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September 2001 : No. 165
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ELECTRONICS and BEYOND

September 2001

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The Past, Present and Future of Electronics

The Electronics and Beyond Team

Jonathan Aldred BSc(Hons) – News and Features Editor

I was born in Wirral, Merseyside, and moved to Aberystwyth in 1993 to read Geography. My interests include current events, new and emerging technologies, and the history and applications of the Periodic Table. My hobbies are creative writing, science fiction in all its aspects, computer art and listening to music. I am also a big fan of Formula 1 and Formula 3000 motor racing.

You can contact me at jaldred@kanda.com.

Anna Penar – Media Sales Manager

I was born in a mountain area in Lower Silesia in Poland in February 1975. I studied Law in three countries: Poland, Germany and United Kingdom.

I have two law degrees and study at the moment a part-time MBA at the University of Wales (Aberystwyth).

I often worked for international organisations like Red Cross in Poland, Konvoi 96 in Germany, but have work experience in administration (magistrate court and Internal and Foreign Ministry in Poland) and business as well (DEBET consulting and accounting company in Wroclaw, Kanda Systems).

One of my passions are foreign languages (Polish, Russian, German, English, Spanish and Italian), Contact: apenar@kanda.com.

Natasha Nagaoka – Publishing Manager

I was born in Aberystwyth, brought up on a welsh hill farm and then studied Politics at Leicester, then a year in Bilbao, Spain as a TEFL Teacher .

I did an MBA and moved to Tokyo, where I worked for two diverse Japanese companies, studied on a Scholarship scheme at Keio University.

I relocated to the UK after 9 years in Tokyo, and joined Kanda in October 2000 as Marketing Manager, and am now in charge of Electronics and Beyond.

I enjoy horse-riding, oriental arts and learning new skills, I speak fluent Japanese and some Spanish.

I can be contacted on 01970 621030 , via Fax on 01970 621040 , email to nnagaoka@electronicsandbeyond.com and welcome any feedback on the contents of the magazine.

Paula Matthews – Subscriptions Manager

I was born in Sutton Coldfield and have a BTEC in Business and Finance.

I worked as a special constable for 4 years in Aberystwyth and then joined Kanda Systems in 1997 as a receptionist and later on as an accounts assistant and customer service co-ordinator.

In my spare time, I enjoy films, reading and dining out and try to do some sport in between.

As Your Subscriptions manager, I handle all day to day queries on Electronics and Beyond, update all customer information and you can ring the Electronics and Beyond Hotline on 01970 621039 which is open between 9 and 5.30pm on weekdays for assistance.

I look forward to talking to you and helping you with any questions you have as a subscriber to Electronics and Beyond.

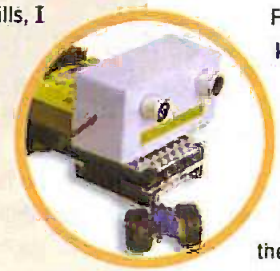
Autumn or Fall is in the air...

As the air cools down, we at Electronics and Beyond bring you a new Electronic DIY section aptly named Constructor's Corner where you can actually purchase kits that may be of interest to you to build. We are lucky to have formed a partnership with Quasar Electronics Ltd who are backed by years of experience in the electronic kit market and if there are any particular kits you would like to see please tell us as this innovative corner is designed to increase the practical application of electronics for everyone.

In Projects To Make, we feature the mains switching timer from David Ponting who shows you how to make a homemade version when commercial ones don't come up to expectations. Ray Marston introduces the 'OPTO' in Optoelectronics in part 1 of a 4-part series by filling in the information gap on all facets of optical parts which many readers may not be familiar with.

Are you for or against the euro?

See the light-hearted read on the Euro in Peter Brunning's diary and tell us your views on whether we should sacrifice the pound for the convenience of the euro. For those of you who may feel like investing in a dot.com company, why not take some advice from Gregg Grant in Ideas into Profit and actually pause and take a moment to weigh up the cons rather than the pros of putting money into trendy and risky dot.com set-ups. In copyright & IP, our in-house news editor looks at the issues surrounding copyright and intellectual property ownership by exposing the pitfalls that lie in wait for employers and employees who are not aware of them.



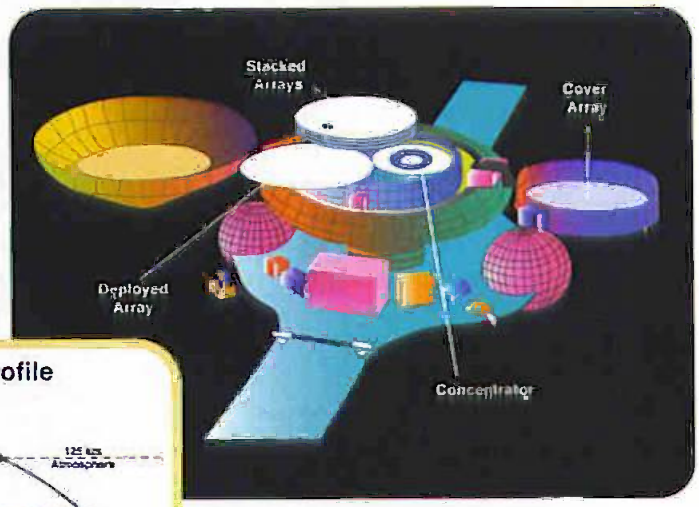
From Germany, in purple we have an article from a well known engineer, Jens Altenburg on Willi robot, which gives us a down to earth perspective on this fascinating area of electronics. Turn to the green pages as CAT puts theory into practise with the CAT Solar Controller project. In our red section, we take a look at Squeezed molecules in the light of recent research and how they affect life today plus the finale of the series on UPS where Shri Karve looks at ensuring a healthy power supply by using the correct pulse rate.

