
- ordering it to pay a $9000 contribution towards the ACCC's legal costs.

The Federal Court also injunction Mr Jones from engaging in advertising or publishing materials concerning the Vital Silver 3000 Zapper', the 'Vital Silver 2000 Automatic' or the 'Vital Silver 2000'. Mr Jones has also been ordered to attend a trade practices seminar to ensure future compliance with Part V of the Trade Practices Act 1974.

Representations made by Vital Earth Company Pty Limited included:
- that the colloidal silver produced by the Vital Silver 2000 and/or the Vital Silver 3000-Zapper kills all disease causing bacteria, fungi and virus within six minutes of contact;
- that colloidal silver has no harmful side effects;
- that colloidal silver could be used as an antibiotic for all the acquired diseases of active AIDS;
- that colloidal silver is effective with more than 650 different pathogenic bacteria and virus types; and
- that colloidal silver has been used successfully against diseases including AIDS, cholera, diabetes, leprosy, leukaemia, lupus, skin cancer, syphilis and whooping cough.

"The ACCC regards misleading or deceptive claims about therapeutic devices seriously", ACCC Chairman Professor Allan Fels said today. "Consumers are vulnerable when buying alternative health products because they usually do not have the specialist knowledge needed to determine whether claims about the products are true. Those unfortunate enough to have life-threatening diseases may be particularly vulnerable to claims that devices can alleviate or cure their particular conditions. It is therefore imperative that consumers are properly informed by advertising of therapeutic goods that is honest, accurate and complete".

"So there's some cheering news - action at last to protect people against some of these devices, as you can see. But you've probably noticed as I did that only Vital Earth's colloidal silver related products were involved in that second action; presumably they're still free to market and promote their Clark-type 'zapper' devices which don't include the colloidal silver production 'feature'.

I don't know about you, but I find that a bit ironic, when to my mind the claims made about zapper-type devices are even more worrying than those made for colloidal silver gizmos. Still, it's some progress at least.

On the other hand...

Now let's turn to consider an email that was sent to EA's editor Graham Cattley not long after the April issue was published. It came from Mr Philip Braham, who runs a firm called Exclusive Products in Indooroopilly, Queensland. This company sells and promotes a range of 'alternative electrotherapy' devices, including colloidal silver devices, Clark-type zappers, Dr Beck-type 'blood cleaners' and magnetic pulsers, and also Rife-type machines which are claimed to treat many ailments via specific therapy frequencies.

As Mr Braham requested that his email be published, 'in the interests of fairness' following the April column, Graham forwarded it to me to do so. Here it is, then:

I read with some interest your article on 'Shonky' alternative therapy devices. There are a number of points that you raise that should be addressed. In addition, I feel that you have been misled on some points.

Cheryl *** purchased the Rife machine from us and we assured her that all our products have an unconditional 30-day money-back guarantee (how many doctors offer that on their treatments?). She purchased the machine for $1200 (NOT $1600 that was stated in your article) and subsequently returned it for a refund. Despite the fact that she returned it well outside of the 30-day limit and despite the fact the machine had been dropped and was returned broken, we refunded her the money in full. I was wondering if it was broken when she tested it, but it appears from the article that she didn't even bother to use it.

There are so many assumptions and so much misinformation in an article that depends purely on emotive terms (eg: 'Do people have to die because they have fallen to plausible sounding sales pitches?') that I can't, in one letter, deal with them all. However the following points should be made:

The columnist seems to assume that people who purchase alternative health products are duped by a cunning sales pitch and salesmen who are interested just in making money. The machines are sold for research purposes only and generally the people who purchase them use them to investigate the effects of electrical frequencies on biological activity. In my experience, most are intelligent individuals who want to research alternative therapies, or who have received no help from conventional medicine. We always advise people with ailments to consult their medical practitioner first and we tell them that we have an unconditional 30-day money-back guarantee. A surprising num-
ter then we would have to say that immunisation and chemotherapy, to name but two commonly accepted treatments, are unscientific. On the other hand we would have to say that homeopathy is scientific - a supporting paper passed a peer review process and was published in Nature magazine. I should point out that when it was realised that the article supported homeopathy it was withdrawn by Nature magazine, which really makes a mockery of the idea of 'science' as being objective. It may make good copy but hiding behind the word 'science' in this way reduces the debate to a religious one, comparable to the burning of witches.

The treatment rate for Chemotherapy varies depending the type of cancer but for some types it is only 2 to 3 percent (John Cairns, 'The Treatment of Diseases and the War Against Cancer', Scientific American, November 1985). On these figures for survival (and there has been no double-blind tests of chemotherapy against a control) a placebo appears to be more effective in many instances. For Pancreatic Cancer even the American Cancer Society admits that by the time the disease is detected there is no effective cure. Are you going to prevent the use of alternative therapies in these situations?

Your report that the 'most worrying' (to whom?) information that the New Zealand inventor-therapist who 'claimed' to treat a boy of cancer is coming to Australia, is rather odd. On any factual basis he DID cure the boy. Why do you say 'claimed'? Can we then say that doctors 'claim' to treat patients? The usual ploy here is to assert that cancers cured by alternative therapies had a spontaneous remission!

In this article you make no attempt to analyse the machine, the treatment or even talk to people who have had very successful results. I suppose that you assumed that judicious use of terms like 'shonky' and 'unscientific' would suffice to satisfy your audience in place of facts. In a previous article you analysed machines and found some of them to be frequency generators. Of course! Had you asked the suppliers they
would probably have told you that without you going to the trouble of 'revealing' it.

Asking a doctor imbued in conventional medicine whether it would work is absurd. What do you expect him to say? And asking an electronics expert if such a machine could cure diseases is akin to asking a pop star for their opinion on global warming— it makes good publicity and fools the gullible but it is not science.

Are you familiar with a defibrillator— a machine that doctors claim can revive the dead? Were you to dissect one of these machines you would find it to be no more than a sophisticated high-voltage frequency generator.

It is interesting to note that the strongest selling books in medical school bookshops in Australian universities are books on alternative therapies. As my own (conventionally trained) doctor put it... "...these natural opaths are way ahead of us. What they do now, we will catch up with in 5 years time".

There are countless examples of accepted therapies that were first introduced by alternative therapists. TENS machines, acupuncture and the beneficial effects of the herb Ginkgo Biloba are just three that come to mind. If I was want use the emotive language of your 'exclusive' builder Bogden Figura, a Queensland-based electrical engineer, told me that he "didn't put 'Rife Machine' labels on the machine or product materials, to protect himself".

Both Mr Braham and Mr Figura told me that their Rife machine was similar to the NZ Quantum Booster (QB) machine shown on '60 Minutes' (May 1999) that had 'cured' the little NZ boy's cancer. But neither man could tell me what was Dr Rife's specific cancer killing frequency, and astoundingly neither can anyone else in the Aust/NZ/USA Rife industry that I have contacted. A recent update on '60 Minutes' reported that Liam's cancer has advanced; i.e., the super Rife-QB machine did not cure him after all. His parents fled to Mexico; that failed. Then they went to Germany, where they finally accepted chemotherapy; but the doctors said it was 'too little, too late'.

For your interest I attach copies of all the 'documentation' that came with the Exclusive Products machine, and also of the correspondence with Mr Braham. As you can see, at no time did he mention that it was damaged when returned. My opinion is that this is just a very cheap attempt by Mr Braham to discredit me.

Thanks for those comments, Cheryl. I think they give most of us all the reassurance we need regarding your own credibility and motives, and inevitably weaken quite a few of Mr Braham's claims.

But that's about all we have space for this month. I'll try to present some of the other material that Cheryl sent soon, though, because I think you'll find it interesting. I know I did.
The backpack is more suited to games machines for kids as it can be strapped on to their back for walkaround action. The backpack includes connecting leads for the PlayStation and N64.

Avalon Platlnuan CDR
74Min. Cat. XC-4715
Now $1.90
BUJ 10 $17.00
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Some of the cartons are slightly scuffed, but the contents inside are perfect!

The cushion version is ideal for throwing on the lounge where you enjoy your Dolby sound movies. By strapping the backpack on, or sitting against the cushion, containing an electrodynamic transducer, the user literally feels through their body every crash, kick and explosion generated by the game being played, or the movie being watched.

CUSHION

The cushion is ideal for home cinema. Simply place one where each person sits, and feel all the action through your back. The cushion is black and won't look out of place in/on most lounges. Pillow size is approximately 320mm wide x 420mm high by 80mm thick at its deepest point. Includes connecting leads for home theatre, TV, PlayStation & N64. Cat. XC-1005

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6 VOLT SOLENOID

These solenoids, are made made in Japan. They are 6 volt, 10 ohms, have a 10mm movement. Size is 36 x 20 x 26mm. Limited quantity. Less than 1/2 normal price.

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Only $15

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Keep track of the time you spend on the Internet with this clever timer and minimise your ISP bills. The unit mounts on top of your monitor and has two timers to keep track of total elapsed time and the current session time. Also ideal for computer operators, desktop publishers etc, who charge their labour on an hourly basis.

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NETWORK YOUR COMPUTERS

ITS EASIER THAN YOU THINK!

Share your printers with other users, access files on other machines, even share your internet access on all your computers (additional software required). Link your computers together using one of our fantastic networking bundles and you’ll wonder how you got on without it. Ideal for home or small business.

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- 5 Port Hub Cat YN-8070 $76.57
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- Patch Lead (2m grey) Cat YN-8142 $8.57
- Patch Lead (5m red) Cat YN-8114 $12.69
- Patch Lead (10m blue) Cat YN-8105 $21.08

**Total (Normally sells for):** $348.86

**BUNDLE 2:** Fast, 100Mbps 100Base-T kit for 3 machines (max 4). $219.98

- 4 Port 100Mbps Hub Cat YN-8080 $190.58
- 10/100 UTP Card Cat YN-8062 x 3 $114.78
- Patch Lead (2m grey) Cat YN-8142 $8.57
- Patch Lead (5m red) Cat YN-8114 $12.67
- Patch Lead (10m blue) Cat YN-8105 $21.08

**Total (Normally sells for):** $348.86

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This power supply weighs only 3.5kg! It features variable output voltage 3 - 15VDC, with a fixed voltage output of 13.8 VDC. And the 40 amp current is CONTINUOUS.

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This speaker has a huge magnet for its size, has a square frame and is 8Ω impedance. We think power handling would be around 5 watts. Small speakers like this are rare. Limited qty available. Cat. AS-3026 $9.95

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Buy yourself that new CRO in July. It’s your last chance, because due to the SA, these will increase from next month. See Cat pages 44/45 for full details.

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Now you can power your 240VAC compact fluorescent lights from a 12V battery! This inverter can drive loads up to 40W for CFLs with 0.95 power factor and up to 33W for CFLs with low power factor.

Kit supplied with diecast box, silk screened panel and all electronic components. CFLs and fittings not supplied.

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Use this compressor to boost the low levels and compress the high levels of your music so it can be better heard in noisy environments including in cars, house parties and restaurants. You can use it "live" or for recording CD's to tape. Kit includes case, silk screened panels and all electronic components.

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5 separate movements. Max reach 360mm, max height 510mm. Controlled by manual box supplied, or by PC with interface (KC-3104 $99). See Cat. page 10
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ABOVE See 99 Cat. page 18.
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Refer SC March/May 2000
This class A/B amplifier delivers up to 100 watts into 8 chms. Heatsink required - use HH-8530
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The Resonance of Towers

REGULAR READERS of this column have probably got the message by now that, while I'm worried about long-term exposures from cellphone handsets held directly against the side of the head, I don't see much in the way of dangers from the low levels of cellphone towers.

This is, of course, completely the opposite of most activist fears. It also goes against most of the sensationalism you read in the newspapers and see on television. The occasional street demonstrations are always against the siting of towers in a neighbourhood, but no one parades around Canberra complaining about the potential dangers of handsets.

From an engineering viewpoint this doesn't make sense, of course. We all know how the inverse square law operates with radio transmitters, and this calculation tells us that a 2 watt battery device held two centimetres from the side of the head can produce much higher power-densities than a 100 watt transmitter a block or two away. In fact, the difference between the two can easily be in the order of a million to one, even if the cellphone tower's beam is highly focussed.

For this reason, engineers will usually look at these figures and decide that they need investigate potential health effects from towers no further, and that certainly was my position until quite recently. Now I'm not quite as sure — but neither am I convinced. I'm fence-sitting here.

People living near a base-station will be exposed to these lower-levels 24 hours a day, and, as the number of cellphone companies increase, the amount of overall daily exposure rises regularly. TV stations and FM radio are also adding to this background smog in roughly the same frequencies.

Simple engineering calculations also fail to take account of different susceptibilities. The DNA in the cells of children are in a constant state of growth, duplication and division, whereas in adults cell division is only an occasional occurrence. That's why differences shows up in diseases incidences like leukemia where children appear to be many times more sensitive to environmental pollutants.

Given the accumulative nature of cancer precursors, it is also possible that some adults are especially susceptible to EMF effects, but this is just conjecture at the present time. Certainly some people claim to feel low level RF exposures as physical warmth or prickling, and before we dismiss these claims too readily we should recognise that some research evidence indicates that there are these biological perceptual differences.

Social issues
And then there are also the social issues to do with individual rights. Handset users are benefiting from cellphones and are making a personal choice. However those families living near towers often get no benefits themselves, and in fact, suffer visual pollution and a possible loss in land values.

So their complaints are understandable. I wouldn't want one of these things in my own backyard either — and if they tried to build one next to my local school, I'd be out marching.

When comparing handsets and towers for potential adverse health effects, electronics engineers like to look at wavelength and resonance calculations. They tend to see biology in simple electro-mechanical terms, and generally believe that the potential for biological effects will be proportional to the amount of energy absorbed by the body. It appears obvious to them that adverse effects can only arise from a dose-related response. This is the basis for all exposure standards.

If body tissue close to a transmitter absorbs twice the energy than a body further away, then engineers assume, on average, that the potential for biological damage (if they even admit such a possibility exists) must be twice as high.

They therefore tend to treat various parts of the human body as a dipole or quarter-wave antenna, and assume that frequencies matching these bio-electrical circuits will resonate. In engineering theory, resonance-related absorption is the key to all effects in bio-electrical circuits, as it is in antenna systems.

In my early school physics days we referred to this type of resonance effect as 'organ pipe', and in my memory, this is the only type of resonance ever discussed. But bioelectrical researchers now see it as only one factor, and think that other forms of molecular resonance may be involved.

However organ-pipe resonance is certainly the most important when calculating the effect of radio waves on tissue heating, and over the years the standards-setters and industry promoters have tried to sell this idea of 'thermal-only effects' as if it were God-given truth.

Of course you get quite different wavelength-resonance effects in different parts of the body, and with different bodyorientations to the incident waves, and when performing these calculations you need to allow for the slower speed of radio through complex resistant (and often dielectric) tissue media.

If body heating was our only concern then clearly research on mice should use wavelengths shorter than those for rats. And in both cases, rodent research should be conducted at frequencies proportionally higher than those humans are worried about.

HANDSET USERS ARE BENEFITING FROM

Yet the cellphone industry regularly condemns any mouse research it doesn't like if it were conducted at non-cellphone frequencies. Because of the need to cut costs, a lot of the research was done with exposure equipment using 2.45GHz microwave oven generators (wavelengths of 12 centimetres) when cellphones operate in the 900MHz range (33 cm).

However these relative dimensions aren't all that wrong for rodents being used as surrogates for humans, if you consider head-widths or body-
lengths. And certainly much better than the cellphones themselves.

However if you are looking for molecular effects on DNA, then mouse DNA is much the same size as human DNA, so here you’d need to use roughly the same frequencies.

Research scientists are much more interested in some new forms of resonance that I must admit, I struggle to understand. Molecular biology literature today has long and complicated discussions on nuclear magnetic resonance, electron spin resonance, nuclear quadrupole resonance, cyclotron resonance and stochastic resonance.

This is all part of the search for possible molecular mechanisms which might explain the limited evidence available that really low level EMFs can produce problems.

Resonance theories
When I did my university physics and biology forty years ago, only electron-spin and stochastic resonances were known (I think). And my understanding of quantum physics today is severely limited, so I find it difficult to judge the importance of such work.

The problem is that resonance theories also attract the film-flam men, the Shirley MacLaines, and the snake oil salesmen. And certainly there are a few way-out believers in the paranormal still working in biomedical research, so sometimes the science and pseudo-science are cleverly blended.

Popular resonance theories often appear aligned with Ancient Egyptian crystal-powers and ley lines of energy criss-crossing the world and can easily be discounted, but some in the scientific community also believe in strange and unusual things.

It is therefore often difficult to know, therefore, which reports are based on established evidence using scientific techniques, and which are unsubstantiated pseudo-scientific rubbish.

It is also important that we don’t dismiss theories and findings just because the pseudo-scientists have taken them up and exaggerated their relevance. Free-radicals are very real in biological cells despite the way they are over-hyped by eco-nutritionists, and stochastic resonance certainly exists at the threshold of sight and hearing.