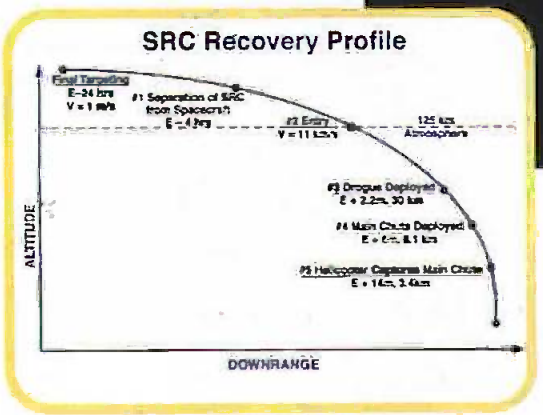
If you are taking a break this Autumn and can't bear to put your cats in the cattery then the Cat Feeder Project will certainly provide the ideal solution to stave off the threat of hungry cats at home ...!

We, at Electronics and Beyond welcome your comments and ideas on this autumnal issue.

Above: LMA technicians install radiation shielding on the spacecraft

NASA's Genesis mission sets out to collect a piece of the sun





Above: Artist's conception of Genesis in full operational mode Left: Event graph showing the recovery of the Genesis return capsule

If all has gone well, NASA's Genesis robotic space explorer will now be on its way to the Sun, where it will go into orbit for three years and collect 10 to 20 micrograms of solar wind (invisible charged particles expelled by the Sun). Genesis will be the first mission to return a sample of extraterrestrial material collected beyond the orbit of the Moon. It is the hope and expectation of all involved that what it returns will help answer fundamental questions about the exact composition of our star and the birth of our solar system.

In October 2001, Genesis will arrive at an area in space far enough away from the atmosphere and magnetic field of the Earth to allow it to gather pristine samples of the solar wind. On board the craft will be a stack of solar wind collector arrays made of such materials as diamond, gold, silicon and sapphire – different materials for different types (or conditions) of solar wind. An ion concentrator will separate out and focus elements in the solar wind (like oxygen and nitrogen) into a special collector tile, and there will also be an ion monitor to record the speed, density, temperature and approximate composition of the solar wind.

The spacecraft will begin its journey back to Earth in April 2004. When it arrives in October, it will drop a return capsule containing the solar samples, and this will parachute down towards the U.S. Air Force's Testing and Training Range in Utah. Friction will initially slow the capsule, followed by deployment of two parachutes – a small drogue chute then a larger main parachute. A dramatic mid-air capture manoeuvre will then take place. A specially modified helicopter with a boom and

NEWS bytes

Maplin goes under the hammer for £42 million

It's been a long time since you've seen the Maplin logo in Electronics And Beyond. The magazine and the company parted ways almost a year ago, when Kanda Systems bought it outright. Now Maplin themselves have been bought by independent equity investor Graphite Capital. The £42 million deal will see more funds put into expanding its retail outlets.

The company does not have any comparable competition in the UK and

winch underneath will snag the chute and collapse it, allowing the capsule to be retrieved safely, in a manoeuvre that has already been practised for real and no doubt will be practised to perfection as 2004 approaches. This mid-air capture is necessary to ensure the purity of the solar wind samples inside – any contamination through coming into contact with Earth's materials would be disastrous.

The samples will be taken to NASA's Johnson Space Centre in Houston, where they will be stored and distributed for analysis. Scientists anticipate that in addition to today's capabilities, new analytical techniques developed in future decades will be used in the study of the solar matter returned by Genesis. Researchers believe that the surface of the Sun has preserved the composition of the solar nebula from which all the different planetary bodies formed. Study of Genesis' samples is expected to yield the average chemical composition of the solar system to greater accuracy and provide clues to the evolutionary process that has led to the incredible diversity of environments in our solar system.

Above: Helicopter successfully snags capsule's parafoil (photo from preliminary test run)

For in-depth information about the Genesis mission go to http://genesismission.jpl.nasa.gov, where you can also learn more about the science of the project and read interviews with the people involved.

Meet Troody the robotic dinosaur

This is a photograph of Troody the robotic dinosaur (or perhaps that should be robotic baby dinosaur, as Troody is only 18 inches high). Developed by the Leg Laboratory, part of the AI Lab at the Massachusetts Institute of Technology, Troody is based upon the Troodon dinosaur of the late Cretaceous. She has onboard computers and batteries, and can operate without external wires – all she needs is command signals from an IR transmitter unit.

This particular species was chosen as a model because of its agility and the way in which it used its tail for balance. Troody's successor will be 50% bigger and designed with a museum environment in mind. He or she (the sex of her successor has not been decided as of yet – the team have decided not to spoil the surprise by going for an ultrasound) will also be designed to jog and maybe even run. If so, it will be the first bipedal robot in the world to be able to walk and run without toppling over when it slows down or comes to full stop.