When looking at the distinction between handsets and towers, we must also consider that radio signals in the outside environment are not pure and isolated phenomena. We are deluged constantly by hundreds of EMF signals with different frequencies, powers, changes in energy levels, harmonics and transients.

Handset radiation, however, can probably be treated in isolation, and considered as having no more than a couple of major components. Obviously the most important one is in the 900MHz RF region (with some harmonics and variations due to voice modulation), but there are also some at audio frequencies from the baseband circuits.

With GSM and all time-division radio systems, the strongest component is at 217Hz which is the power-pulse frequency (with harmonics also) from the transmitter being rapidly turned on and off.

Another major difference between handsets and towers is the duration of exposure. People living down-wind from a cellphone tower live in its ‘blue smog’ 24 hours a day.

**CELLPHONES AND ARE MAKING A PERSONAL CHOICE...**

It is not at all clear that low-level constant exposures of this kind are likely to be more benign than spasmodic bursts of higher levels of energy from a handset. So-called ‘window effects’ appear to exist, where the influences of power and frequencies are non-linear, and sometimes seem to exhibit cyclical variations, which may be related to resonance effects.

We know that some of these window effects (or reverse dose-related effects) certainly exist. For instance, low levels of gamma rays can cause cancer, while high levels are used to kill cancerous cells. It is better to completely disrupt the functions of a cell and cause it to die, rather than create minor modifications to the DNA which might trigger an uncontrolled reproductive phase.

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**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 compiled (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. A Tiger with 128kB FLASH, 128kB CMOS RAM and RT clock costs only $162. 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.

**RS232 to RS485 Converter**

The small plastic case 100mm by 55mm by 25mm is an Australian-built RS232 to RS485 optoisolated converter. It connects a PC or PLC RS232 serial port to a multidrop RS485 differential cable up to 4,000 ft long. The J995X converter has an internal microprocessor to automatically connect the transmitter to line, so the user program need not use the RTS line for RS485 TX control.

Cost $160 plus $20 plug pack.

**$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.
DO YOU BELIEVE IN MIRACLES? Electronic miracles at least? There have been a lot of tempting miracles lately. I've just finished reading the Forum column in April EA, a renewed discussion of electronic therapy devices said to cure anything that ails you.

Here we had the brave 'Nurse Cheryl!' raising embarrassing questions about the effectiveness or otherwise of 'Rife Machines', allegedly able to cure things like AIDS, hepatitis, and sexually transmitted diseases.

Many people, as a last resort, plunk down big money for gadgets that look suspiciously like Dick Smith surplus items joined together by test leads. But, for them, any hope is better than no hope at all.

My own illness is not so serious, but it still exists: something-for-nothing addiction, and cheapskate-itis. I have a television, and a thin wallet. I live within moderate TV range of three major markets - Seattle Washington, and Vancouver and Victoria in Canada. A cable system is available which combines many of these stations with some cable-only networks, fifty channels in all, for $35 a month. Trouble is, most of the cable channels don't interest me.

Non-cable homeowners usually erect large fringe-area antenna arrays on top of their houses, aimed at the desired city by an electric rotator. But if you're a renter, like me, there's no way you can do that. So that leaves two TV options: cable, or rabbit ears!

I've gone the rabbit ears route for several years, getting up to tweak the set-top antenna with every change of channel. Reception is noisy and ghosty, but watchable (at least for cheapskates). So imagine my joy upon discovering a magazine advert for the Xium Spilateral Antenna, The World's First All-Directional Source for Great TV Reception on EVERY channel.

Rabbit in a can

No multi-element array here. The Xium looked like a two-litre paint can, made of black plastic, with a standard type-F television antenna connector mounted on one end. It could thus be mounted virtually anywhere, indoors or outdoors, and easily taken down again when you moved house. As the blurb said, "You can mount your Xium in any attic, closet, or other out-of-the-way indoor location. You can mount it on a horizontal mast, closet rod, or suspend from a roof support by one of the included base mount brackets... The Xium Spilateral Antenna is so versatile and may be used inside or outside the home. Simply connect it to your TV, satellite, stereo... and that's it!"

Well, that antenna was going to be the total solution to my TV and FM reception woes, and I could even connect it to my satellite (?). I just had to have one, even though it cost nearly a hundred bucks. I came with a 90-day money-back guarantee, so if it didn't work, I had little to lose other than the shipping charges. The order was placed, and while I was waiting, I did some more reading on the electronic principles involved in the Xium antenna.

"Broadcast signals are sent out from area stations. The Xium Spilateral Antenna collects those signals with its special patent pending technology. The Xium's unique 'interceptor' circuitry allows those collected signals to resonate energy between each of Xium's multidirectional elements. The 'interceptor' elements join together to form the Xium's electromagnetic energy core for producing higher levels of passive energy for broadcast signals, for adding up to 50% more coverage."

Hey, did you readers get all that? Neither did I. But Xium had included screen photos of a typical TV set. The one using 'Indoor/Outdoor Antenna Gimmicks' had a picture broken up with noise and interference. The photo using the Xium was perfectly clear, a nicely saturated red flower. You could even see water drops on it. What an amazing difference! I was so glad that I'd ordered my Xium.

Two weeks later the miracle antenna arrived, and I real
ized I had nothing to hook it up with. So off I went to the hardware store to by an eight-metre cable with type-F connectors on each end. These turned out to be on sale for around $3.00, about a third the going rate. I considered it good omen for the success of the Xium.

**Xium clearly now?**

Time for the test: I rolled out the new RF cable to its full length so it strung clear across my living room and dining room. Then I turned on the TV and selected Seattle Channel 4 which was one of the stronger signals. There was a little noise on it, not bad. Should be noise-free with the Xium, right? Wrong!

I disconnected the rabbit ears and connected the cable from the Xium. What I got on Channel 4 was almost all noise and no picture. So I took the Xium in one hand, and the TV remote control in the other, and started moving around the room. There were places where it peaked a little better than the rabbit ears, but the location was very critical. With the antenna oriented for Channel 4, there was only noisy garbage from Channels 5, 7, 9, and 13 - four more Seattle channels.

The Canadian stations were non-existent.

Time for the test:

...then the other... See it... there was a little noise on it, not bad. Should be noise-free with the Xium, right? Wrong!

I disconnected the rabbit ears and connected the cable from the Xium. What I got on Channel 4 was almost all noise and no picture. So I took the Xium in one hand, and the TV remote control in the other, and started moving around the room. There were places where it peaked a little better than the rabbit ears, but the location was very critical. With the antenna oriented for Channel 4, there was only noisy garbage from Channels 5, 7, 9, and 13 - four more Seattle channels.

The Canadian stations were non-existent.

**Second chance**

Not long after these initial tests, circumstances forced me to move house. I got evicted) so I was able to try the Xium all over again in a whole different setting. This time I was up on the first floor, so I had some altitude between me and terra firma. But alas, the Xium was even worse at this location. At this stage I started to suspect my El-Cheapo RF cable, but substituting another cable made no difference at all.

So what we had here was a $100 antenna that was inferior to my $3 rabbit ears. What was this "Genuine All-Frequency Spilateral Technology", anyhow?

Perhaps there was just a short coil of hook-up wire, rolled up, shoved into the can, with one end soldered to the output connector. It seems that would work just as well. It went through my mind to reverse-engineer the Xium - cut it open with a hacksaw to see what is inside. But that would void the 90-day money-back guarantee. And now the antenna is definitely going back where it came from. They might not appreciate a two-part Xium.

Was Tom a silly boy? I don’t think so. The Xium was one of those things that just had to be tried. Maybe it would have worked. Maybe it would work just fine in an urban area where there are big fat signals.

It cost me twenty bucks in shipping to find out about the Xium. But that’s fine, because I did get a Madhouse column out of it. After all, that’s why they call this Moffat’s Madhouse! •

**WHAT AN AMAZING difference! I was so glad that I'd ordered my Xium.**

ELECTRONICS Australia, July 2000 51
Ghosts, teenage monsters and an interactive fantasy

THE FRIGHTENERS

Universal, 1996. Directed by Peter Jackson, with Michael J. Fox, Trini Alvarado, Jeffrey Combs and John Astin. Widescreen; colour, 105m. SS/DL disc, Dolby Digital 5.1; Columbia TriStar Home Video, RRP $34.95.

I MUST confess I didn’t really notice this one when it went through cinema release, but it turns out to be a kind of Ghostbusters-meets-Psycho melding of tongue in cheek comedy, horror and thriller – and surprisingly good fun, in a gothic screwball way.

Michael J. Fox is excellent as the common/poltergeist-eliminator hero, while Trini Alvarado is good as his somewhat reluctant assistant and love interest. Jeffrey Combs is also great as the nazi/nut-case FBI agent, too, and the ‘supernatural’ special effects are very well done.

The image quality is very good in this DVD transfer, and the 5.1-channel discrete surround sound is also very clean and well balanced (although the movie doesn’t offer much in the way of dramatic explosions or other ‘showoff’ scenes).

There isn’t a great deal in terms of bonus extras: just the original trailer and some notes on the production, cast and film-makers. But despite this the movie itself is sufficiently entertaining, and the technical quality of the DVD sufficiently high enough, to make it good value for money. (J.R.)

TO SIR, WITH LOVE


IT’S GREAT that CTHV has been able to release this classic movie on a Region 4 DVD. As you may remember Poitier is superb as the engineer reluctantly working as a teacher, who is really ‘thrown in the deep end’ at a last-resort secondary school in London’s east end. Judy Geeson and ‘Lulu’ head the class of ‘rebellious teenage monsters’ that he gradually tames, and as the film progresses we are brought to realise how these troubled kids change ‘Sir’ just as much as he helps them prepare for survival in the adult world.

Despite the film’s age, the image quality on this DVD transfer is in fact excellent – sharp and clean, with very little in the way of distracting artifacts. The mono sound is not quite as good, with a slight edginess that suggests the recording people may have tried too hard in improving the S/N ratio or bandwidth during the transfer. Overall it’s quite acceptable, though, and rarely detracts from your enjoyment of the movie.

The bonus extras are pretty modest: just the original trailer and some notes on Poitier, Geeson and producer/director Clavell. That’s not a major drawback, of course, and neither is the slightly edgy sound. The movie is a real classic, and very involving. (J.R.)

TENDER LOVING CARE


NOT A CONVENTIONAL movie at all, this one – more a hi-tech mind game: it’s billed as an ‘interactive full-length movie’. The disc contains multiple versions of scenes and story endings for its psychodrama, and which version you get depends on your answers to on-screen multiple choice ‘thematic apperception tests’ (TATs) which are shown after each short sequence. It’s supposed to involve you in the story, explore your personality and give you ‘the fantasy you really want’. John Hurt is host/shrink Dr Turner, who gives you an initial introduction and ‘seeks your opinion’ from time to time.

The acting of the other players is a bit unconvincing, though, and there’s a few image coding artifacts at some of the scene changes. The TATs are also a bit intrusive, which I found made it hard to get involved.

The image quality is very good, and the sound is fine too. Along with the TATs you also get options to ‘explore’ the house in which the drama is played, and make ‘reality checks’ from time to time. There’s also an accompanying 16-page ‘manual’.

An interesting and innovative disc, which should appeal to adventure fantasy and mind game enthusiasts despite its shortcomings. Don’t expect to watch it in just a couple of hours, though. (J.R.)
Professional

THIS MONTH:

54  Silicon Valley News
60  Solid State Update
62  Professional Products
66  History & Crossword
**IN BRIEF**

- Sony, Toshiba, Matsushita and Pioneer - are aiming to increase their combined market share to around 90 percent.

- Coca-Cola has announced plans to spend US$100 million retrofitting 500,000 vending machines with credit/debit card scanners and thermometers that will allow the machines to charge higher prices for a can of Coke on hot days.

- Software will hook the machines up to the Internet. Consumers will be able to browse the Internet and use audio and video to communicate with the vending machines.

- Intel has discovered a serious flaw in its PC motherboards and will recall up to a million computers using them. The recall program could cost Intel hundreds of millions of dollars. On Wall Street the news caused Intel's stock to sink by US$11 a share. Intel said the flaw causes systems to crash easily, and was the result of a defective memory translator hub (MTH) IC that translates signals from SDRAM memory to the Intel 820 chipset.

**Fujitsu & AMD boost flash partnership**

**FUJITSU AND ADVANCED** Micro Devices have expanded their long-time flash memory chip alliance by announcing they will spend US$2 billion on new flash IC fabs, including a new $1.3 billion facility in Fukushima in northern Japan. The latter fab adds to the other two flash production fabs they already own and operate.

The announcement came just one day after Intel said it would also spend $2 billion to increase flash memory production in the face of booming global demand.

The AMD-Fujitsu fab could produce as many as 13 million flash memory chips per month by March 2002. Initially most of the chips will have a 1.6-megabit capacity using a 0.23-micron manufacturing process. That will be improved to 0.18 micron and smaller by 2002. Plans call for boosting the output to 52 million chips per month by March 2003.

Demand for the flash memories is outstripping supply. "We predict that the worldwide flash memory chip market will grow by 91% this year to about US$8.4 billion", said Fujitsu executive Hirofumi Takeda.

The two companies will split the cost of the new fab 50/50, or $655 million each. The two firms will invest another $650 million to triple the flash memory production at a fab in Oregon. The plant's current output is around 10,000 200mm wafers per month. That will increase to 30,000 wafers a month by 2003.

Sales of flash memory chips are expected to rise to about US$15 billion in 2002, up from about $5 billion in 2000, according to researcher Dataquest.

**Intel closes gap with AMD**

**INTEL HAS LAUNCHED** a new 933MHz version of its Pentium III processor, a chip that will cost US$744 in quantities of more than 1000 units. The company also announced plans for a new US$2 billion 12-inch (300mm) fab in New Mexico.

The new Pentium chip will allow Intel to compete more effectively with Advanced Micro Devices, which has been selling 900, 950, and 1000MHz versions of its Athlon line of high-end PC processors since March. 1GHz Athlon-based PCs are now commonly available in US computer retail stores. Intel's top-of-the-line PCs currently run at speeds of 866MHz.

Intel, which misjudged PC demand, has been caught struggling to catch up with AMD in the PC performance race as well as bringing new high-end chips to market.

Intel also announced plans to spend $2 billion to boost microprocessor production at its Rio Rancho New Mexico plant, which will also be used to produce the company's forthcoming Itanium 64-bit processor. "This is in support of the healthy growth of the industry", said Michael Splinter, head of Intel's technology and manufacturing group.

The factory will use 300mm wafers and start with a 0.13-micron production process. The new fab will employ 500 to 1000 workers. Already 5200 people work at the Rio Rancho fab campus.

The facility will have 135,000 square-feet of clean-room space and one million square-feet of building space. It is planned to be running at volume production in the second half of 2002.

**Gates outlines 'next generation' platform**

**MICROSOFT CHIEF** Bill Gates told a gathering of 160 top industry executives in May that Microsoft plans to unveil a 'Next Generation Windows Services' (NGWS) long-term strategy aimed at developing new software and standards for a broad range of future products.

The NGWS initiative will include technology for smart cards that can be used to identify individuals and give them access to sites and information on the Internet, as well as new programming standards that would allow information to be delivered to different devices without having to reprogram them.

"Part of this is to move beyond the individual PC and to all user devices, whether it's a device in a car, or the TV in the living room, or the PC in its multiple form factors out there. That's a very challenging software problem and even with our $4 billion in R&D, it will take many years to achieve," Gates said, at the start of Microsoft's fourth annual CEO summit at its headquarters in Redmond, Washington.

The 160 attendees were all chief executives of companies representing 37 industries. Among them were Walt Disney Chairman Michael Eisner, eBay CEO Meg Whitman and WorldCom CEO Bernard Ebbers. The executives spent two days in seminars and speeches at Redmond, and attended a private dinner at Gates' US$80 million mansion on the shores of Lake Washington.

One seminar was presented by legendary Wall Street tycoon Warren Buffett. "Next to the World Economic Forum in Davos, this is the best event a CEO can go to", said Carol Bartz, chairman and chief executive of design software maker Autodesk.

The NGWS program also includes developing technology to deliver software products, upgrades and technical support directly into a user's computer over a phone line, rather than having it installed separately. "That degree of user satisfaction and simplicity will be another thing we'll be able to advance pretty dramatically", Gates said.
An unsung Genius, and a clear look at video compression

LOST GENIUS


I've always been in awe of the enormous impact that Alan Blumlein's research work has had on the world-wide development of electronics, especially when you consider that he was only 38 when a plane accident cut both his career and life short in 1942.

During that very short career he produced some 128 patented discoveries, many of them quite crucial to fields as diverse as stereo audio recording and reproduction, electronic TV and scanning radar. What might the man have achieved if only he'd lived and worked for another 20, 30 or 40 years!

All of which makes it even sadder that few of the younger people in today's electronics industries have even heard of this retiring but incredibly brilliant engineer.

Perhaps it would have been different if he'd have been an American, instead of a Brit; or he hadn't been killed on a secret wartime flight, testing radar equipment; or if most of his papers and records hadn't been snaffled by a secretive biographer, who held on to them tightly for decades before himself dying – and still without producing the promised biography.

Still, British engineer and magazine editor Robert Alexander has now made a sterling effort to bring Blumlein's fascinating life and achievements to light, in this solid and informative book.

Amazingly he still couldn't get access to any of the papers held in the deceased biographer's estate, but was able to unearth a lot of information both from Blumlein's patents and the archives of EMI, where Blumlein did a lot of his work. He also apparently talked to and gleaned reminiscences from some of the remaining people who knew and worked with Mr Blumlein – such as famous astronomer Sir Bernard Lovell, who wrote the book's Foreword.

It's ended up a highly detailed and rather technical work, a little heavy going in places but on the whole a great effort considering the difficulties Alexander must have encountered.

So if you'd like to get a much better idea of at least some of Blumlein's amazing achievements, and why he's regarded by many of us as the great 'unsung genius' of electronics, this one's a must.

The review copy came from Butterworth-Heinemann, PO Box 146, Port Melbourne 3207. (J.R.)

PRIMER ON JPEG, MPEG


The subtitle of this book is 'Fundamental Compression Techniques and an Overview of the JPEG and MPEG Compression Systems', which in itself gives a fairly clear idea of what it's about.

Author Symes is an experienced video and TV engineer who was Manager for Advanced Technology at the Grass Valley Products division of Tektronix, and wrote the book for fellow video engineers or indeed anyone with a reasonably sound knowledge of conventional analog video, who wants to gain an understanding of the digital domain.

There are 12 chapters in all, starting with a look at basic compression concepts and image parameters and then progressing logically through entropy and predictive coding principles, transforms and quantisation. Then the specifics of JPEG are introduced, followed by motion compensation and then MPEG-1 and MPEG-2 in turn. Finally to round things off there's a chapter looking at audio compression, and a 'Closing Thoughts' chapter discussing the DV compression system, SX compression, sub-band compression, mezzanine compression and newer systems such as wavelet and fractal compression.

It's all carefully and clearly covered, with plenty of diagrams and other illustrations, and only enough maths to make the concepts clearer. This should indeed make it a good choice for almost anyone who wants a clearer basic understanding of video compression technology – and how it makes possible movies on a DVD and the soon-to-arrive digital TV.

The review copy came from McGraw-Hill Australia, of PO Box 239, Roseville 2069. (J.R.)
Advanced Electronics for Highly Dependable Automotive Systems

With microprocessors playing a key role in the advancement of automotive electronics, manufacturers are now developing very sophisticated hardware, software and communications systems to expand its contribution. In this article, Ross Bannatyne brings us up to date with how the latest electronics is making cars safer and more reliable.

by Ross Bannatyne
(Advanced Vehicle Systems Division, Motorola)

THERE ARE an increasing number of systems for various applications that require highly dependable operation, often in safety critical applications. One of the latest areas to experience significant growth in this requirement is the automobile. As electronics continues to become a more important part of the design of a new vehicle, systems are performing many more functions under the control of microprocessors and consequently mechanical and hydraulic systems are being replaced by 'by-wire' configurations of sensors, microprocessors and actuators.

Fig.1 illustrates a roadmap which highlights the main electronically controlled functions for a vehicle chassis, and highlights how they are being amalgamated under electronic controls. The goal is to achieve the 'automated highway' – vehicles which will autonomously drive in infrastructures which support higher traffic throughput with fewer accidents.

Four systems are shown on the left hand side of the roadmap – Braking, Steering, Suspension and Collision warning. These systems are being integrated together through serial communications links so that they can share data. This shared data allows more powerful algorithms, which coordinate the functions to be implemented. The integrated systems enhance safety by using more information to optimise system operation. For example, if an object is detected which could be hazardous to the vehicle, the brakes could be applied automatically.

Culminating around 1999, several 'enabling' technologies were pursued aggressively in order to facilitate the fully integrated chassis control systems. These technologies are fail-safe or fault-tolerant implementations (which this article discusses), semiconductors

Figure 1 - Development of Dependable Systems for Automobile Chassis Control
Redundant CPU Configurations

Each of these types of systems require fail-safe operation. Traditionally, this function has been facilitated using two microprocessors. There are two common configurations – when two identical microprocessors are used, the configuration is known as symmetric redundancy, and when a smaller, less powerful 'watchdog' microprocessor is used, the configuration is known as asymmetric redundancy. These configurations are shown in Fig.2.

Although each configuration has its own advantages and disadvantages, the symmetric approach is becoming more popular, particularly when both of the Central Processing Units (CPUs) are integrated onto a monolithic silicon chip. The symmetric single-chip solution is popular on account of reduced physical size and increased reliability, which results from fewer high-speed signal connections to the outside world. Another benefit of having fewer communications links between several chips is the difficulty in synchronising the operations of the two CPUs.

An advantage of using two separate microcontrollers (rather than two CPUs on a single die) is that there is more choice to select from the many different off-the-shelf devices available. It is also possible to introduce redundancy into the software by using two different routines.

Analysis of the respective reliability equations for each type of system illustrates that the asymmetric approach can only begin to achieve the same level as the symmetric approach if the total fault coverage accomplished by the 'watchdog' CPU is unity. This is a significant factor in favour of using a symmetric approach.

These considerations on the implementation of redundant systems have led to the popularity of using a symmetrically redundant approach in many cases. Examples of such products with two CPUs could be used in failsafe systems.

There is an important difference between fail-safe systems and fault-tolerant systems. Today's Antilock Braking Systems (ABS) are fail-safe: if an electrical system error is detected, the ECU switches to a safe 'off' mode, allowing the foundation hydraulic brakes to operate without the faulty ABS system interfering.

A fault-tolerant system must not only recognise that an electrical fault has occurred, but must continue to operate safely with the existing known fault. Antilock braking systems use redundancy to facilitate a fail-safe system. Typically the CPU at the heart of the system supervises the continual testing of all major system components. The CPU can only validate these components however, if the CPU itself is known to be 'sane'. Hence a second, redundant CPU is used to validate the sanity of the first CPU.

A redundant CPU can either be implemented as a second standalone microcontroller or as an error detection CPU with comparison logic on the same microcontroller chip. This type of dual CPU configuration is shown in Fig.3. If the two CPUs disagree over result of an instruction execution, the 'fault' signal will be enabled and an interrupt will initiate a sequence of events to switch the control unit into the safe 'off' mode. Dual CPU microcontrollers will increase their popularity in automotive safety critical applications such as steering and airbags, as well as ABS.

Both CPUs are fed with the same inputs, although only one of them (Main CPU) is used to control the chip functions. The Complementary CPU is used only as a check to ensure that the output is exactly the same as the Main CPU. In the event that a fault is detected, an interrupt can be generated which will indicate that the system should deploy its 'failsafe' state of operation.

Memory Validation Techniques

There are other on-chip systems which may be required to satisfy dependability requirements; one might be the ability to verify the contents of on-chip memory. This may be a requirement if a dual CPU is system is used with only one memory array. Therefore something is needed to provide a check on the memory contents. There is a possibility that a memory bit may be flipped (it is after all, impossible to discount the possibility of an alpha particle hitting a memory cell and flipping a bit...).
Until we helped mum cope, the kids were left to help themselves.

Every day, more kids are learning how to survive on their own. Please help us to help them when the Salvos call on you.

Thank God for the Salvos.

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The configuration illustrated in Fig.4 illustrates a module which is connected to the internal bus structure of the device. The module will look for free cycles on the address and data buses, and when the bus is not in use, a word will be fetched from memory. This word will be fed into a signature analyser. The process repeats until the entire memory contents have been fetched sequentially and a signature representing the memory contents has been generated.

This signature is then compared to a previously generated value which is representative of the known correct memory contents. On CISC (Complex Instruction Set Computing) microprocessors, there are usually lots of free cycles (often at least one every five cycles). On RISC (Reduced Instruction Set Computing) based microprocessors, there are fewer free cycles, although it is possible to set the memory validation up such that it will 'steal' a cycle if no free cycle is available. This allows deterministic validation time. If the signature matches, there is no need to generate any interrupts so the validation process is basically invisible and will be performed whilst the CPU is executing a control algorithm at full speed.

One shortfall of the memory validation approach is that it becomes very difficult to use this approach on the contents of RAM, which change often. Unless the CPU can stop executing the control algorithm for a RAM check exercise (very unlikely in highly dependable real time embedded control systems), another method is required to ensure dependability of this array. There are two obvious approaches which can both be employed. The first is to add a redundant RAM array. This can be expensive though, as RAM requirements may be large. The other approach is to add a parity scheme to the RAM such that each byte of RAM has an associated parity bit. A parity RAM generator is required to add these bits when the data is written to memory. When the data is fetched from memory, a parity checker is required to decode the parity and ensure that the data which is retrieved is the same as that which was written. Unless the RAM array is very small, the parity scheme is likely to be more inexpensive than using a redundant RAM array.

In addition to these schemes for validating that the CPU and memory arrays are operating correctly, there are several features that are common on most families of microprocessors for fault detection. Bus Errors are usually generated if a non-implemented or reserved address is specified. Clock monitors are used to detect slow or irregular system clocks, and illegal opcode traps are useful to flagging faults that may occur in memory, software faults and dynamic or static bus faults.
**Conclusion**

This article has discussed several of the key areas where microcontrollers are being enhanced to be better suited to applications which require a high degree of dependability or the ability to diagnose faulty operation. Until only recently, such functionality was almost always implemented at the system level, as there has been limited availability of semiconductor devices with appropriate functionality.

The number of applications that require such capabilities is increasing significantly. The automotive marketplace is only one example in the growth of highly dependable system operation, but has been influential in driving progress through its high volume appeal.

The low cost requirements in this market has also helped lead semiconductor vendors to implement such on-chip systems as efficiently as possible. The same approach can be reused in other application areas that require the flexibility and performance of an 'off-the-shelf' popular microcontroller family, but with specific features added to ensure high dependability.

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**HIGHLY DEPENDABLE SERIAL COMMUNICATIONS**

Future automotive systems will require a capability to handle high levels of data rates for improved communications. One difference will be that the number and type of messages being transmitted in the vehicle will increase. Unfortunately, a single communications protocol that can cope efficiently address every automotive application does not exist.

A major problem is evident in the design of microcontrollers, which is the need for efficient design. High performance microcontrollers are becoming available, but the nature of the system is changing. This change means that new solutions are needed to meet the requirements of the system.

When considering the design approach for microcontroller systems, it is important to be aware of the need for efficient design. Providing a consistent interface to the system is an important aspect of the system. This is because a reliable interface between the microcontroller and the bus is essential. Apart from the consistent interface, the microcontroller must also address the interconnection between the microcontroller and the bus. The present paper is aimed at showing this relationship between the start of a reliable transmission on the bus and the final destination.

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PORTALPLAYER HAS INTRODUCED the Tango digital media platform, a complete system for new consumer electronics products with digital audio downloading, recording and playback capability. The new platform, targeted at next generation designs of portable MP3-type player/recorder systems, hybrid systems combining CD and digital audio players and recorders, and hard-drive equipped digital audio jukeboxes, is the industry's first single-chip solution supporting direct recording of CD content in MP3 file formats.

The Tango digital media platform includes the PP5001 Super Integration system-on-a-chip controller, the PP7001 Digital Media Manager application for Windows PCs; and all necessary firmware to implement mass-market products, including licensed applications and the Real-Time Operating System (RTOS).

PortalPlayer also provides a development kit and reference design (PP6001) to produce systems fully compliant with standards defined by the Secure Digital Music Initiative (SDMI).

"Consumer electronics OEMs recognise that adding digital content recording and playback capability is a killer application, not just in new portable devices, but for the mass market audio products that make up a huge part of their business," said Gordon Campbell, chairman of the board of PortalPlayer. "Our goal is to make it as easy as possible for these manufacturers to produce great products."

Platform for Differentiation

The Tango digital media platform supports a broader range of licensed and ported applications and memory/media types than any other currently available solution. It includes an extensive suite of decoders, encoders, digital rights management technologies, encryption standards, audio effects, and both solid-state and disk-based storage.

With the Tango digital media platform, a consumer electronics OEM can focus its resources on brand-level product differentiation, while PortalPlayer provides a strong hardware and software base to build on. Since standards and technologies are very fluid, particularly related to security and digital rights management, the platform is designed to be upgradable via downloads of new firmware. This allows both feature enhancements and security system modifications, preventing the end user's purchase from quickly becoming outdated.

"We think that the enthusiasm surrounding MP3 and other digital compression formats in the personal computer and portable device markets validates the enormous market potential of digital content distribution," said John Mallard, president and CEO of PortalPlayer. "As OEMs build support for these digital formats into traditional audio products, such as car stereo and mini-component systems, and new types of hybrid devices, market volumes will quickly reach tens and hundreds of millions of new systems annually."

Highly Integrated System

Based on PortalPlayer's Super Integration Chip Architecture, the PP5001 Controller integrates an ARM7 TDMI host processor, a co-processor for hardware accelerated encoding, and comprehensive external interfaces to peripherals and storage. PortalPlayer customers can define the precise firmware implementation of the Tango platform to produce a tailored product with the codecs, security and memory configuration desired to meet specific end-product price and feature requirements.

The Tango platform is the first low-power, single-
chip solution to support MP3 audio encoding for direct recording of CD content without a PC, making it ideal for personal stereos and other compact system designs. It also supports multiple decoding formats for playback, enabling manufacturers to produce single systems that can handle content in all popular and many emerging formats, and provides consumers with a much broader range of content compared to currently available devices.

To date, PortalPlayer has announced support for MP3, Advanced Audio Codec (AAC), Microsoft Windows Media Audio, and QDesign decoder technology. Voice codecs with increased compression ratios for spoken word content, and additional codecs for recorded music, will be made available in the future through flash programmable upgrades and PC application plug-ins.

PortalPlayer also implements multiple levels of security and Digital Rights Management in the system firmware. The Tango platform is compliant with SDMI Portable Device Specification 1.0, Phase 1, including Verance Corporation's SDMI Phase 1 Watermarking System. Announced support for Digital Rights Management (DRM) systems includes the InterTrust MetaTrust Utility, DOWNLOADdirect by Mjucie, and Microsoft Windows Media Rights Manager.

**Comprehensive Feature Set**

OEMs also have the flexibility to design-in any current or new storage media format for consumer electronics systems. The PP5001 controller directly supports Compact Flash, Sony Memory Stick, SmartMedia, MultiMediaCard, and SD (Secure Digital) Memory solid-state storage. Tango-based systems can support two banks of Flash memory, with up to 128MB per bank, and two banks of SDRAM, with up to 128MB per bank.

Other hardware features of the Tango platform include an ATA-33 IDE controller for direct interface to CD-ROM and computer disk drives, an LCD graphics controller for single-screen, 16-gray scale displays, general purpose I/Os for navigation buttons, and an AC '97 2.1 compliant audio codec interface.

Additional features to optimise the system for portable devices include FM radio preset storage, and a remote control interface for transport, volume, and display of LCD data on a headphone cable.

**Optimised PC Software**

As part of its commitment to speed time-to-market for its consumer electronics customers, PortalPlayer provides a Digital Media Manager software suite as an integral part of the Tango platform. The PP7001 software is a complete Microsoft Windows 9x compatible application that an OEM can customise with its own user interface, or 'skin', to create a distinctive look and feel.

Designed as a best of breed application, the PP7001 provides 'Virtual Content' management to seamlessly unify local and web content, audio effects, and including reverb and stereo enhancement.

The Tango platform is priced at $40 (1000) per set. It is now sampling to qualified OEM customers, with volume production scheduled later this year.

For more information on contact PortalPlayer at www.portalplayer.com.

**Miscellaneous**

The ARM7 TDMI core provides processing power for next generation decoding/encoding algorithms and complete SDMI support. FM radio station preset storage capability. Displays song title, time played and total time of track.

Support for automatic download to portable from PC Digital Media Manager application. Firmware Media Management enables track deletion, record, playlist selection and equalisation modifications directly on player. Status indicators while recording music directly from a CD and while downloading music files from the PC. Flashable firmware capability. 208 pin TQFP, 256 BGA package.
**Monitor test generator**

The GV-241 Test Generator from Promax is an indispensable instrument to verify and repair computer monitors.

**THE GV-241** is a universal generator that accommodates the multiplicity of the different graphics systems used in today's marketplace. The signals obtained from the GV-241 are truly reliable in terms of synchronism periods and both line and frame blanking periods, and supports up to 29 possible graphics systems.

The instrument can manage 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 interface. The user can select.

**BASIC Tiger Micro Module-E**

A NEW ADDITION to Tiger microprocessor family is an economy model, designed to allow for Tiger use in applications where cost or size previously precluded its use.

The device has a high speed 16/32 bit microprocessor, with built-in RAM (32KB/128KB/512KB) and FLASH memory (128KB or 512KB). There are two UARTs and a 4-channel, 10-bit ADC. Digital I/O ports allow direct I/O or external expansion, via a low-EMC peripheral bus structure, to 1,920 bits of I/O, directly controlled under BASIC with IN and bit-masked OUT instructions. SPI and I2C instructions as well as LCD drive and keyboard scan are provided. (If a real-time-clock is needed, a standard Tiny Tiger with RTG is available, or the SPI instructions can communicate with an external clock chip.)