Pioneering electronic ink display to go colour by 2004

E Ink's high contrast electronic ink display has already received a lot of print space in various electronics and computer magazines. Now E Ink have teamed up with Toppan Printing Company Ltd, a global market share leader for colour filter arrays in the flat panel display industry, to produce a colour version that will be sold commercially by the year 2004.

NEWS bytes

has seen its turnover rise from £32m in 1996 to £52m last year. According to Maplin, the extra capital is essential for making sure that they continue to grow at the same rate.

There are currently 59 Maplin stores in the UK and they plan on there being at least 100 by 2006. The money will also help with the ongoing development of their e-commerce operation.

Average director is 51 and earns £54,000

A study by Plimsoll Publishing has looked into the job statistics of 1,283 UK electronics design industry directors and found that the average director was 51, had been in the same post since the age of 45, and earns £54,000 per year. 35% of the directors had been in the same role for over ten years, and 10% have changed jobs, companies or both within the last year.

Robotic aircraft to investigate hurricanes for NASA

Aerosonde Robotic Aircraft Ltd are the designers and manufacturers of a remarkable robotic plane that weighs just 13.5 kilograms and can fly over 2,400 km on a tank containing four litres of fuel.

The Aerosonde has long-range environmental monitoring and surveillance

NEWS bytes

capabilities and is designed for undertaking observations in remote and otherwise inaccessible regions. Launched from the roof of a car, the robotic plane is fully autonomous once in the air. Its missions are conducted in a completely robotic mode, with the aircraft under the command of a ground controller who monitors the mission.

The company has tested in Australia, Canada and the USA. Their most recent mission was to the Arctic, where the company has been testing Aerosondes in conjunction with the US National Science Foundation. The aim of the mission was to develop engines, icing strategies and a camera to enable the Aerosonde to fly in the harsh Arctic weather and collect information on the atmospheric and sea ice conditions.

This May, NASA awarded the company a million dollar contract to conduct missions and research on clouds and hurricanes off the USA's East Coast as part of the NASA Cloud and Moisture Experiment program. In partnership with the University of Colorado, Aerosonde will operate aircraft over the North Atlantic Ocean taking observations in the lower atmosphere in conjunction with the NASA DC-8 aircraft, the US Air Force's C130s, and the National Oceanic and Atmospheric Administration's P3s.

You can read articles about the Aerosonde, download numerous pictures and keep up to date with all the latest testing programs by logging on to the Internet and typing in www.aerosonde.com.

Toppan have also bought a $5 million stake in E Ink and will also work with the company on other projects such as flexible display panels.

Like the monochrome version also in development, the colour electronic ink displays will exceed the contrast ratio of newspapers and will be readable in both dim light and full sunlight. Like paper, it will present a clear, bright image that can be seen at any angle without any change in colour or contrast. The image will remain on the screen even after the power source is shut off, which means that the battery life will be dramatically longer. Also, the display should draw less than a tenth of other 'low-power' display technologies commonly used in smart handheld devices. The smaller batteries this would lead to would mean lighter, more portable and less expensive devices when the technology is licensed out to third party developers.

E Ink expects the first monochrome high-resolution electronic ink displays to be made commercially available in 2003, with the colour versions following a year later in 2004. www.eink.com for details.

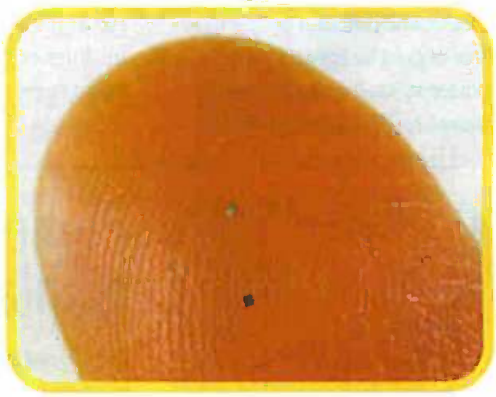
New Polysilicon LCD display from Kent Modular Electronics

Kent Modular Electronics (www.kme.co.uk) have launched a new colour LCD (TFT) monitor utilising Toshiba's Polysilicon (p-Si) technology. The 29LM081D41MP allows up to three signal sources to be connected simultaneously, and switched between from the front of the monitor. These are RGB data (VGA or SVGA), PAL/NTSC video (from a camera source) and S-VHS (from a video recorder). Options exist for a fourth source: 525/60 or 625/50 component digital TV signals (SDI) compatible with SMPTE protocol operating at 270Mb/Sec.

The analogue-digital board at the heart of the display has been designed by KME at their facility in Rochester, Kent. It has autoscanning/autosizing capabilities, converting the analogue inputs to perfectly scaled pixels on the Toshiba screen. Th p-Si construction of the TFT panel has distinct advantages over the Amorphous Silicon (AM-Si) construction of normal TFTs – namely better viewing angles and increased reliability under shock and vibration. The components are housed in a rugged all-metal housing and the result is a solid, multi-purpose monitor suitable for mobile and land-based applications in a variety of extreme environments.

KME has also developed versions for CRT monitor replacement. The so-called 'Legacy' monitors, in 9" or 10" sizes may have horizontal scanning frequencies anywhere between 15 and 30kHz, which are not readily accepted by standard TFT monitors. As they become harder to replace, many users are converting their designs to TFT, and KME believe their 8.4" monitor (see photograph) is ideally suited for this problem, scaling the lower resolutions into a full-screen, crisp display.