The Module-E (or Economy) Tiger is only 39mm long, 28mm wide and 10.2mm high, and weighs 16g. It has 28 pins (reduced from the 44 pins of the now widely used Tiny Tiger). The Module-E has 28 of the same 0.025" square gold pins on 0.1" centres as the Tiny Tiger, in rows 0.9" apart. An adapter is available to allow the Module-E to plug into BASIC or Tiny-Tiger prototype boards.

The development environment for the Module-E Tiger is exactly the same as for the Tiny Tiger – a Windows or NT based compiler on a PC edits, compiles and links the code written in powerful 32task, multitasking BASIC. The resultant machine code file is downloaded to FLASH memory inside the Module-E via a serial port at high speed. The code can then be debugged remotely with break points, single stepping and 'data watching' all operating via the serial cable. No in-circuit emulator or other debug hardware is needed. Users only need an RS232 buffer in their target system from one of the two serial ports, and a link or switch to enter 'download' mode.

JED supports the whole Tiger range in Australia with local boards, development systems, applications help and custom system design services. Contact JED at: JED Microprocessors Pty Ltd, 172 Boronia Rd, Boronia, Vic., 3155. Phone (03) 9762 3598, fax (03) 9762 5499, or examine BASIC Tiger data on www.jed-micro.com.au
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Battery Engineering Lithium-Thionyl Chloride Batteries are priced according to configuration and quantity. Literature and price quotations are available upon request.

For more information contact: Battery Engineering, 100 Energy Dr., Canton, MA 02021 U.S.A.

Email: info@batteryeng.com, Website: www.batteryeng.com.

Bus-based temperature controller

DANAHER CONTROLS has announced the new MLC9000, a bus-based temperature control innovation that interfaces with PLCs or Human Machine Interfaces (HMIs), to integrate temperature control and machine control. The MLC9000 eliminates the need for integrated PID blocks that degrade PLC performance, and multiple single-loop panel-mount controllers that waste panel space and prevent centralised control. It is an integrated solution that works with the PLC or HMI to deliver machine control and high-performance temperature control with a single centralised interface. The MLC9000 will be marketed under the Danaher Controls brand names of: Dynapar, Partlow, and WEST.

Eliminating the PID block removes the burden of analog temperature control from the PLC, delivering single-loop performance levels with a host of advanced features. RaPID fuzzy logic offers quick reaction to process disturbances, maintaining constant precision control. EasyTune offers an adaptive tuning algorithm for auto-tuning the PID loop, eliminating expensive software solutions. Other features include a deterministic 100ms sample time, built-in heater break alarms, the ability to hot-swap single loops, and a building block approach to adding additional loops, eliminating the need to purchase four or eight loops at a time.

For more info, contact Danaher Fulfillment, Next Communications 6520 Edenvale Blvd., Ste. 112 Eden Prairie, MN 55346.

Fume exhaust arm

THE ALSIDENT System ESD 50 and ESD 100 series of fume exhaust arms have achieved the unique distinction of gaining certification attesting to their safety for use in electrostatic discharge sensitive (ESD) and explosion sensitive (EEx) applications.

Pyrotek - who distribute both the Alsident and Fumex ranges in Australia and New Zealand - claim that it is the first time any fume extraction equipment of its type has gained certification by an accredited test authority that the electrical conductiv­ity of the system as a whole exceeds relevant standards.

The certification is good news for computer and other electronics manufacturers whose reject rates are lessened by any measure that lowers the risk of electrostatic discharge through PCBs and other sensitive components.

It is equally important for laboratories as well as chemical, pharmaceutical, food and similar industries facing the need to exhaust powders, combustible gases, dust/air mixtures or fumes that pose possible explosion hazards.

Using the ESD/EEx models of the Alsident Systems 50 and 100 puts an end to the need for such users to keep treating surfaces with expensive chemicals to ensure the fume exhaust equipment remains antistatic.

The Alsident System, in either capacity, is available for mounting on wall, worktable or ceiling. Designed ergonomically for improved productivity, its three joints enable the operator to effortlessly position the mouth spatially anywhere within its reach, which can be up to 1350 mm, and lock any joint at a finger-tip of a knurled knob.

Get more info from Pyrotek, 147 Magowar Road, Girraween 2145; phone (02) 9631 1333.
UV to IR spectroradiometer

INTERNATIONAL LIGHT introduces the IL2000 SpectroCube Spectroradiometer. It is a new automatic, high resolution, absolute reading spectroradiometer that operates over a wide spectral and dynamic range, with low scatter, and can be controlled remotely from a PC or laptop over a phone line.

It features double pass single grating optics, which provides a scatter figure of 1 x 10⁻⁶ and dispersion of 4nm/mm. Operating from 250 to 1100nm and autoranging over eight decades from 200pW/cm²/nm to 40mW/cm² (at 500nm), with an f/4 aperture ratio and ±0.5nm wavelength accuracy.

Fully automated, the SpectroCube is powered on/off under remote software control and has a sleep mode for unattended field monitoring. Measuring 225 x 225 x 225mm and weighing 9kg, it can be used in any physical orientation. Standard features include a lock-in amplifier, firmware for optical wavelength self-calibration, and a LabView™ software user interface.

The IL2000 SpectroCube (tm) Spectroradiometer is priced from $24,995. (U.S.D.) (list). Literature is available upon request. For more information contact International Light, 17 Graf Rd., Newburyport, MA 01950, or visit their website at www.intl-light.com.

Pentium SBC has superior AV performance

A NEW Advantech SBC, 5.25" single board computer has been released by Priority Electronics. The PCM-9574 supports Pentium III processors plus impressive video and audio capability. This socket 370 SBC offers a Trident Cyber 9525 DVD controller for on-chip 2X AGP 3D VGA/LCD as well as an on-chip hardware-assisted MPEG 2 accelerator.

The ESS 1989 Audio controller with I.I W per channel amplifier supports AC97 3D stereo surround sound with additional support for a MDC connector for optional software modem card. These advanced video and audio controllers in combination with Intel's Pentium III processors up to 866 MHz and higher, can satisfy system designers' most demanding video/graphics application needs.

The PCM-9574's functionality can be used in exciting new ways. For more info, contact Priority Electronics, 189 Bay Road, Sandringham, Vic. 3191. Email: sales@pe.com.au

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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

Magnetic pickup cartridge: Goldring engineers have succeeded in producing a small magnetic pickup cartridge which will directly replace many flat type crystal cartridges now in use. Using a replaceable miniature sapphire styli, it is virtually needle-armature movement, and the styli can be changed with the fingers. Stylus are available for either standard 78 rpm or long playing discs, it being assumed that the arm will be suitably counter-weighted when the latter are being played.

Flying saucers: The daily press carried recently what are claimed to be the first actual pictures of a flying saucer, snapped by an American farmer.

While not very conclusive, in themselves, the photographs, together with a report from two local airline pilots, must force one to the conclusion that there is something very tangible behind all the vague rumors and reports.

The authorities, whom one concerned, are apparently taking little notice of it all. Either they take a lot of convincing or else someone has gone farther along the road of development than it is politic to admit right now.

25 YEARS AGO

Gloomy future for colour TV makers: Mr Tiki Shigemi, Australian Sales Director of MELCO-National, manufacturers of the National range of Panacolour TV sets, recently forecast a gloomy future for Australian colour TV manufacturers. Mr Shigemi was commenting following a recent decision by the Australian Government to reduce import tariffs on colour TVs.

"The decision by the Australian Government not to give adequate protection to the Australian colour television manufacturing industry is, bluntly, a shocker," Mr Shigemi said. "The black-and-white TV manufacturing industry in Australia is dying on its feet and this latest decision means that by this time next year, the colour side of the industry will be in the same state."

Canada’s domestic satellite system: Telsat Canada recently launched its third and final spacecraft in the Anik series to complete Canada's domestic satellite communications program. Known as Anik III, the new satellite joins two sister spacecraft launched in 1972 and 1973. The Canadian Telsat program has been designed primarily to improve radio, television and telephone links throughout the country, with particular emphasis on the remote northern areas.

50 YEARS AGO

ACROSS

2 Property of certain alloys able to recover form. (5,6)
5 Colour variety of quartz. (4)
6 Basis of certain earphones. (7)
9 Reproducing from an original. (7)
10 Metallic element discovered by Gadolin. (7)
11 Electrode. (5)
12 Summed. (8)
13 A gateless triac. (4)
14 Name of key. (5)
15 Large asteroid. (4)
16 A type of memory. (3)
17 Checked performance. (6)
18 Flow of excess current. (5)
19 Very large scale integration. (1,1,1,1)
20 Insulating substance. (7)
21 Communication pathways to satellites. (7)
22 Element number 31. (7)
23 Theorist on minute matter. (7)
24 Reverse a procedure. (4)
26 French Nobel prize winner for magnetism studies. (4)
27 Professional person with technical skills. (8)
30 Said of iron used in electromagnets. (4)
31 Instrument recording muscular actions. (8)
32 Theorist on minute matter. (7)
33 Shifting of some beats in a metrical pattern. (5-6)

DOWN

1 Alloy showing excellent shape recovery. (6-8)
2 Back-up in advice and help. (7)
3 Line at centre of rotation. (4)
4 Flow of excess current. (5)
5 Put information in suitable form. (6)
7 Metallic element discovered by Gadolin. (7)
8 Compressed transmissions. (6)
9 Property of certain alloys able to recover form. (5,6)
10 Reproducing from an original. (7)
11 Metallic element discovered by Gadolin. (7)
12 Name of key. (5)
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Simple Waa-waa circuit

This circuit can be incorporated in guitar amplifiers or even built up as a freestanding pedal effect.

A phase shift RC oscillator makes up the basic circuit. C4, C5, C6 and R6, R7, RV2 make up the components of the bridge that determine the operating frequency, by feeding part of the signal back to the base via C2.

The oscillator is held just short of actual oscillation, and waa-waa effect is achieved as certain frequencies are amplified more than others due to the 'instability' of the circuit.

The transistor used is not critical however it should have a gain of more than 150. An NPN type such as the BC548 or BC549 is suitable.

The values of C4, C5, C6 are chosen so as to emphasise the waa-waa effect on the higher audio frequencies. This gives the sound its brilliance. These values can be changed quite freely until the specific desired effect is achieved.

When adjusting the unit initially, RV1 is turned to its minimum value. RV2 is now adjusted to and fro until a point is found where an audible whistle appears, indicating oscillation.

RV1 is then adjusted until the oscillation just disappears. RV2 is then turned over its whole range, and if at any point oscillation recovers, RV1 is again adjusted until it ceases.

It should be possible to set RV2 to any value over its range of adjustment without any oscillation being apparent; this should also be achieved with the minimum possible value of RV1.

Dual mode battery charger

I recently purchased a battery backup to my smoke detector system by using sealed lead-acid batteries. Then of course, I needed some type of charger.

The problem with using a constant voltage type of charger is that the current flowing at or near full charge is quite low, while when the battery is discharged it is very high. On the other hand, with a simple constant current circuit the battery will be overcharged by the constant charging current, which can be calculated by incorporating both these into the circuit shown here. Here, 18 - 20V DC is applied to the input of LM317 which is regularly connected to its output to form a voltage divider. The resistors are chosen so that the output voltage of 12V is applied to the input of LM317. The resistor R1 is chosen to be 1000 ohms, which gives about 300mA. Use the formula V1 = 1.25/I to determine R1 for other currents.

At lower states of charge, or when the battery is completely discharged and the charging current is high, the second LM317 (even though it is connected as a voltage regulator) simply acts as a series resistor. As the battery reaches full charge, the regulator starts to act as a constant voltage source, and then becomes a trickle charger.

When the battery is fully charged, VR1 should be adjusted to provide voltage at the battery terminals that falls in the range 13.5 - 13.6V. Diode D1 is included to prevent reverse current flow if the mains power fails.

David Allen
Finton, SA 836

ELECTRONICS Australia, July 2000
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.

Driver for digital countdown timer

I HAVE USED elapsed time measurements for measuring electrical quantities such as amp-hour capacity of rechargeable batteries and capacitance of extremely large capacitors by measuring their discharge time constant.

In each case a sensor measures voltage, and switches OFF when a certain level is reached. For time elapsed measurement, I used cheap analogue quartz alarms available in the range $2 to $5.

Digital countdown timers and sports stopwatches are available, and can be easily adapted. Most use the same button for start and stop functions. The switch contacts are accessible (except in wrist-watches) and they tolerate a resistance of several hundred ohms as a make contact.

The following circuit takes the continuous output from the sensor to give a short pulse at the beginning, and a short pulse at the end of the activity. It uses a 4093 quad NAND Schmitt trigger to generate the pulses, plus a 4066 analogue switch to drive the clock switches - note that the circuit can operate over a supply range of ±3V to ±15V. In the rare case where the clock has separate start/stop switches, the start/end pulses could be buffered with IC1c and IC1d, and these used to drive two sections of the 4066 switch.

Victor Erdstein
Hightett, Vic $30

7-segment AC/DC indicator

This SIMPLE, but very visual, AC/DC indicator uses two common low-cost FND500-type seven-segment LED displays - and not much else.

When the input probe is monitoring a DC voltage, elements b, c, d, e and g are activated in the left-hand display (LHD), while segments a, f & h on the right-hand display (RHD) illuminate.

The 1000uF capacitor blocks the incoming DC level from segment a on the LHD, so the overall display will read "dc".

On the other hand, when the input probe applies an AC signal to the circuit, this is also passed to segment a on the LHD via the 1000uF coupling capacitor. The AC signal will only drive the display's LEDs during the positive half cycles, but now, all connected segments will be activated so the display reads "ac". The two variations are shown on the diagram.

The display brightness is set by the value of cathode resistor R. As you'd expect, this is a compromise between display brightness and how much current should be drawn from the circuit it's monitoring. Use the formula R = (Vin - 1.7)/0.01 ohms as a starting point, but remember that the current drain and LED brightness will vary significantly with the input voltage level - you could always replace R with a constant current circuit.

Author unknown (please contact E!) $25
Low Cost Video Fader & Enhancer

Here's the design for a colour video fader that's very low in cost, yet at the same time easy to build and get going. It even includes a switchable enhancer circuit which lets you compensate for the inevitable losses, when you're doing basic editing and re-recording of your home video programs.

BACK IN THE APRIL 1998 issue, I described a fairly elaborate Video Fader and Wiper unit. It turned out to be a reasonably popular project, with hundreds of kits being sold by the various kit suppliers. However to some extent the circuit had been complicated by the horizontal and vertical wiping functions, and this tended to make the design a little tricky in terms of setup adjustments.

Since then, I've had a number of requests for a simpler unit that would hopefully be easier to get going. People don't seem to be particularly worried about keeping the wiping functions, either, particularly if this helps result in a cheaper and more compact unit.

So there seems to be a definite need for a simple 'no frills' video fader, which is probably all that many people need for basic video editing.

So this new 'fader only' design is much simpler to build and get going, and significantly cheaper as well. I estimate that you should be able to build it for less than $59, even buying the parts individually.

Despite its simplicity and low cost it still provides smooth and reliable video fading up and down, without degrading the synchronising, video bandwidth or colour stability. And it even includes the same video enhancer circuitry as the original design, so you can add a little judicious 'high peaking' to compensate for video dubbing losses.

It all runs from a standard 12V DC plug pack or 12 - 15V battery supply, by the way, making it quite suitable for 'field use' if it's needed. Total current drain is less than 120mA.

How it works

If you're at all familiar with the April 1998 design, you'll find quite a lot this circuit pretty similar. There's just somewhat less of it!

The basic idea of this kind of fader is that unlike an audio fader, we can't simply vary the amplitude of ALL parts of the video signal -
that would upset the synchronising and colour stability. We can only allow the fade control to vary the amplitude of the active part of each video line, leaving the 'hidden' sync pulse and colour burst sections untouched.

This is done by a system of rapid switching, as we'll see shortly.

As you can see from the schematic resistor R1 first terminates the incoming video signal with 75 ohms, to match the input cable correctly. The signal then passes through coupling capacitor C1 to the input of U1, an NE5534 low noise op-amp connected here as a wideband unity gain buffer amplifier.

Although C1 obviously doesn't pass the DC component of the video signal, we effectively restore this again by means of an active clamping system. This uses analog switch U2d to connect the junction of C1, bleed resistor R1 and the input of U1 to a 'reference blanking level' of +0.6V DC (developed across diode D4), during the colour burst interval of each video line. Don't worry for the present about exactly how this is done; just note that as a result, the blanking level of the video signal entering and leaving U1 is effectively clamped at +0.6V.

The video fader pot RV1 is connected between the output of U1 and this blanking level, as you can see. So the pot can be used to select whatever proportion of the video signal we want – anything from the full amplitude, at the top, right down to zero at the bottom.