Hitachi produce chip thin enough to be embedded in paper



This is a photograph of the world's smallest RFID (Radio-Frequency Identification) integrated circuit chip – the Meu chip by Hitachi. Thin enough to be embedded in paper, the device raises a whole plethora of possibilities for document management, security and access.

The chip integrates a 2.45GHz high-frequency analogue circuit and a 128-bit ROM in an area of 0.4mm square silicon. According to the company, it will enable electronic information on networks and information on paper to be linked anywhere and anytime with assurance, thus making new services possible.

The implications of being able to embed RFID ICs in paper are wide ranging indeed, and no doubt we can expect much discussion on the topic as the technology develops and applications for it start to become more and more commercially likely.

COMPONENT NEWS

Piccolo Point from InControl Solutions

Available in the UK from Diamond Electronics, the Piccolo Point MiniJoydisk is a tiny joystick aimed at wireless and handheld products. InControl claim it to be the smallest manual input device in the world, and it has a low profile measuring less than 4mm, and a footprint of 14 by 18" including the connector.

The device has two parts – the sensor and the disk actuator. The sensor consists of a small-printed circuit board that easily connects to the system, and the touch-sensitive cursor controller allows the ability to scroll and point with the use of a fingertip.

InControl CEO, Chris Haverty, says 'Everyone is talking about wireless, getting the Internet on their cell phones, megabyte access, WAP, 3G services, Bluetooth, etc. But people can't use buttons to do everything they'd like to now with their handheld devices'. Which is where the Piccolo Point comes in, be it for cell phones, handheld computers, PDAs, TV remote controls or computer console gamepads. 'It's inevitable that we'll see force-sensing technology become more and more prevalent in products with demanding space constraints as displays increase in size and resolution, and wireless Internet access becomes faster'.

Diamond Electronics can be contacted at Fourways Technology Park, London Road, Smallwood, Near Sandbach, Cheshire, UK, or phone them on +44 (0)1477 500 450.

Maha MH-C777Plus from Nevada Sales

Nevada Sales (02392 313090, www.nevada.co.uk) have announced their appointment as UK distributors of Maha Chargers and Powerex batteries from the USA. The first products to be released are:

FNB-72 (£59.95 including 'rapid charging cable') – An ultra high capacity 1700 mAh battery pack for the new Yaesu FT817. The 'rapid charging cable' will allow the battery pack to charge in around 3 hours using the Maha MH-C777 or MH-C888 charger.

MAHA MH-C777 (£49.95) - A charger that will charge, condition, analyse, and digitally display capacity, voltage, and time for almost any Lithium Ion, NiMH, and NiCD battery packs. It has comprehensive LCD readouts for capacity, Voltage and time. The unit will also work direct from a car cigarette lighter socket.

MAHA MH-C777PLUS (£89.95) – The 'Plus' version of the MAHA MH-C777 (pictured) is supplied with a universal 80V to 240V AC adapter to allow use anywhere in the world.

The MH-C777PLUS has a digital display to indicate voltage, time, and capacity throughout the charge and discharge processes. A 'floating contact pin' system enables you to move the charging contacts from left to right and from top to bottom to charge almost any shape of battery pack. It supports a wide voltage range of 1.2V to 14.4V (1 to 12 cells) for NiMH & NiCD, and 3.6V to 14.4V (1 to 4 cells) for Lithium Ion. Additionally, the included 'alligator clip-lead cable' will allow you to connect the charging terminals to external batteries, including battery cases which can then be used to charge AA, AAA, C and D battery cells.

MICRF102 from Micrel

An integrated, single-chip ASK (Amplitude Shift Keyed) RF transmitter designed specifically to meet the needs of low-cost loop antenna transmitters is now available from distributors of Micrel Semiconductor products.

Highly integrated in SOIC-8 packaging, the MICRF102 requires only five external components. It incorporates transmit power control and automatic antenna tuning.

The MICRF102 operates off a 5V supply, consumes 7.5mA (mark) and 4mA (space) supply current and has a shutdown pin to further conserve power.

To overcome the problem of a user's hand in proximity to the antenna modifying the resonant properties of the antenna circuit and de-tuning it, the chip continually tunes itself to the antenna; if the resonant properties change, the MICRF102 automatically adapts.

NEWS bytes

New platform from Amkor decreases test times for RF components

A new platform for radio frequency devices that is capable of dramatically reducing test times for RF components, some as much as 80%, has been developed by Amkor Technology.

The platform consists of proprietary software that optimises standard industry instrumentation systems for faster results. RF testing for dual band power amplifiers (PA) on a typical ATE tester, for example, can take as long as 1.8 seconds. PAs can be tested on Amkor's new test platform in as fast as 470 milliseconds (ms). Low noise amplifiers (LNA), which normally take up to 1.3 seconds to test on typical ATE testers, can be tested as fast as 170 ms. In addition to testing LNAs and PAs, this new test platform is also designed for high volume testing of mixers, RF switches, phase locked loops and voltage controlled oscillators.

Amkor Technology (www.amkor.com) provides a full range of test development and high volume production services across virtually all semiconductor technologies and has test development centres in California, Korea, Japan and the Philippines, with further expansion already going on in China and Taiwan.