The output from the pot is taken via analog switch U2a to the base of transistor Q1, which is the first stage of the output video buffer amplifier. As switch U2a is turned on during the active part of each video line, this is the main video path through the circuit, and under the control of the fader pot.

How do we prevent the pot from changing the synch pulses, or the colour bursts? Simply by turning off U2a whenever these are present, and turning on paralleled switches U2b and U2c instead. As you can see these switches simply bypass the pot, allowing the sync pulses and bursts to pass straight through to the output buffer without any disturbance.

The output buffer amplifier is exactly the same as that used in the earlier design, with transistors Q1-Q3 providing the voltage gain and Q4 providing Q3 with a constant-current collector load. The overall gain of the amplifier is set by feedback resistors R12 and R11, and the end result is a low distortion video amplifier with a bandwidth of over 10MHz and a gain of 2.0 – to compensate for the loss in R16, the output cable back-terminating resistor.

Note that the LED is used to establish a voltage reference for the base of Q4, as well as serving as a power-on indicator.

The components connected across R11 via resistor R13 are to allow a small amount of video enhancement, by means of a simple 'treble boost' circuit which raises the amplifier gain by a maximum of about five times (+8dB) at a selected upper video frequency. Here switch SW1 allows selection of the peaking frequency, by choosing either C9, C10 or C11 (or none, for a 'flat' response), and the selected capacitor forms a series resonant circuit in conjunction with inductor L1. Pot RV2 allows the actual amount of peaking to be adjusted, by varying the amount of series resistance, while fixed resistor R13 sets the minimum total impedance and hence the maximum peaking level.

So that's the basic signal processing path.
As you can see from the main schematic above, there isn't much in it – thanks to U4, which derives all the key switching signals. Below is the power supply circuit, delivering plus and minus 5V rails from the plug pack input.

Through the circuit: blanking level clamp, input buffer, fader pot, video component switching and finally the output buffer and optional peaking. Now let's see how those analog switches are controlled, so the right things happen at the right times...

Most of the work for this is done by U4, a low cost LM1881 sync separator chip. This is fed with the video signal from input buffer U1, as you can see, via R5 and C4 (forming a low-pass filter, to block colour information) and coupling capacitor C5.

The LM1881 is a very powerful chip, which takes the incoming video signal and derives from it a bunch of useful sync and timing signals. For example at pin 3 it produces vertical sync pulses, and at pin 7 a signal indicating the odd and even fields of the video. We're not using these signals here, but we are using two other signals it delivers: a full composite sync signal at pin 1, and a colour burst gating/back porch clamp signal at pin 5.

We make use of the burst gate signal by first inverting it via U3d, to produce a positive-going version, and then use this to control our input blanking level clamp switch U2d. That's how the switch is turned on only at the correct time during each 'back porch' of the video blanking pulses, for correct level clamping. (Series inductor L2 is used to prevent the clamp from disturbing the incoming colour bursts, by the way.)

Both the composite sync and burst gating signals from U4 are also fed to U3b, which is used here as an active-low NOR gate. As a result the output of U3b goes high only during either the horizontal and vertical sync pulses, or the colour burst intervals. And as you can see this signal is then used to control video switch U2a and U2c, so they're turned on only at these times.

When those switches are turned on, inverter U3c is used to turn off video switch U2a, so the video fader setting can't produce any shunting of the sync pulses or colour bursts.

The next result is that U2b-c pass the sync and colour bursts straight through when these occur, but the rest of the time U2a passes the video signal level selected by fader pot RV1. Nifty, don't you think?

The power supply circuitry for the fader is exactly the same as before. Positive regulator U5 is used to derive a regulated and smoothed +5V DC rail for both the logic circuitry and the video buffers, while 555 timer U6 is used as a self-oscillating 'charge pump' DC-DC converter, with diodes D2 and D3, to produce an unregulated -10V supply rail from the incoming +12V DC. This is then regulated by U7 down to -5V, to provide the negative rail for U1 and the output video buffer.

Diode D1 is used to prevent damage to the power supply circuitry in the event of accidentally connecting the +12V plug pack or battery with the wrong polarity.

Construction

Building the fader is fairly straightforward, because most of the parts are mounted on a small PC board measuring 127 x 58mm, and...
The board are the connectors. Components not mounted on fader pot RV1, the enhancer switch SW1 and pot RV2, the LED and the video and power connectors.

As you can see from the photos the pots, switch and LED are mounted on the front panel of the utility box to house the project. The video and power connectors are mounted on the rear of the box. The box itself is a low cost ‘UB1’ plastic jiffy box, measuring 160 x 96 x 55 mm, with the PC board mounted on the bottom with four 10 mm long M3 countersink-head screws, fitted with extra M3 nuts as spacers.

Fitting the smaller components to the PC board shouldn’t present any problems if you use the overlay diagram and the internal photo as a guide. The main thing to watch is that you fit all of the polarised parts the correct way around, by following the diagram as carefully as possible. This applies particularly to the ICs, diodes, transistors and polarised capacitors.

Everything else is fairly non-critical, but I suggest that you fit the resistors and small capacitors in a systematic fashion to make sure you fit the right values in the right places. It’s probably also a good idea to fit the three wire links to the board first, to make sure that you don’t forget them.

You might want to fit PCB terminal pins to the board at the video input and output points, and also at the 12V DC input point, to make it easier to fit the wires leading to the box connectors when the PC board is mounted inside the box. For the same reason I also fitted pins for the connections to the components mounted on the front panel – the three connections to RV1, the two to the LED, and the four to enhancer switch SW1 and pot RV2.

When you’ve mounted everything on the PC board, you can put it aside for a while and prepare the box and lid. A photocopy of the front panel artwork can be used as a template to mark out and drill/ream the holes for the controls and LED, while you should be able to mark and cut out the three holes for the connectors using the photo as a guide. Their exact positions on the rear of the box are not critical.

You can also use a photocopy of the PC board pattern as a guide to drilling four 3 mm holes in the bottom of the box, for mounting the board. The holes can be countersunk on the outside, to allow the screw heads to be flush.

A dress front panel can be made using thin adhesive-backed aluminium foil, of the type available in A4 sheets. Most photocopiers will accept half a sheet, allowing you to make a direct transfer from the artwork shown. Just be careful when you’re sticking it to the front of the box!

Once the panel is prepared and attached to the box lid, you can mount the controls (after cutting their spindles to the correct length for the knobs) and mount them to the panel, then adding the knobs. You can also glue the LED into its hole.

To fit the leads you should use the leads from the top of the diode, while the other end of the diode can be soldered to the bottom side of the panel. This will ensure the correct orientation of the diode.

You need to use a small amount of solder to make the connections, and you should use a small amount of thermal paste to prevent the heat dissipation from the diode.

Once the diode is in place, you can then fit the other components to the panel. You might want to use some thermal paste to make sure the diode is well-secured.

It’s important to ensure that the diode is correctly orientated, as well as the orientation of the other components. You should also ensure that the diode is well-secured, and that you use the correct amount of thermal paste to prevent heat dissipation.

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You can also use a small amount of thermal paste to make sure the diode is well-secured, and that you use the correct amount of thermal paste to prevent heat dissipation.
Here's the artwork for the front panel, again actual size so you can use a photocopy for your panel (and as a drilling template).

from the rear, with a small quantity of epoxy resin adhesive.

Then it's simply a matter of mounting the PC board assembly in the bottom of the box, and making the various off-board connections using light duty hookup wire. Your fader should then be ready to try out, after a final check to ensure that you've placed all components correctly and not made any accidental shorts while soldering them to the PC board.

Checkout time
There's actually very little involved in checking the fader, and virtually no setting up to do. All you should need to do is connect up the plug pack supply or other 12-15V DC source, and check that the power supply circuitry is working correctly.

As soon as power is applied, for example, check that the LED is glowing. If it's not, you've either connected it in with the wrong polarity, or made some other wiring error - either with the connections for the 12V DC input, or the polarity of diode D1. Or you might have accidentally swapped the two regulators U5 and U7. So if there's no glow, remove the power quickly and track down where you've made the error. Fixing it should make the LED glow correctly, and if you check the +5V and -5V supply rails with a DMM, you should find that they're both within about 150mV of these values.

Assuming that you haven't made any other blues in fitting the ICs or transistors, your fader should now be capable of working. So try feeding some video through it from a VCR or camcorder, and connect the output to a monitor or TV receiver video input to check what it's doing.

First of all, turn the fader pot to the fully clockwise position, and set the Peak Freq switch to the Flat position to disable the enhancement circuit. The incoming video should simply pass straight through the fader, without any noticeable degrading at all.

If you now turn the fader pot slowly anticlockwise, the picture contrast and colour saturation should fade smoothly and with no effect on picture locking or stability. By the time you reach the fully anticlockwise position, the picture should be black; but turning the pot back up again should restore both contrast and saturation to their original levels.

That's it as far as fader operation is concerned. However if you are doing a video transfer and want to introduce a bit of HF peaking to 'sharpen it up', this is done simply by turning the Peak Freq switch to one of its three 'live' positions, and then adjusting the amount of peaking using the Hi Peak pot.

The idea is to add no more peaking than is necessary to achieve an improvement in the apparent picture sharpness. Too much, and you'll get annoying 'ringing' - multiple white and black lines to the right of vertical edges in the picture.

The switch is arranged so that you can try peaking at 3MHz first, and only progress to the lower frequencies if you really need to. This is because the lower the peaking frequency, the harder it is to achieve a useful enhancement.
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Is this the biggest service job ever?

The biggest service job you've ever heard of, the most remote job we have ever reported, and more on wrongly labelled components - there's something for everyone in this month's column.

**WE START** this month with a story you'll find hard to believe. What began as a simple washing machine repair became a major operation involving dozens of people and lots of money. This incredible yarn comes from Kevin Summers, of Seymour in Victoria. See what you make of his adventures...

Let me start by providing some background information. I am the owner of a small service centre in central Victoria and we cover service for all domestic appliances and brown goods. We are also warranty agents for most large manufacturers. Sufficient time has now passed to allow publication of the details of this particular job.

It involved a U/G Email washer, the District Radio Inspector, The Police Department, the R & D section of Email in SA and the Area Technical Inspector for the SECV. It also covered a period of about four weeks and a handful of lost hair from my topknot.

We had a call to service an U/G Email washer that had an intermittent out-of-balance fault. The machine was one of the early electronic units from Email, and had been working well for about three months before the client moved into another flat, in the same block of units.

A service technician was dispatched to the site and the result was a "No fault found". The client was advised to contact us if the fault re-occurred. After four days we had a recall.

This time we took the washer into the workshop. After inspection and cycle testing couldn't fault it, we contacted the Email Tech Rep. After a number of recalls and replacing, among other things the electronic control PCB, wiring loom and lid switch assembly, Email finally exchanged the machine for a new one. With fingers crossed, we delivered it and hoped that it was the last we would see of the problem. Alas it was not to be.

A few days later we had the dreaded phone call. This time the customer had just turned the machine off. Upon arriving, sure enough the machine was in an out of balance condition. At this stage I contacted the R & D Dept of Email in Adelaide and obtained permission to pursue the fault to its conclusion. As luck would have it that morning we had our local Radio Inspector call in for his usual cup of coffee and a chat. In passing, I mentioned the washer.

The game's afoot!

At his suggestion we started to investigate the possibility of radiated RF interference causing the fault with the microprocessor. As the location is in an industrial area and next door to the regional Police Station this had possibilities.

The next day bright and early I went to the flat armed with a DF loop and Field Strength meter. The machine was playing up but alas no joy with the RFI.

I then connected a CRO to the mains and lo and behold, a 40V p-p signal, at approximately 15 to 20MHz was present. To try to find out the exact times of this interference, I left the CRO connected to an outlet in the flat and suggested that the owner turn it on occasionally. If there was no interference she could do the washing.

Over the next few weeks the customer logged the times when the fault occurred and this was between 7:30am to about 4pm, but only during the week. My early suggestion to only wash in the afternoon or on the weekends was not received very well. Fortunately the customer was a good sport. We then fitted a computer line filter to the power outlet and this allowed the customer to use the machine without restriction.

The next step was to try to locate the source of the interference. So with CRO and isolation transformer in hand I went to the Police Station to see if it was present there. This is where I ran into a brick wall!

To test the mains in the station required written clearance from Police Headquarters in Melbourne. The request took two weeks to be cleared, only to find there was no interference. Bugger it!

I then enlisted the help of the Area Technical Inspector from the State Electricity Commission. This would allow us access to any location without any hold ups. The upshot was that we found the interference on one phase only, hence moving the machine from flat 2 to flat 7, from one phase to another, caused the fault to appear.

The culprit...

After checking, and shutting down the power to five factories, two Government office buildings and various private houses we arrived at a block of flats about 600 metres up the road. It was just on 12 o'clock and we
had the interference present. Then suddenly it disappeared. First thought was that someone had shut down a machine for lunch. As we were contemplating where to go next, a resident of the flats walked out to the drive so on the spur of the moment I asked if he had just turned off any appliances.

His reply was, "Yes, the TV." Just for the hell of it I asked him to turn it back on again. Bingo! The problem was back. The set was a Sanyo CTP 7620.

On instructions from Email, we proceeded to purchase the TV set and on investigation found two dry joints on the main filter electrolytes (C310 and C311) in the power supply. Email required the set in SA so that a permanent solution to the fault could be found. The result was the fitting of a ferrite filter to the active line of the washer.

It appears that the out-of-balance switch in this machine has a low voltage pulse supplied to it. If the switch goes open the pulse disappears and the microprocessor shuts the machine down. The interference was causing the signal to be distorted and this was the cause of the fault.

Some of the interesting aspects of this case are:

1: The reason that we assumed that the interference was coming from the Police Station or commercial premises was the times and duration of the fault.

2: It transpired that the owner of the TV set was a night shift worker who turned the set on about 7:30 in the morning and left it on until he went to work in the early afternoon — and he wasn't home at the weekends.

3 It is amazing that the owner of the set could even watch it, let alone why he didn't get it fixed.

4: After the set was removed from service, four residents from the block of flats informed us that their faulty digital clocks had started to work OK again.

Also, the head of the R & D section in SA informed me he had the same model Sanyo TV. After resoldering his dry joints, the clock in his stove rectified itself as well. It had been running fast intermittently.

All in all an interesting and unusual set of circumstances, but a highly fruitful exercise. The cost to Email was in excess of $1200 (including purchase of the TV set). However they considered it to be good value for money.

I didn't charge for the loss of hair.

Now isn't that something? We have told of some complex searches in the past, but I can't remember one that involved so many people or so much geography. I mean, most jobs involve the owner and the serviceman, and are located in either the home or the workshop. Kevin's story goes from flats to factories to an interstate manufacturer, and even visits the local Police station.

As I said at the top, the story is almost unbelievable. But I can quite imagine that it's true. Many microprocessor controlled devices are proving very susceptible to EMI, hence the new conformity rules. However, as this story shows, damaging EMI can arise in old, non-conforming appliances and can lead to the most unexpected symptoms.

Thanks for that story Kevin, and I hope your fee for telling it will cover the cost of a bottle of hair restorer.

**Magnetism? Who needs it?**

Now we come to another 'almost unbelievable' story, this time from Archie Pearce of Point Sansom, in WA. Archie outlined his story in a letter to The Serviceman and has left it to me to tell the tale in my words. This is the gist of what he has to say...

A few months back we discussed the problem of missing magnetism in part of a high pressure car washing machine, and the story prompted comments from several readers who had suffered similar problems. Archie Pearce is one such reader and has told about a vexing problem that he was able to solve with a dash of typical Aussie ingenuity.

The story is about a Honda 'Robin' 5hp two stroke engine that was used to drive a portable air compressor. According to Archie, he took the system to a remote country area but was unable to start the engine. He eventually discovered that the flywheel magnet had lost its magnetism and the rest of the story is about his ingenious fix.

(A brief description of magneto ignition, for those unfamiliar with the technique.

A strong magnet in the flywheel generates a current in a coil mounted close to the edge of the wheel. The current is at it's greatest as the magnet passes the coil, and while this current is flowing, it
A LOUD BANG AND WAVES OF SILENCE TOLD ME SOMETHING WAS NOT RIGHT

is interrupted by a cam operated switch.

As the switch opens, a high voltage is induced in the coil and this is conducted to the spark plug to ignite the charge in the cylinder. Magneto ignition is simple, efficient and usually very reliable.

Archie was faced with a long drive back to civilization, without even starting the job that took him to the bush in the first place. So he looked about for some way to overcome his difficulty.

As is common in many country towns and remote stations, there were a number of derelict vehicles lying around and one of these caught Archie's eye. It was a 1967 Valiant utility and its ignition system was still intact. Using the Valiant's ignition coil and a few lengths of cable, Archie was able to cobble together a rough Kettering ignition system to get the Robin running.

Unlike magneto ignition, the Kettering system requires an external current supply and Archie's only battery was in his car. So to minimise the chance that he would be stranded with a flat battery, he salvaged an ammeter from one of the wrecks and incorporated that into his lashup, along with his multimeter to monitor the system voltage. He assures me that everything worked like a charm and he was able to finish the job he had gone bush to undertake.