© & IP

(Copyright and Intellectual Property)

...and what you really didn't know you should know about it.

by Jonathan Aldred

JONATHAN ALDRED OUTLINES THE BASIC INFORMATION THAT ALL EMPLOYEES AND ESPECIALLY EMPLOYERS SHOULD KNOW ABOUT THE ISSUES SURROUNDING COPYRIGHT AND INTELLECTUAL PROPERTY. WHEN AN EMPLOYEE USES HIS OR HER CREATIVE TALENTS ON BEHALF OF A COMPANY, WHO OWNS THE RIGHTS TO WHATEVER IS PRODUCED? THE ANSWER IS NOT ALWAYS AS CLEAR CUT AS YOU'D THINK.

As someone who writes both for a living and as a hobby, I need to know about copyright laws and the issues surrounding intellectual property – but do you? You may think you don't; but if you own a business or work for one, there is a very real possibility that through not knowing about © or IP rights, either you or your business will lose out.

Firstly, let us briefly set out what IP and copyright are. My hobby is writing novels and short stories within that genre that is often referred to as 'science fiction and fantasy' (a nice heading as it covers both spacecraft and magic – two things that you'd assume to be mutually incompatible). When I joined the E&B team I was asked to put one of my short stories in to see what the reaction would be. I was pleased to do so, and I added at the bottom the standard IP notice that I automatically attach to anything I write (excluding, of course, features such as Web Electronics, Beyond Belief, etc that I put together for E&B).

I do hold the IP rights to 'The Factory'. I also own the copyright. If, however, I had sold the story to E&B, they would hold the copyright and would be able to sell the story on to someone else (essentially they would, depending on the terms of the sale, be able to use it as they see fit). E&B has 'one-time publishing rights', meaning that anyone who contributes an article remains in possession of the rights to it. We can sell the article as part of the magazine, or photocopy that printed article as part of our back-articles service, but we do not have any rights to sell it on (to, for example, another magazine). If someone other than the author has bought the full rights to a story (or song, or film, etc), then they can licence it as they see fit – but, as they do not own the IP rights, they cannot remove the author's name from it or alter it any more than what basic unobtrusive editing would allow.

Sometimes rights are bought outright; other times an author will get a percentage based on sales of copy (for example number of books sold) or a repeat fee based on the number of publications the same article is licensed to appear in (as was the case with Uri Geller's Extended Reality). It is essential that any author who sells the rights to his or her work thinks through the terms of the sale thoroughly before agreeing to any contract – pity the poor author who agrees a lump sum for outright sale of his book and then finds it is to be turned into a film and he is not going to see a penny.

'The Factory' is now in print and, as such, it is copyrighted. I did not need to do anything for this to be the case – I can now prove this is my work and can exert my right not to have anyone copy it. It did, after all, appear in the June 2001 issue of Electronics And Beyond, otherwise known as 'Exhibit A' when I take whoever has stolen my material to court and sue them. Sending unpublished work to literary agents or publishers is a different matter. What if they are careless with your manuscript and it falls into the hands of someone who will copy it and try and pass it off as his own? If this happens you have to prove that you wrote it and not them – before sending your manuscript off, you should ask yourself 'would I be able to do this?' My recommendation is to send a full copy of the manuscript through the post to your own address before you send any others off. It will then be sealed and will show your own address and when you posted it. Then

leave the package in the care of your solicitor or a trusted family friend. Remember that putting an IP notice is a good statement of your rights – people who have read the document cannot claim they did not know you didn't want them to copy it – but it is not an automatic barrier against fraud. As an analogy, burglar alarms will not stop burglaries 100% of the time, but you'd never go without one just because of this.

So – copyright can be demonstrated easily, although it might be owned by someone other than the author; and IP is always owned by the author, but is more difficult to prove.

Actually, IP is not necessarily always owned by the individual who created it (or individuals – the legal difference between one and more than one author is not something we need to go into here). So why sound so sure about it in the statement above? Well, the trouble lies in the definition of the word 'author'. If you write an article or design some advertising on behalf of your company, then your company is usually considered to be 'the author' of that article or advertisement. You can claim credit for it on your CV but if you leave the company you do not take the rights to it with you. If you work for a company and develop an idea as part of your job, then in most cases the employer will own the IP to that idea. IP covers articles, reports, design rights, software, hardware, patents and trade marks.

If I designed a new database for Kanda Systems, our parent company, and then tried to sell it elsewhere, I would be in the wrong because they would own the rights to it – reason being, I developed it in my capacity as an employee of the company. If I wrote an article on the importance of C compilers and the role of the compiler's pre-processor, surely that article would belong to me – or would it? Under copyright law, computer programming code is considered to be a form of literary work, just the same as the C compiler article. But the perception of where the IP ownership lies can be very different for any two differing examples.

Kanda might use the C compiler article as part of, for example, the press release for their new Optama C Compiler. They might then decide to sell it to, for example, Personal Computer World. Under this scenario it is possible that I would not have any say in this and would not get any money from the deal. It might not necessarily be the case that Kanda takes the money and holds on to it – they might give the article to PCW in exchange for advertising. Another possibility is that I could sell the article to PCW and Kanda would come down on me for selling what they consider to be their material.

Solicitors have been doing good business from borderline cases where employees have argued that creation of IP was not what they were employed to do, and that as such it belongs to them. All this could so easily be sorted out from the start when employment contracts are drawn up, or by employers telling their staff exactly what their duties are and what is and is not expected of them.

But it doesn't stop there. Nowadays it is common for companies to 'outsource' work to contractors when the job cannot be done by in-house staff alone. These companies might be IT consultants, web page designers, logo creators – whatever. Would it surprise you to learn that the agency who designed your new logo or the designers who created your web presence own by default the copyright themselves? Well, if you haven't explicitly sorted all this out in the contract, here's a wake up call for you – they do. Ownership should always be settled at the start of any such commission because after the contracts are signed and the fees are paid it is far less likely that any rights will be handed over. You will be left with, at best, a licence to use the IP rights resulting from the work and you may be powerless to prevent a competitor from also receiving a licence. In effect, you could end up with a situation where your competitor has a web page that looks exactly like yours, or an online ordering system virtually indistinguishable from yours. If they are a bigger company, it could appear to your customers that you have been copying them, when in fact neither company has copied anything.

Coming back to the issue of copyright, it is important to remember that copyright is only a right to stop anyone else from copying your IP. It is no judgement of quality and is certainly not a monopoly for you to exact over ideas or concepts. Copyright is not a patent – it only protects the expression of an idea and not the idea itself. If someone has come up with the same idea independently, or come to the same conclusion without copying your work, then there is no infringement upon your copyright as far as the law is concerned.

To conclude, if your business is dependant upon anything that you don't actually own – be it a delivery company, the premises you lease or the database an IT firm has developed for you, then you are leaving the doors open to a risk that, nevertheless, you cannot avoid taking. Business is, of course, all about risk – but every good businessman and businesswoman knows what the risks are and takes steps to manage them. A little bit of forethought can save a lot of turbulence in the long run.

Artwork by Jonathan Bethell-Aldred.
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Peter Brunning's Public Diary

To Euro or Not

THE END OF JUNE BEGINNING OF JULY IS HOLIDAY TIME AT BRUNNING SOFTWARE. ON THE 24TH JUNE PETER BRUNNING PACKED HIS TENT AND TINY SHARP 3100 PC, GOT ON HIS BICYCLE AND TRAVELLED HALF WAY ACROSS EUROPE THINKING ABOUT MONEY!

Monday 2nd July 2001.

I'm sitting writing this with snow covered mountains to my left and straight ahead. It's 9.30 in the morning. I am recovering from a hard day of cycling yesterday where I reached 8230 feet above sea level. My mind is clear telling me that my body is in great shape but when I put my legs to the test they tell me otherwise. So today is to be a rest day doing nothing more than sitting and typing.

My conversation last night just before I fell into bed sums up what I want to write about. The subject of languages cropped up while talking to a chap from Belgiun. This overnight stop is in the Tirol part of Italy where German is spoken almost as naturally as Italian, and there I was speaking English to a Belgiun man. This Gasthof has the outside appearance of being in Austria and payment in German marks is as acceptable as lira. 'So' I said to this Belgiun man 'what do you think about a common currency, the Euro'.

'It is good' he said 'but it is you British who are causing the problems'.

'Yes' I agreed 'but remember how this all started. We were in the ERM, the pound came under pressure and the other european currencies did not come to our aid. The pound was allowed to collapse. The whole point of the ERM was that we should support each others currencies so that currency speculation could not succeed'. He had no answer so I continued 'I am in favour of a common currency but I want to keep the pound! How do you reconcile that?'

He gave a short synical laugh 'That is difficult' he said.

This Gasthof makes an ideal place to reflect on these problems as does my cycling holiday. Gasthof Schlossberg is high up in the foot hills of the Alps, overlooking St Leonhart, a small town situated where the Timmelsjoch and Yaufen passes converge. Although well inside the Italian border its German name clearly shows its Austrian influence.

Travel by bicycle (with the help of an occasional train ride) is the best way to become involved in the places which are visited. I am English through and through but there is little outward signs of my British connection apart from my rather too fair complexion for being this far south. I never have found problems with any country that I have visited (Europe). I am always accepted for what I am, a holiday making cyclist who might be tarnished with the grime of a day's cycling, but is neither the less of obviously pleasant character. My one problem is needing so many different currencies. Dutch guilders to pay for the cycle on the train through holland, German marks for a few day's in Germany, Austrian shillings, Italian lira, and French francs.

Curve 10. Me & cycle 2442 meters (8011 feet) above sea level.

So far this year I have paid the Dutch conductress in German marks and received the change in Dutch guilders. I have used my plastic to extract German marks when I reached Germany, changed some Irish pounds left over from a previous holiday into Austrian shillings, and used the cash machine yesterday in Italy.

The point is this. The language and customs of each country that I visit is what creates the interest. The fact that I am using a different currency for each pays absolutely no part in the interest. Quite simply this means that for me personally a common currency would be a distinct advantage. However, ask me if I want to give up the pound and that is a completely different problem. I do not like the fundamentals of my life to be changed. In this Gasthof I can pay in lira or German marks without them batting an eyelid either way, but when I am home all my monies are in pounds.

I stopped and looked around at the peaceful mountain scenery for inspiration. A minute or two passed without any cars on the pass 20 meters (20 yards if you must) in front of me. A moment of total peace without any solutions springing to mind. This is because there is no magic solution. The answer can only be found in a compromise, and that is what the Euro is all about. Think of the Germans giving up the mark, the French giving up the franc, the Italians giving up the lira, Need I go on. None of these countries want to give up their own currency.

It is the languages and the customs which create the differences, a common currency can only be in all our interests.

So the argument changes to how can we ensure that our British culture survives, not one of how to keep the pound. We could so easily keep the pound while losing our true British way of life.