So the loss of magnetism is not as rare as one might think. And with a bit of cunning one can often compensate for the loss. Thanks for that little story Archie. I quite enjoy these simple and amusing tales and I hope our readers do, too!

Those &%$#*! electros!

Now the last story for this month, like the first one, refers back to an item in a previous column. This one comes from Robert Hitchin, of Burpengarry in Queensland.

The October '99 article on wrongly labelled parts brings to mind a repair to some of my own equipment which I tackled then and still have, although I don't play very often these days. The instrument concerned is a Yamaha E10AR Electone organ which I bought in 1973 and still have.

As I was busy at work and it was close to Christmas, I decided to get the Yamaha technician to have a look at it. He replaced all the electrolytic capacitors on the combined main amp and power supply board and the problem was solved, for a while anyway.

Three years later the problem recurred.

This time I had a bit of spare time and, as I had also acquired a manual for the beast, I decided to do the job myself. Fortunately the room housing the organ could be closed off from the rest of the house so that I could dismantle it and leave it for a day or two if necessary.

After removing the front and back panels, removal of the amplifier and power supply is straightforward as it lifts out on an aluminium chassis, similar to some of the old valve chassis with the center cut out.

The cause of the problem was fairly obvious as the two 2200uF/80V capacitors were both leaking. Several other electros including three 1000uF/25V appeared suspect so the decision to replace all of them was made. Getting suitable capacitors was the next problem as, although Newcastle was well serviced with suppliers, some electros were in short supply and getting the 25V units was a real problem...until I found some 1000uF/63V units.

Bang!

On the basis that a bit of extra headroom would not go astray, I used these and soon had the instrument back together. At turn on all seemed well so I finished the assembly and put the instrument into its normal position in the room. Later that day I decided to give the organ a work out and all went well until I applied some real volume. A loud bang followed by a pop and waves of silence told me something was not right.

When the main amplifier was again opened it was covered with the insides of the three 3000uF capacitors which had literally exploded while the two 2200uF units had popped their ends and were leaking all over the board. It was not a pleasant sight.

The board was again removed and cleaned, checking as I went to make certain that I had not done something stupid. On the under side of the board some of the tracks were missing while others looked decidedly black. Further investigation proved that one pair of diodes was open circuit, as were the transistors in the output stage. I made up a list of what I needed and went shopping.

The first place I went to was the shop where I had obtained the capacitors and the minute I mentioned that I had bought some, the owner asked if I had had any trouble. I told him the story and he admitted that they had since found out that the whole shipment had been wrongly labelled and were in fact 16V types. At least the man was honest.

The next problem was then the output transistors and their drivers as these were Japanese in TO3 cases and unlisted as far as we could tell. Detective work eventually led to using BD139s driving 2N3055s.

After it was all back together I took my courage in both hands and tried again. Everything held together but a certain measure of distortion was evident.

(continued on page 97)
### Component Closeup

#### Memory

<table>
<thead>
<tr>
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<th>RAM Data</th>
<th>EEPROM Data</th>
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#### 8-pin PIC microcontroller

#### Specifications

- **Package**: 8-pin DIP
- **CPU**: On-board PIC
- **Instructions**: 38
- **Data path**: 8-bit
- **Instructions**: 16-bit
- **Clock speed**: DC - 6MHz
- **Addressing**: Direct, indirect and register
- **EPROM**: Static, 1024 x 12
- **I/O**: 6 I/O lines/4 ports
- **Max I/O current**: 2mA
- **Supply voltage**: 5V or 12V
- **Standby current**: 1mA typical
- **Voltage range**: 2.5V to 7V

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*ELECTRONICS Australia, July 2000*
Napster and Gnutella: A Pirate's toolbox, or a new world order?

SEARCHING THE WEB for MP3s is often a fruitless task. With the vast majority of search results pointing to 404s, ratio servers or pages full of dodgy banner ads, what you really need is a tool designed for the job. That tool has been around for quite some time now, and it's called Napster. The principle behind Napster is simple: you run the Napster client, log onto a central server, search for the song you want, and download it.

Sounds like yet another MP3 site so far, but there's one crucial difference: instead of keeping the MP3s on the server, they're kept on the hard drives of everyone who's logged into Napster at the time. When you log onto Napster, the details of all the MP3s in your shared folder are sent to the server, which adds them to its global database. When you run a search, the server looks through this list of MP3s, and sends back results pointing directly to the files themselves - allowing you to download straight from the person who has the song you want.

This means that the bandwidth is distributed; everyone contributes a little bit so the speed is kept close to the maximum, and there isn't some poor overloaded fileserver trying to send MP3s to half a million people at once - all it has to handle is the searches themselves. This also takes the legal heat off in the event of problems; as Napster don't touch the files themselves, it's not their fault if someone decides to distribute copyrighted material... But more on this subject later. Suffice to say that if it's been recorded as an MP3, it's probably on Napster somewhere.
Napster nags
Now, Napster isn’t perfect, and there are some really annoying things about it that can drive you up the wall.

First up, there are a number of Napster servers out there, and for some reason, they’re not linked, and you can’t choose which one to join. This means that the whole Napster network is divided into pieces and you can’t see what is on any of the other servers. So you have to take pot luck. The servers are usually pretty well-stocked, though; as I type this there are 406,031 files on the server I’m using, taking up over 1600GB - it would seem that you can find anything if you look long enough.

Also, you have the power to terminate any uploads you’re providing at any time. While this is only right, it means that there’s a good chance of getting kicked off in the middle of a file. Long-term Napster users therefore generally have a huge collection of half-completed songs that they’re never going to find again.

Of course, when half a dozen people start sucking up your bandwidth while you are trying to download the song you’ve wanted for the last six months, ones community spirit has a slight tendency to go out the window...

Apart from that, though, it’s the fastest, easiest and most reliable way to find MP3s on the net today. Check it out at http://www.napster.com

Gnu kid on the block
Of course, there are some design limitations in Napster - if the main server goes down everyone is out in the cold, you can only use it for MP3s, and its centralised nature makes it far too vulnerable to nuclear war or hungry lawyers.

This is where a new program called Gnutella comes in.
The System File Checker is a part of Windows 98, and can be very useful in fixing a broken system.

Gnutella is very similar to Napster, but with two critical differences: it's not limited to MP3s, and more staggeringly it has no centralised servers. That's right, none. Gnutella is nothing more than a network protocol, and instead of requiring a main server to connect to, clients simply connect to each other. All you need is the IP address of one pre-existing Gnutella user, and your files and search requests will get distributed across the planet, daisy-chained from user to user, across the whole network.

Just as the original idea of the internet was to make it unkillable through redundant routing (though just a few bombs placed under a few major routers today would probably bring the whole net to its knees), Gnutella has no central point of weakness, and self-heals around any gaps that form.

With nobody to sue, and no high-traffic servers to go down, you can always get onto Gnutella. With hundreds of thousands of users doing their own dynamic routing, network partitions are unlikely at best. And with files not limited to any particular filetype, people can't even call it a piracy tool - it can just as well be used to exchange recipes, images or savegame files from quake as music.

Now, the very nature of the beast brings its own limitations; the number of searches sent through your system can easily soak up most of a 56k connection, so it's not the most efficient, and having to update all the hosts every time you start the program can mean it's a good 5 minutes before you get useful results.

Also, there's an awful lot of porn, spam, viruses, and generally unpleasant material out there. This is no fault of Gnutella, but it's something to be wary of - just because it's called 'curry recipe.html', doesn't mean it's not a link to 'the best XXX site on the web!!!!!!!!!!'. There are some very lame people out there who poison the well with as many fake keywords as they can, in order to get a few more hits on their pathetic websites. (The above just happened to me, and boy, was I annoyed.) Oh, and if you use Gnutella, don't even think of downloading any programs from it.

Windows Reference

Is there a good reference text for Win95/98 that details the inner workings of the system, how the various files and directories are set up, the organisation of the registry, and such?

I work a lot with small business and domestic users of the system, and frequently get faced with a full re-install when it is obviously only a file that has been corrupted (the area is prone to power flicks) or a single setting that needs to be changed. And, of course, having done a re-install, I then have to re-install all the applications, when they are already on the disk, only Windows does not know it! I have tried saving all the .ini files and then returning them to Windows, but this still does not get them back on the desktop. A good text, rather than having to learn by trial and (mostly) error would be wonderful. (Bruce Burdekin, via email)

The best reference out there for this kind of thing is probably the Windows 98 Resource Kit. You get 1792 pages of exhaustive detail on installation, configuration, networking - the works. There's also a CD full of extremely handy little tools, and huge resources of searchable text - a must-have if you're professionally involved with 98. At $160, it's not cheap, but it's worth it. You can order a copy online at http://www.microsoft.com/AUSTRALIA/mspress/books/book191.htm. There's a Win95 version as well, for only $99.95. Check it out at http://www.microsoft.com/australia/mspress/books/book105.htm.

One other thing: for a quick fix of your 98 system, try running SFC from the command prompt. This starts up the System File Checker, a handy little utility that checks the various DLLs, etc, that are installed by default, and can replace any that are corrupted, missing or changed - a real lifesaver, on occasion.
So you think a computer virus is a bad thing? Maybe not, says Peter...

Topics this month include a reader suggestion on measuring wind velocity, which leads into a discussion on the factors that affect sound velocity. There's also a suggestion on instantaneous communication, more discussion on Telstra's deal for a second phone line, but first a look at the effects of computer viruses.

MOST READERS will have heard of the Love Bug virus, a nasty bit of code that in April allegedly caused worldwide damage costing billions of dollars. I first heard of the virus at 7.00am on the day it was released, and like everyone with email, I feared the worst. It seems this virus, like so many others, was aimed at those running Microsoft Outlook where the virus could make good use of the Outlook address book. My initial reaction was one of exasperation and anger, but when I realised my computer was not affected, I began thinking about the positive aspects of such a villainous act. What positive aspects you say? How can a virus be a 'good thing'? Well, consider this. Some time ago I compared computer development to the development of the motor car, and concluded that computers today are at Model T Ford status. The 'highways' linking computers are probably somewhat better, given the longer development time, but in general, the whole system still has a very long way to go.

Today we drive cars that are so much safer than ever before, but it was to take 40 years or more after the Model T before Ralph Nader made safety such an issue. Thousands of people had been killed simply because cars were not safe. And that's where the internet and computers are today: unsafe. True, you won't be killed by a computer system, but your stress levels will be pushed through the roof each time a virus catches you out.

Today the world is virtually dependent on computers, as evidenced by the Y2K bug. It seems reasonable to suggest therefore that if a couple of 20-year-olds can bring the computer world to its knees, then what would happen if some real experts where hired by a terrorist movement or an aggressive military establishment. My point is, each time a rogue programmer unleashes a virus, it shows up the weakness in the system, highlighting the need for better security.

And just as it was in the automotive industry, money won't be spent on internet safety until there's enough pressure from the computer industry. This will only come from users, not manufacturers, and every time a virus is released, this pressure increases. The internet must be made 'safe' if our dependence on computers is to continue. Every virus simply serves to highlight just how fragile the internet system is, making this a far greater security risk than the Y2K bug. Presently, as has been demonstrated so effectively, the world's computer systems are very vulnerable, given that the Love Bug virus was written in Visual Basic, a programming language we all have access to. Scary, isn't it!

Having got that off my chest, here's our first reader letter on a topic which is a spin off from our discussion on measuring water flow. This time it's about measuring air speed, but will our reader's idea work?

Measuring air speed

I have been considering an idea for an air speed measuring device that you might consider for an EA project. I am aware that sonic anemometers are commercially available, but I have never seen their principles described and this basic idea is original to me, although maybe not unique.

I assume that sound travelling against the wind requires more time to cover a given distance than sound in still air. Using this concept, I envisage a system comprising two frequency sources, a couple of gates, a 'speaker' and a 'microphone'. The distance between the speaker and the microphone is a quarter of a cycle of the lower frequency. A frequency of 275Hz might give a path of 30cm or so. The higher frequency is chosen to suit the speaker and microphone, and I expect a practical system would operate at ultrasonic frequencies.

In calm wind conditions there would be a 90° lag in the arrival of the sound bursts when referenced to the lower frequency, and considering that the duration of the sound bursts is 50 percent of the time, we would see a tone at the output for 25 percent of the time. When the wind blows towards the speaker the arrival of the sound bursts will be delayed even further and the output duration would drop. When wind blows towards the microphone the sound bursts would arrive earlier and output duration would increase. Therefore the system will measure wind in both directions.

It could be a fairly simple circuit operating a cen-
to the zero meter, but a more useful system would have two microphones mounted, for example, north and east of the speaker. This would give everything needed for a wind speed and direction anemometer. The output of the microphones could be passed to a PC via a stereo sound card, where software would process the resulting "WAV" file and drive on-screen speed and azimuth displays. I think I could manage the software development, but the electronic design is beyond me.

Such a system would have significant appeal, as commercially available ultrasonic anemometers are quite expensive and lower-priced mechanical systems have maintenance and reliability problems. It would be more accurate than any other system except the best mechanical types, which are very difficult for the home constructor to calibrate. Calibration of my proposed system requires only a ruler and calculator. I look forward to your comments, even if they only point out a basic flaw in my understanding of the physics involved! (John Hill, Island Bay, NZ)

Unfortunately I think there's a problem in the principle of operation of your idea John. As far as I know, the speed of sound is determined by two main factors: the type of medium it's travelling through, and the temperature of the medium. Turbulence or motion in the medium has no effect.

Temperature is certainly a factor, as many people would have experienced. The speed of sound in air is 331.29 metres per second at 0°C, but because sound waves propagate faster in warm air, they travel faster closer to the Earth. The higher velocity of sound in warmer air near the ground creates what's called "Huygens' wavelets" that also spread faster near the ground. Because a sound wave propagates in a direction perpendicular to the wave front formed by all the Huygens' wavelets, sound under these conditions tends to refract upward and become "lost". The sound of thunder created by lightning can be refracted upward so strongly that a shadow region is created in which lightning is visible but the resulting thunder is silent.

Sound velocity in water is determined by the square root of elasticity divided by the water's density. Because water is only slightly compressible, it has a large value of elasticity and therefore conducts sound rapidly. Since both the elasticity and density of seawater change with temperature, salinity and pressure, so does the velocity of sound.

In our oceans the speed of sound varies between 1,450 and 1,570 metres per second, increasing by about 4.5 metres per second for each degree Celsius increase. Increasing salinity increases the velocity, as does an increase in pressure, at the rate of about 1.7 metres per second for an increase in pressure of 10 bars or so, which is around 100 metres in depth.

Regarding an ultrasonic anemometer, I could find nothing about such a device, although there are certainly a number of different types of anemometers. The best known is the revolving-cup electric anemometer, in which the revolving cups drive an electric generator connected to a meter that's calibrated in wind speed. The useful range of this device is from five to 100 knots. Other types include the pressure anemometer (which has a pitot tube), a hot wire type, and various anemometers with some sort of rotating device driven by the wind. But a sonic type? If anyone can help out on this device, please let me know.

Staying with the concept of velocity, here's a letter that suggests communication might well be possible at speeds faster than that of light...

**Brain waves**

Is it possible that we are wasting our efforts in the way we are trying to receive transmission from intelligent life in space? Intelligent life might be the human race, years into the future. Given that we learned to communicate at the speed of sound and, more lately, at the speed of light, then why not transmissions faster than the speed of light?

If we progress to that point, presumably we could both transmit and receive – that is, receive transmissions from a time yet to "occur". Now, wouldn't that be a fundamental change to the nature of man? But do we know of any particle, or non-particle, that can travel at these speeds? I think it probably does exist – the clue to its form may well be found on your shoulders. (Stephen Butcher, Masterton, NZ)

I was intrigued some time ago by a TV program that dealt in a simplistic way with quantum physics. The show described an experiment which proved "beyond doubt" that the behaviour of a particle (I forget which type) was influenced by another particle, with communication between particles apparently occurring instantaneously. That is, at a speed well beyond that of light.

So Stephen, perhaps you're right. There might well be a means of communication that doesn't require any time to elapse between receiver and transmitter. Just what form it might take is anyone's guess, but it's an exciting concept, and one I'd love to witness if it's discovered in my lifetime.

**What's happened to EA?**

Change is always a challenge, and I guess the following letter might ring a few bells with our regular readers, following the recent changes made to the magazine's format, and name.

"I have been a regular reader of EA for nearly 35 years, and I don't recognise it anymore. What's going on? It seems gloss and colour are more important than anything else; I even have difficulty finding where your column is in the magazine. To me, a technical magazine doesn't need lots of pretty pictures or fancy design, it needs content that is technically relevant and easy to find. It should also have more projects and the type size should be larger. After all I'm now Pushing 80, and my eyesight is not what it used to be. Are all these changes due to your new editor? I preferred the way it was when Jim Rowe was in charge." (Warwick Moriarty, Padstow, NSW)

The magazine business is not what it used to be. Warwick. These days we are up against the Internet and
other sources of information. As well, statistics have shown that magazine readership in Australia has been steadily declining over the last 10 years or so. We have a loyal readership, but unfortunately one that has an average age much higher than most magazines. To stay in business, we need to attract more readers from a younger age group.

To achieve this we need to ensure EA looks the part. It’s a very visual world these days, and maintaining a layout and design that has its roots in the 1960s is not a way of attracting new readers. But, design aspects aside, I agree that content is most important. There have been a few complaints about the reduction in the number of projects, but this has nothing to do with the new design. It’s simply a fact of life: some issues have more projects than others. We don’t intend cutting back on projects as we see these as an essential part of the magazine.

Regarding type size, you might notice that the quality of the paper is now much higher, giving sharper print and better reproduction of photos. I too need fairly strong glasses these days, and yet I find the print size ok. True it’s down a point size or so to what it was, but it’s still perfectly readable, and pretty much the same size as that used in most newspapers. Furthermore, the content has not changed, although some contributors are no longer with us, due to all sorts of reasons.

The changes have nothing to do with EA staff by the way. We are simply a part of a larger organisation that needs to keep all its magazines profitable. The new design has been done in consultation with our staff, but was not driven by us.

However, we all feel the results are going to pay off, and that we can look forward to producing the magazine for many years to come. But without the changes, we could have been out of business in a year or so. Still, reader comments about this are important to us as we don’t want to alienate our existing readership.

Second phone line

I’ve had a few letters in response to the discussion in May about Telstra’s ‘black box’ technology that provides two phones over one pair of copper lines. But as the following letter describes, there’s another older system used by Telstra, called a pair gain system, that according to our reader is not all it’s cracked up to be.

I read with interest your article about Telstra offering a second line using a ‘black box’ for $75, which I assume is a pair gain system. I had one of these black boxes installed about a year ago. Previously, with the single line, I was regularly getting a typical connection speed of between 48k-56k. Now all I get is a rock solid 26.4k, no higher and no less. The pair gain system was installed because there were no spare pairs from my house back to the telephone exchange.

At the time I was promised there would be no perceived reduction in the grade of service to my home. I should also add that when using the normal telephone there is an annoying background hiss which is always present on the line. Progress? (Ian Anderson, email)

I recently had an enquiry about the black box system mentioned in May from a reader who was having difficulty convincing the Telstra representative he spoke to that the technology is in fact available. However, after much phoning around he found out the following:

I have now delve further and questioned Telstra at length, and they still denied all knowledge of the $75 deal. After a lot of calls, I finally talked to someone who knew, and the ‘black box’ (beige actually) is called an ANT1 (Analog NT1). It’s a derivative of the OnRamp ISDN service and was originally designed to get Telstra out of the smelly stuff when they couldn’t supply more copper to a location requiring two phone lines.

It gives the equivalent of two simultaneous copper pairs over one pair, but unlike the pair gain system, it offers no degradation of data rates, and in fact can actually offer better rates due to the ISDN quality. However there’s one condition, you can’t be more than 4.5km by cable from your nearest exchange! (Tim Stockman, email)

I am interested in hearing again from you Tim, or from any readers who have this ‘beige box’, to learn how it performs. However, whether it’s excellent or not, it still assumes one copper line which as I experienced recently, can be a real limitation.

My new phone line had become extremely noisy, to such an extent that I could not use it for any on-line purposes.

I got around this by swapping the modem to the other line, which was not exhibiting noise problems. Any form of line sharing would not have given me this option. I should point out though that Telstra fixed the problem the day after I lodged a complaint.

5 channel mixer

Audio type projects are always popular with readers, but can we help with this next request? Surely we can…

I’m new to electronics, and I wonder if you can help me with a query about a project you might have published. I’m want to build a five channel audio mixer (three mics, two line), and was wondering if EA has ever published a balanced microphone preamplifier. If not, are you considering one in the future? (David Elsbury, Auckland, NZ)

I spoke to our resident audio expert Rob Evans who suggested the Multi-purpose Preamp Board project published in November 1988 (page 64). This project lets you build up virtually any type of preamp, balanced or unbalanced, mic or line input, tone control etc. However you would need a few boards, interconnected as required...
Transistors – 1

This month, Darren begins a new series looking at how transistors work.

If ever there was an electronic component to change the course of history, it would have to be the transistor. This three-legged device first created in 1948 took the world by storm with its low power consumption and tiny physical size.

It was a breakthrough of epic proportions – you have to remember that back in those days, the only amplifying device around was the valve (or 'tube' as the Yanks called them).

Values were bulky and required significant amounts of power just to heat up the filaments - and that’s before you even started doing anything serious.

The idea that what previously required lots of space and power could now be achieved by a tiny package smaller than your fingernail was nothing short of mind-boggling.

Millions of transistors can now be found in every personal computer – in fact, without them, the personal computer revolution would never have got off the ground.

When you hear the word 'transistor', it’s generally associated with the most common type known as the bipolar junction transistor or BJT.

Today, there are two types of BJT, and they’re known as NPN and PNP.

OK, lots of three-letter acronyms make for confusion so let’s get a look at Fig.1 to see what this is all about.

Fig.1 shows a very basic block diagram of how an NPN transistor works. You can see there are three basic regions – the n-type emitter, the p-type base and the n-type collector. There are also two 'pn' junctions – the base-emitter and the base-collector.

Each of the three regions has a terminal connected to it; they’re the ones we use to connect them into our circuits. Hopefully, you can see too that a PNP transistor is almost the same except that the region types are swapped.

Now transistors are pretty clever little devices – not only can they amplify a small signal but they can also be used as a controllable switch (it’s this feature that makes computers possible). It all comes back to those two PN junctions we talked about a few seconds ago.

Transistors have three modes of operation known as ‘cutoff’, ‘active’ and ‘saturation’.

Which mode it operates in depends on how the junctions are ‘biased’. If we think back to the good old diode for a second, we know that we must have 0.6V more on the anode than the cathode of a diode for a current to flow from the anode to cathode.

We say the diode in this situation is ‘forward biased’. If the voltages were the other way around, that is, the cathode at a higher voltage than the anode, we’d say the diode was ‘reverse biased’.

OK, back to our transistor.

Regardless of whether it is a PNP or NPN type, a transistor is in cutoff mode if both the base-emitter (BE) and base-collector (BC) junctions are reversed biased. It’s in the active region if the BE junction is forward-biased and the BC junction reverse-biased and the device is saturated if both junctions are forward-biased.

Notice the arrows in the schematic symbols? You can think of these as the direction of conventional current flow. In fact, we mentioned the diode above for the very good reason that the base-emitter junction acts just like a diode – a fact exploited in one of the very first circuits: an amplified crystal radio.

Putting it very simply, in order to switch on an NPN transistor, the base needs to be 0.6V above the emitter. To switch on a PNP transistor, the base must be 0.6V below the emitter.
This might seem like a lot of theory but really, it's nothing compared to what you need to know for some of the more specialised uses of these things.

**Simple circuit**

OK, this is as simple as it gets. It's not very useful for anything but it gives us a good glimpse at how these devices work. Fig.2 shows us a 9V battery, two resistors and a transistor.

Arguably the most important parameter of a transistor is its amplification factor or 'beta'. It varies quite widely from a few tens for large power devices to many thousands for smaller devices.

There are many other parameters that determine how a transistor works and how you can use them - if you have a Dick Smith Electronics catalog, you'll find plenty of that data in the back.

We'll leave the issue of transistor data for next time.

Our transistor here is the imaginary EWE01 and it has a beta of 100. Knowing the beta plus the other component values, we can work out exactly what's going on with this circuit.

To start with, current flows from the battery, through the 100k resistor connected to the base pin (I'll refer to this as the 'base resistor' from now on), through the base-emitter junction and back to the battery.

Since we know the value of the base resistor, we also know that the current flowing through the base-emitter junction is:

\[ I_{be} = \frac{(9V - 0.6V)}{100k} \]

= 0.000084 amps or 84μA

From this we can work out the current flowing through the collector resistor:

\[ I_c = I_{be} \times \beta \]

= 0.000084 x 100 = 0.0084 amps or 8.4mA

And this current flows from the battery, through the 1k collector resistor, through the collector and emitter of the transistor and back to battery-negative.

The voltage at the collector is therefore:

\[ V_c = V_{battery} - (I_c \times R_c) = 9V - (8.4mA \times 1000) \]

= 0.6V

Hopefully, you can see that this transistor is in the active region (just) - the BE junction is forward biased and the BC junction is reverse-biased, although with the collector only 0.6V above ground, it's not the ideal operating point for an amplifier circuit.

You should also notice that this circuit is heavily reliant on the transistor beta to determine the amplification or gain - that's not an ideal situation because every transistor has a different beta, even two of the same batch.

Fig.3 shows a slightly more complex circuit and what we're going to do is to again work out the DC voltages and currents.

Looking at the circuit, we know that the base voltage is 2.8V so the voltage at the emitter is going to be 2.8 - 0.6V = 2.2V. The emitter resistor is 2.2k so the emitter current will be 2.2V/2.2k = 1mA.

What we haven't said until now is that the emitter current is the sum of the base-emitter junction current and the collector-emitter current. Given that our transistor has a beta of 100 we know that the base current is 1mA/100 = 10μA. That means the collector current has to be 1mA - 0.01mA = 0.99mA.

From this, we can deduce that the voltage at the collector is 9V - (0.99mA x 4.7k) = 4.347V if you do the maths. In practice, it will most likely hover somewhere between 4.2 and 4.5V depending on component tolerances.

**WOULD NEVER HAVE GOT OFF THE GROUND.**
With most of these simple circuits, it's fine to be within +/-10%. Although not as forgiving as valves used to be, transistors will still work in circuits over a fairly wide range of tolerances.

**PNP analysis**

So far, we've only dealt with NPN transistors so let's do that last DC analysis circuit again, this time with a PNP transistor instead. We'll call this transistor EWE02 and it also has a beta of 100.

Looking at the circuit in Fig.4, we know the base voltage is 3.0V so the emitter voltage is going to be 0.6V above that (remember the forward drop of the BE junction), which is 3.6V. The current flowing through that 4.7k emitter resistor is (9V - 3.6V) / 4.7k = 1.149mA. The base-emitter current (flowing from emitter to base this time) is 1.149mA/beta = 11.49μA.

From this, we can figure that the collector current is 1.149mA - 11.49μA = (approx.) 1.137mA, and so the voltage at the collector of our transistor is 2.2k x 1.137mA = (approx.) 2.50V.

Go through these last two circuits a few times until you get the hang of it.

**Phase relationship**

While it may not have been obvious, you may have seen that the emitter voltage follows the direction of the base voltage, that is, raise or lower the base voltage and the emitter voltage follows it - we call this being 'in phase'.

However, if we raise the base voltage, the collector voltage drops and vice versa. We say the collector voltage is 'out of phase' with the base voltage. As an example, take another look at Fig.3 again but this time, instead of a base voltage of 2.8V, substitute 2.5V and 3.3V and redo the calculations and you see this relationship between the three terminals.

This is an important lesson to remember and one you'll use time and time again.

**Three basic amplifiers**

Now that we've looked at the basics of the transistor, let's look at some simple amplifier circuits. The first one is the known as the common-emitter amplifier shown in Fig.5. The input signal is applied to the base via a coupling capacitor and the amplified output is taken from the collector via another coupling capacitor. The reason for these capacitors is so that the preceding and following stages connected to this circuit don't cause any changes to the DC operating conditions.

This circuit is known for its good voltage gain and reasonable power gain. By 'power gain', I mean its ability to turn a weak (high impedance) signal into a low-impedance signal.

This circuit is the best way to implement a one-transistor amplifier that is stable, reliable and most importantly, virtually transistor-beta independent.

While it's difficult to see straight off and without a couple of pages of theory, the gain of this stage is basically equal to the collector load.
divided by the emitter load.

Notice here that we have a comparatively large capacitor across the emitter resistor. In this situation, the emitter resistor is by-passed and has no effect on the AC signal but rather than no emitter resistance whatsoever, the base-emitter junction of the transistor itself has a small amount of resistance known as "re".

This emitter resistance is: \( re = \frac{Vt}{I_e} \), where \( Vt = 25\text{mV} \) and \( I_e \) is the DC emitter current.

The gain of the circuit is then effectively:

\[ \text{Gain} = \frac{R_c}{re} \]

Also take note that the output signal is out-of-phase with the input.

The circuit in Fig.6 is the common-collector or "emitter follower". Here, the signal output is taken from the emitter rather than the collector. It offers no voltage gain whatever however it has very good power gain. It also has a very high input impedance which effectively equals the total emitter resistance times the transistor beta.

It means we can connect up a high impedance signal to a low-impedance load without any significant loss of signal. The output signal is also in phase with the input.

The last circuit in Fig.7 is known as the common-base amplifier and is the least common of the three. Although it can be used for audio amplification, it is most often used for radio frequency work.

It's a little unusual in that the base is connected to ground via a capacitor and the input signal is fed into the emitter instead. However if you look carefully, it's little more than a common-emitter amplifier on its side.

Like most devices, transistors run into problems when it comes to amplifying high frequencies. One cause of these problems is known as Miller capacitance, an internal parasitic capacitance that progressively reduces the transistor's ability to amplify high frequency signals. The common-base circuit negates this capacitance by grounding the base pin.

The problem with it though is that it provides reasonable voltage gain but at the expense of power gain, meaning that it has a low input impedance and a high output impedance, which limits what you can connect to it. The output is also in phase with the input.

**What? That's it?**

Well, we've tiptoed around some of the basic theory of transistors, which is as much as I can hope to do in a couple of pages. I could point you to a number of fairly good reference books but I reckon there's no better place to learn than in the school of experience - you'll learn much more by doing than you'll learn by reading.

While I graduated in electronics at university level, I easily learned as much again in the field by getting my hands dirty and making a few mistakes along the way.

Another tip that really helps is look at as many circuits as you can find - even build as many of them as you think necessary. Not every circuit you'll find will work perfectly; some may not even work at all but the more you build, the more you will learn.

Next month, we're going to look at the area of datasheets, how to read them, what all that data means and how it affects your circuit design. See you then.
Restoring a crystal set, & their place in history

This month's story concerns one of the simplest of all radios -- a crystal set, and its a crystal set with one of the simplest circuits possible at that. But the simplicity starts and finishes with the circuit.

CRYSTAL SETS are almost a sub-culture amongst radio and vintage radio enthusiasts, and some very elaborate designs have been proffered by members of various crystal set societies. But these sets are far more than just a curio and a challenging past-time, despite what many people may think. In fact crystal sets have had three important roles in the long history of radio.

Firstly, crystal set radio pre-dates just about any valve radio. ('Crystal set' in this context refers to radio without valves.) Detection may not have necessarily been by a lump of galena and a length of spring steel wire. Some very VERY early types may have used a Marconi magnetic detector or a carborundum detector.

Secondly, a crystal set was the answer for those who couldn't, or wouldn't, purchase a valve radio in the 1920s. A crystal set was seen as a serious answer for budget priced radio. The fact that usually only one person could listen to it at any time seemed of no great importance then.

Thirdly, a crystal set was almost universal as a 'first step' in fostering a budding interest in radio, for a young lad or girl. When valve radios were still out of reach for a youngster's budget, a crystal set was often the only answer. Just about every lad with a mechanical or curious bent built a crystal set, whether they went on to develop a career in electronics or not.

Crystal sets were probably built right up to about 1960 or perhaps beyond. Some were sold commercially as a complete unit, particularly by the 'Aegis' brand, and from the 1950s a germanium diode tended to supersed the old lump of galena and cat's whisker wire.

Limitations
Some elaborate and sensitive crystal set designs have been developed over the years, and some of them will actually separate the local stations! (Refer EA for June 1988; the 'Deluxe Crystal Radio'). Sets like this often rely upon today's vastly increased signal strengths, which allow bandpass tuning to greatly enhance selectivity.

But in the early 1920s and the mid 1920s in particular, crystal set design was not so eloquent. Firstly, the 'B' class, or commercial radio stations were limited to only 500 watts power. The 'A' class stations, i.e., those which derived their revenue from licence fees and which ultimately went on to become the ABC, had transmitter power from 3kW to 5kW. As there were only two stations in all cities except Sydney, selectivity was not a problem unless one resided close to the B class transmitter. As a result, very simple crystal sets were practical and the order of the day.

Basic tuning
Many, many crystal sets comprised little more than a coil and variable capacitor forming a tuned circuit. The coil often had taps at every 10 or so turns on a total of 60, such that the aerial and the detector could independently be selectively coupled to the tuned circuit.
This was to facilitate optimum antenna coupling as an aid to selectivity, and optimum coupling of the detector so that the tuned circuit was loaded as little as possible for a given reception locality. Ultimately, so the theory goes, selectivity was improved; and in many circumstances it was.

But what if a tuning capacitor could not be afforded? At the time, some tuning capacitors cost as much as an apprentice's weekly wage!

The answer was to use the self-capacity of the coil, i.e. the small capacitance that exists between adjacent turns for each turn of the coil. The station selection then depended on varying the inductance and capacitance combined, either by a slider contact over enamelled wire, or a multi-tapped selection switch.