Here in this corner of Italy they are happy to be Germanic. The scenery is much the same as Austria and so is the way of life. It is the terrain of the land which has the greatest influence, although obviously the history of ownership is also important. A change of currency would make no difference to the way of life here.

We the British have a culture which changes dramatically from one corner of our island to the next (just as in Italy). But our culture is based on a certain amount of isolation because we are an island nation. The coast nearest to France has no increased French influence, just as there is no increased Dutch influence on our south east coast. However just like Italy our culture has been created to a degree by the various invading forces over the years. There is no such person as a real Englishman, Welshman or Scotsman. We are all mixtures of many races.

We the British though do have one very strong feature to our culture (or maybe I should say did have), we are a Kingdom. Other counties in Europe do also claim this attribute but in reality their royalty has little significance.

I have set the scene for the crunch. Our island outlook makes giving up the pound seem such a dreadful possibility that we need to look to a way to offset the effects. We need at the same time to strengthen our underlying sense of national identity. When Charles and

Diana were predominant in our lives our being a true Kingdom was the envy of all nations. Now following the dreadful sequence of events our royal family is at its lowest esteem ever and the fact that we are a Kingdom is of very little significance. I believe that if Charles becomes King our identity as a Kingdom will fall to zero. At one time Charles had everything going for him. He was married to the idol of the whole world, what more could any future modern King want? But somehow his upbringing had failed. His tutors did not succeed in educating him with the values that a modern King absolutely MUST have. In olden times a King might choose to take every virgin just before her wedding night. The world has moved on from those barbaric times. A modern King must display all the virtues of a perfect husband. He must be faithful, allow his wife freedom of speech and movement, and he must be seen to be an ideal father to his children.

Charles started out correctly and then somehow allowed himself to be side tracked. Why he did is not important. Even if he could prove that it was totally Diana's fault (which I very much doubt), Charles supposedly had been bought up to be our future King, it was his responsibility to ensure that the monarchy was not compromised in any way. He bears the responsibility for the outcome, no one else.

Charles and Diana have created the person who can set our national identity back on course. William has the good qualities of both Charles and Diana. He must preserve himself for a truly delightful virgin queen to be, and Charles must step aside so that William and his bride (as yet unknown) can give us back what we lost when Charles and Diana parted. If Charles publicly states his intention to step aside for William then giving up the pound for the Euro will be of no significance.

Thursday 5th July 2001

The scenery has changed dramatically, I'm now well on the way to the mediterranean. It is so hot when the sun is at its height that I've stopped for an hour or two over a pint (half a litre in these parts) and a coffee (caporchinee). The coffee has taken away the effects of the beer and I feel active again although venturing out into the sun does not quite have the same appeal as it did back in England. I digress, this is supposed to be my final reflection on the whether we should be committed to the Euro or more to the point whether we should give up the pound. The answer is quite simple now that I've had a few days of reflection. Yes, there is no doubt in my mind we absolutely must join in the true spirit of Europe, we must become part of the single currency.

I've been thinking about this as I've cycled. Quite simply I can think of no good reasons for not joining. Much as we might like to think we have a pound which can be controlled by our own government without any concern for the wider aspects of currency regulations, that is not true if we are to have significant trade with other countries. If our currency is not stable then our credibility as a major trading nation is undermined. We cannot behave as if we are alone in this world AND expect to be

In the Oetz Valley Austria

respected in the commercial world. Quite simply we have no choice but to control our inflation and keep our pound stable. So we have nothing to loose and everything to gain except, we do eventually give up the pound. As I've said in theory I am against that except that the alternative is even less acceptable to me. I'm now on my fourth currency this holiday if we ignore the starting point (pounds), and I am now offering a handful of coins when the amount is small. It takes me too long to count out lira and I do not want to be taking home half a tonne of small coins.

Where I am sitting the pounds in my wallet have no value, neither do the German marks or Austrian shillings. Only the lira have spending power unless I visit the local bank and pay to have the other currencies converted into lira. Back home it actually makes no difference which currency my business trades in. Foreign orders are always paid by bankers order in my chosen currency or by Visa or Mastercard where the originating currency is not important.

It's 4 o'clock and the heat of the Italian sun (same as our's but higher up) is more acceptable. Time to get my legs moving. Tomorrow I will reach the Mediterranean. Yes, let's go for it, this Europe that unfolds before me bit by bit every day is fantastic let's keep Britain as a major part, let's keep up the front and be in with the controlling influences. Europe here we come.

Monday 9th July 2001

Four days on and I'm 15 miles from the French border. I've not been hurrying. I'm in no rush to get home. For two and a half days I've been cycling along by the mediterranean. I have yet to feel the sea against my body, today is Monday and there is now free space to be seen on the beaches. I'm writing this as my last thoughts before leaving Italy. It is 6 years since I was last here. Italy has changed, it is a quieter tidier country but it has always been tolerant of English speaking visitors. I speak no Italian. Imagine an Italian visiting England speaking absolutely no English. It does not bear thinking about!

Wednesday 11th July 2001

I am seeing the snow covered Alps once again.... correction not the alps but the massif in central France and this time I'm viewing from 35000 feet in extremely clear conditions. It is just so easy to fly with a cycle compared to using the train. I'm looking directly down onto the massif with the odd blob of snow here and there. They look decidedly uninviting, grey and green, parched like desert.