The circuit of such a device is abidingly simple, and is shown in Fig.1. One slider selects the coupling for the crystal detector, and the other varies the length of the coil, and hence the inductance and capacitance (combined).

Such a scheme also has another advantage. The 'Q' of such a coil is quite high, and it is a high-L/low-C circuit. This will increase the voltage developed across the coil at resonance, such that the detector can be tapped lower 'down' the coil and reduce the loading - which will enhance selectivity.

A lost cause?
The little radio shown in Fig.3 was the topic of much discussion between its intended owner and the author. It originally purported to be a valve radio, but an ungainly three-coil tuner, the small cabinet as well as the series of vacant holes behind the control knobs suggested otherwise.

Further investigation showed that the three-coil tuner had been fitted where a crystal detector had once been, and the little labels were actually crystal set labels. There were two binding posts, no doubt for the filament battery, which were of a different style to those at the top of the panel.

Inside was an enormous 23-plate tuning capacitor, a dud Philips type A110 (1925) valve, and a grid leak and grid capacitor strung together in a fairly untidy manner.

My guess was that this radio started life as a crystal set and perhaps together with an old valve and some bits and pieces was given to a novice, perhaps 10 years later, for him to build a valve radio. The new owner presumably thought that it would be nice to go that one step further and 'upgrade' the crystal set.

Originally, there were only two controls, and behind each control was an arrangement of holes around the circumference of a circle. So the only possibility was for a switch-tuned receiver in which the taps replaced a continuously variable slider.

Another factor which affected slider-tuned sets was that they had to rely on a coil of enamelled wire, and not cotton-covered wire. The enamelled wire tended to be of a fairly hefty gauge, as thick as 20 SWG. The thicker wire was chosen to prevent short circuiting of one or many adjacent turns by the slider contact.

As a result of the thicker wire, the number of turns to the inch was reduced to about 30 turns. This meant a large diameter former - often 5" (125mm) and containing up to 300 turns, with a length of about 10" (250mm). That is why those very early slider-tuned crystal sets had such enormous coils.

On the evidence available, this particular crystal set had only two controls and these were both stud switches. (The Americans prefer to call them 'tap switches'.) Therefore, there was no tuning capacitor. However the cabinet simply did not allow for a 5" diameter, 10" long coil former. So in this case the coil was most likely a 3" former, and allowing for end space, no more than 6" in length. It was also enclosed in the small cabinet, making access to sliders somewhat difficult. Everything points to a switch-tuned coil wound with medium to fine gauge wire, and in keeping with the day, the wire would have most likely been cotton covered.

The holes for the studs were all over the place, but they seemed to be in arcs of 1-1/2" (38mm) radius. One switch was obviously for the 'earth' end, which altered the tuning parameters. The other switch was by implication for positioning the tap for the crystal detector.

A big, long coil
At this stage I decided that speculation must give way to design and construction - or reconstruction, if you prefer.

To contemplate winding a coil for this receiver, the constraints of space had to enter the equation as already mentioned. Fortunately, a very enterprising person has devised a coil winding chart, which is a sort of ready reckoner for coils: a series of parallel and graduated line-graphs. The first is for capacitance, the second for frequency, the third for inductance. Then there are a series of four other graphs
seven detector taps, again an odd number.

Calculating the taps was guesswork relying upon experience. For the tuning taps, there are four intervals of 5 turns, four intervals of 7 to 8 turns, four intervals of 10 turns and four intervals of 20 turns, approximately. All of those figures do not add up to exactly 300 turns, but no matter.

The coil former was marked out and drilled at the required distances from the start of the winding. The detector taps were placed at about 20 turn intervals from the top of the coil, marked out in a similar manner.

When completed, the coil's total inductance was measured on a digital meter and came out at 2200uH. Something went right! The small difference in a coil of this size is negligible.

As well as being split, the original front panel also had too many holes in it that were not original. It had been made of thin but solid timber, and painted black. A new piece of similar thin solid timber was selected, and duly marked out for the switch studs.

Then it was into the spares department to see how many brass switch studs could be unearthed. By salvaging another old and derelict panel, 24 studs and their stoppers were unearthed, and they all cleaned up a treat. I also turned up a genuine crystal detector, with a lump of galena and the swivel arm. These items were all duly cleaned up and polished.

Assembly & results

In the first instance, the coil was lashed together on the workbench using test leads dangling in all directions. The outside antenna was connected (if you can coil 10 to 12 feet of hookup wire thrown over a bush an antenna), together with a germanium diode and a pair of headphones.

It worked! Not only that, but two stations could be separated out from a quite powerful local transmitter. The assumptions made for the coil were obviously not too far out....

Better still, when the cat's whisker detector was hooked up that worked as well - although the germanium diode does give a slightly louder signal.

By inserting a small capacitor in series with the antenna, slightly better results again were obtained, and a further small improvement was obtained by connecting a 1nF capacitor across the phone terminals. These components were not in the original design, but can be added externally to improve results.

The end result is most gratifying. Scrounging around for parts, particularly the tap switch assemblies was no mean task.

So too was calculating the coil, winding it, and marking out the switch holes with a template after first using a protractor and a piece of paper. The design is so simple, yet restoring it required skills significantly different from valve radio.

In all, it was a very satisfying project. If you get a chance to tackle a crystal set restoration yourself, I can recommend it!
Electronics

by PETER PHILLIPS

AN EASY INTRODUCTION TO ELECTRONICS FOR STUDENTS AND HOBBYISTS

PLUS Simple projects to build

On sale now at your newsagent.
Reversing motor drive

Want to get a model car or truck driving around by itself? Add this little project, and you can have your vehicle driving forwards and backwards in no time. It can automatically switch from forwards to reverse and back again, or you can have it respond to different light levels. Either way, this is a simple (and cheap!) way to bring your model alive...

**PARTS LIST**

<table>
<thead>
<tr>
<th>Resistors</th>
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<tr>
<td>R1</td>
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<td>R2</td>
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<td>R3</td>
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<table>
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<tr>
<td>IC1</td>
<td>555 timer</td>
</tr>
<tr>
<td>Q1</td>
<td>BC340 transistor</td>
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<table>
<thead>
<tr>
<th>Miscellaneous</th>
<th>Description</th>
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<tbody>
<tr>
<td>RL1</td>
<td>Mini DIL PCB relay with 5V DC coil, 1A contacts</td>
</tr>
<tr>
<td>DC motor</td>
<td>stripboard 17 x 80mm (6 strips x 11 holes), 10 x 1mm terminal pins, 8-pin IC socket, 2 x crocodile clips or switches, 4 x battery holder</td>
</tr>
</tbody>
</table>

**THIS CIRCUIT** was originally designed for a model steamroller toy, but it has many other applications. It provides the drive current for a small DC motor with two modes of operation.

1. **Automatic:** the current reverses automatically every four seconds. You can adapt it to make the periods longer or shorter if you want.
2. **Light level controlled:** the current reverses depending on whether the vehicle is in a relatively bright situation or in dim light. You can set the light level at which reversal occurs.

The circuits for the two options are quite separate so, if you decide that you do not want one of the options, you can save costs by leaving it out.

Automatic action is ideal for the steam roller application. The roller runs backward and forward indefinitely, reversing every four seconds. A similar action can be set up if you arrange for the floor to be brightly lighted in one area and shaded in another. The roller runs back and forth, alternating between the light and dark areas. If you direct a torch beam or laser pen at it, the model can be made to reverse whenever you catch it in the beam or allow it to escape.

This circuit can also be used for powering other toy vehicles, such as model locomotives, tanks and tractors. Make the model yourself, using stiff card or polystyrene sheet, or adapt a ready-made toy for the purpose. Since the circuit can switch motors powered on any DC voltage from 1.5V upward, it can also be used in conjunction with existing model railways and other toys.

There is also the possibility of using the circuit to drive static toys, such as a model carousel or roundabout. Alternatively, it can drive a mobile Christmas decoration, or a shop window display. It all depends on your inventiveness and model-building skills.

**How it works**

The reversing action of Mode 1 is provided by a relay with double-pole double-throw (DPDT) contacts. When wired as in Fig.1, the direction of current through the motor depends on whether or not the relay coil is energised. The automatic reversal of Mode 1 makes use of a 555 timer (IC1) wired as an astable. The timing depends on the values of R1, R2 and C1:

- The output is high (relay not energised) for: 0.69 x (R1 + R2) x C1 seconds.
- The output is low (relay energised) for: 0.69 x R2 x C1 seconds.

In Fig.1, we have made R1 much smaller than R2, so the high and low periods are roughly equal. With the given values, the on and off periods are 3.93 and 3.86 seconds. The output of IC1 provides sufficient current to drive the relay directly.

For Mode 2, we use a simple light sensitive transistor switch circuit. R3 is a light-dependent resistor. In darkness or dim daylight, it has a resistance of several tens of kilohms so the voltage at the base of Q1 is less than 0.6V and Q1 is turned off. The coil of the relay is connected to the collector of Q1. With Q1 off, no current flows and the relay is not energised. In bright light, R3 has a resistance of only a few hundred ohms. The voltage at the base of Q1 rises above 0.6V, turning it...
on. This causes current to flow through the relay coil, and the flow through the motor is reversed. Note that the current for the motor is shown as coming from a separate 1.5V source, sharing its 6V line with the circuit. The motor used in the prototype runs on 1.5V, even voltages greater than 6V. However, as the switching is by relay, we can use any suitable voltage instead of 1.5V, even voltages greater than 6V. If the motor is to run at 6V, the terminal labelled +1.5V can be connected to the 6V line of the circuit. If the two inputs to the relay contacts are made entirely separate from the main circuit (that is, leaving out the common 0V connection) we can use an AC supply to the motor. All voltages and currents must be within the maxima quoted for the relay contacts. There are some types of DC motor that turn in the same direction whatever the polarity of the supply current. Obviously, such motors are unsuitable for this project.

**Construction**

The first step is to decide on what materials are to be used for the model. Its dimensions must be chosen so that there is room to contain the battery holder, the circuit board and the motor. The location of R3 (if installed) and of switches must be decided on. To save costs, the mode selector switch can be a crocodile clip with two metal pins for it to be clipped to. A SPST switch of some kind is needed in the common 0V line to switch the power on or off. Switches are relatively expensive but can often be improvised from wire paper clips.

One of the most essential points to consider is the speed of the motor, which is typically several thousand RPM under no-load conditions. Usually, some form of reduction gearing is needed. Several electronics suppliers list plastic gearboxes, and some types of motor already have a built-in gearbox. Fig.2 shows how to improvise a reduction gear at no cost. The shaft of the motor carries a small rubber 'wheel'. Push a rubber stopper or similar cylindrical object on to the shaft. We used a small rubber grommet for this purpose. The small 'wheel' makes contact with a much larger wheel, which then rotates more slowly than the motor shaft. In a model roller or tractor, the larger wheel is one of the driving wheels of the vehicle.

Again, these can be improvised. A plastic cap from a large jar of Vegemite makes an excellent wheel, and its ribbed rim helps to grip the small rubber wheel and also the road surface. There is need for pressure to hold the small wheel in contact with the larger wheel. Often the simplest way of providing this is to mount the motor loosely so that the small wheel is partially supporting its weight. Then gravity provides the required force and there is no need for precision engineering.

If all else fails, judicious use of rubber bands is quite effective...

A simple circuit such as this presents no construction problems. Assemble the timing and relay circuits and connect the crocodile clip to pin A. Connect a meter or the motor to the terminal pins labelled 'M' and check that the current reverses regularly. If both the circuit and the motor are running on the same 6V supply, it is possible for voltage spikes from the motor to reset the timer irregularly. If this happens, try wiring a 10uF capacitor across the 0V and 6V lines near to the supply terminals of IC1. This should effectively decouple the interference.

The light sensitive circuit is also easy to build and set up. When the circuit is complete, connect the crocodile clip to pin B and switch on the power. Turn VR1 as far left as it will go and expose R3 to bright light. Then turn VR1 slowly right until you hear a faint click from the relay as Q1 turns on and the coil is energised. Listen again for the click as you cover R3 to turn Q1 off and de-energise the relay.
**DIY CCTV PAKS**

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<td>4 Cameras &amp; Switcher</td>
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<td>$419</td>
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P.O. BOX 94, Deer Park, VIC 3023
The only other similar project was one presented in May-June 1983, a full-on eight channel, semi-professional mixer desk. Unfortunately kits of parts for both projects are probably no longer available, although the PCBs might still be available through RCS Radio. So perhaps it’s time for us to look at another mixer type project.

What??
This month’s question requires a degree of logic, and is based on a true situation. It was sent to me by Robert Bowman (Dereel, Vic), who says the problem continually confounds his friends. It goes like this:

My first reaction was to blame the modifications
I had made however any check I was able to make was spot on.
Finally I disconnected the main speaker and just left the eight inch mid-range in circuit. The distortion disappeared. The main speaker in the E10 is a huge, odd shaped, plastic skinned affair. It looked expensive... and was! In the end, I settled for a more conventional speaker with similar power handling capacity. It worked like a charm and the organ is now back in full service.

All this goes to show just how much trouble you can get into because a one dollar component was wrongly labelled.

My parents have been married for 35 years. However my 36 year old brother (no, he’s not adopted) was born four years after they married. How can this be?

Answer to June
Marianne will be 29 as she watches the Y2K Olympics. If you got past the frivolity of the question, you could determine that Mary-Anne (born 1958) was 26 in 1984, 39 in 1997, 41 in 1991 and 42 in 2000. Again from the information in the question, Marianne was born 1971, she was 13 in 1984, 26 in 1997, making her 29 in 2000.

All too true, Robert. As I recall, the October story told of the demise of a well designed and properly constructed stereo amplifier. Then there was a story once about errors in the silk-screening on a PCB which led to the ruin of every electro in the set! It seems that the poor old electro’s bad press comes not only from it’s own characteristic faults, but also from faults imposed on it through careless manufacture. It doesn’t alter the fact that electro’s are the cause of more trouble than we can shake a stick at.

Thanks for that story Robert. As I’ve said before, it’s good to hear about products other than TVs and videos. And that’s it for this month. I’ll be back next month with more stories from your bench, or mine.
Valve sound and *rat routers*

Electronic hobbyists are generally a pretty strange mob – some will be hell-bent on proving microprocessors can do everything; others will say bring back valves and let’s hear some serious sound quality.

I lean more to the latter group (for which I make no apologies) and one software tool I have found to be a real hit is the ToneStack Simulator [www.duncanamps.com/tsc/index.html](http://www.duncanamps.com/tsc/index.html). For those who don’t know the lingo, a ‘tone stack’ is a passive tone control circuit that often incorporates bass, mid-range and treble controls as found in vintage guitars and amps.

This excellent piece of software allows you to change the values of components in a number of common tone stacks and actually shows you the frequency response as you move the controls. It runs on Windows 95 and a 486 computer.

**IF YOU’RE LOOKING** for more pages of circuits to add to your growing stockpile, there’s more over at 4QD [www.4qd.co.uk/ects/index.html](http://www.4qd.co.uk/ects/index.html).

While the author retains copyright, there are plenty of interesting circuits here.

**THERE’S NOTHING** quite like designing your own circuits but unfortunately, without the right component specifications, it can be a real nightmare. In the old days, it meant keeping a book-shelf full of databooks from various manufacturers, which often took ages to look through to find exactly what you were after.

For better or worse, much of that information is now available on the Internet but rather than having to remember the web addresses for each individual manufacturer, you can now head over to Semiconductor Datasheets on the Web ([http://www.bgs.nu/sdw/](http://www.bgs.nu/sdw/)) and find the manufacturer of your choice.

That may not always help if you’re after the maximum collector current for a BC549 transistor but it’s a great place to start. Has lots of weird and wonderful makers but also the big names such as SGS-Thomson, Motorola and National Semiconductor. Another one for the favourites folder.

**LOOKING FOR MORE** theory to delve into? Why not try the University of Washington’s Electrical Engineering site. Not only does it have a few circuits for you to try, it also has some lecture notes online, including the theory behind magnetic recording and high-definition television. Point your browser to [http://www.ee.washington.edu/circuit_archive/index.html](http://www.ee.washington.edu/circuit_archive/index.html) for all the details.

**NOW STRAIGHT FROM** our ‘it could only happen in America’ file, if a week doesn’t go by without your dose of The X files, you need to take a trip down the twilight zone at Information Unlimited [www.amazing1.com](http://www.amazing1.com).

This place is full of eccentric electronics gadgets from the Rid-A-Way Rat Router to the 300,000-volt Sizzler stun gun. These guys are perfectly serious and while there’s not much here by way of seriously useful stuff, it’s always good to have a bit of a giggle now and then.

**I DON’T NORMALLY** give plugs to companies here but Rocky Electronics is a Melbourne-based operation that offer monthly specials that will make your mouth water... Well, if you call NE5532 op-amps for 30c each mouth-watering, head over to [www.rocom.com.au](http://www.rocom.com.au). They have an on-line catalog and mail order so if your needs aren’t being met by the big boys, why not give this mob a go?
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