My last night in France was spent in a typical airport hotel. Good value but rather clinical in its handling of the hundreds of one day visitors. I was given a shade of individual treatment by being a cyclist. Quite to my surprise the young lad on reception who booked me into the last available room suggested that I bring the cycle into the hotel....

A large lake below is just before a huge area of snowy peeks. This is incredibly rough terrain, which warrants a visit some time, though the way I feel after two weeks of battling along mountains routes the idea of cycling this way can be happily left.

I'll be landing in England in just over an hour and it will be time to start thinking again in pounds. I started by writing that I did not want to give up the pound but that is exactly what I have done for the past two and a half weeks. 746 miles cycled, 300 miles by train, 800 miles by air, physically tuned and mentally refreshed.

The SOLAR CONTROLLER

The Centre for Alternative Technology (CAT) is based in Machynlleth in mid-Wales and has been at the forefront of the alternative technology movement since its inception in 1975. Originally intended to be a statement in environmentally friendly living by a group of like-minded individuals looking to practice what they preached, CAT has grown into an internationally renowned centre for research into renewable energy systems, organic horticulture, alternative building methods and waste and water treatment systems. The centre offers consultancy in all its main areas of interest, runs a visitor's centre open to school and university groups and the general public, runs educational and leisure courses, has developed a travelling exhibition and collaborates with two universities on higher degrees. CAT also has its own list of publications to support the services offered by its free information service. The extract featured here is taken from one such title.

ELECTRONICS & BEYOND'S GREEN PAGES FOR SEPTEMBER FOLLOW UP ON THE JULY ISSUE'S SOLAR WATER HEATING ARTICLE WITH PLANS FOR A CONTROLLER YOU CAN BUILD AND FIT YOURSELF, DESIGNED TO SUIT SOLAR POWERED DOMESTIC HOT WATER SYSTEMS.

A solar water heating controller is a gadget used in conjunction with a solar water heating panel array to supply hot water to your taps. In the simplest systems, water circulates by itself. However, if you install a pump it means greater choice over where you position the panel, plus improved thermal efficiency. The controller is a simple thermostat that only switches on your pump to carry water from the heater when it's hot enough to be of use.

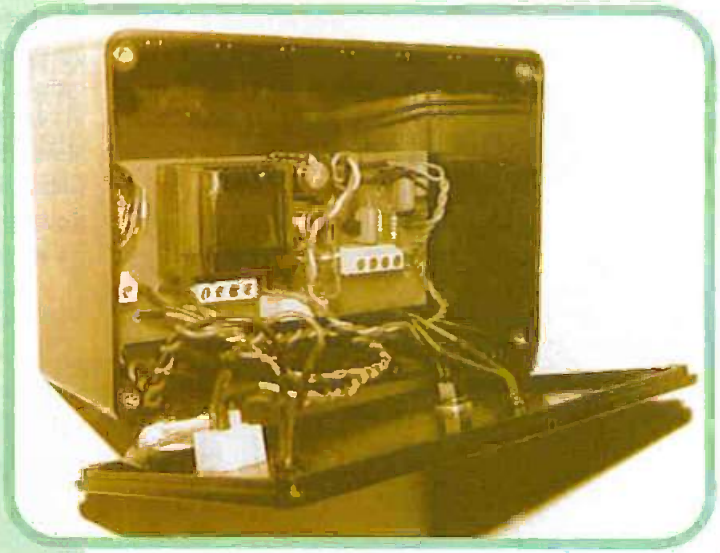


Figure 1. The completed box with the lid open demonstrating the circuit board and components

How to make and install a solar controller from standard electrical components.

This controller can be used for most solar heated water systems. Let's look first at how it works and then at making the control box, fitting the sensors, choosing the temperature difference, testing procedure, installation, and some additional technical detail.

How it works

Two sensors are mounted one on the hot water tank and one on the solar panel. They measure the difference in temperature between the two. When the panel is sufficiently hotter, they tell the controller automatically to switch on the pump. When the tank has heated up it will switch the pump off. There is also a manual override switch.

Building the control box

Most of the components are fitted on to a printed circuit board. This is shown in Figures 3 and 4. Figure 2 shows the circuit diagram. The board was designed to fit inside a plastic case measuring 150mm by 80mm by 50mm, although any reasonable size may be used; you could adapt something or build it out of wood. It should be possible to solder together and construct the controller, and put it in the case, with careful reference to the diagrams and photograph. However the following points are offered to avoid some of the mistakes that might occur.

Three rubber grommets are fitted to cable holes in the lid of the case, and the LEDs and switches are fitted in the lid. Take care to position these lid-mounted parts so that there's enough clearance space when the case is put together. When fitting the diodes and the capacitor C4, make sure that their polarity is correct and that the integrated circuit IC1 is the right way round. Similarly, when completing the interwiring between the components, pay careful attention to the polarity of the LEDs, to make sure they are connected the right way round.

Check the wiring of switch S1 since this will carry mains voltage. When the components of the board are all securely soldered in place, lower the board into the case you have made and connect a three core mains cable to the three way terminal block. The cable should be fitted with a 3 amp fused plug.

Installing the sensors.

First, make up the two sensor leads, one for the solar panel and one for the hot water tank. Use twin core 7/0.25mm cable. The type with one side marked with a coloured stripe or ribbing is ideal. At this stage each lead may be about 2 metres long. If necessary, extend

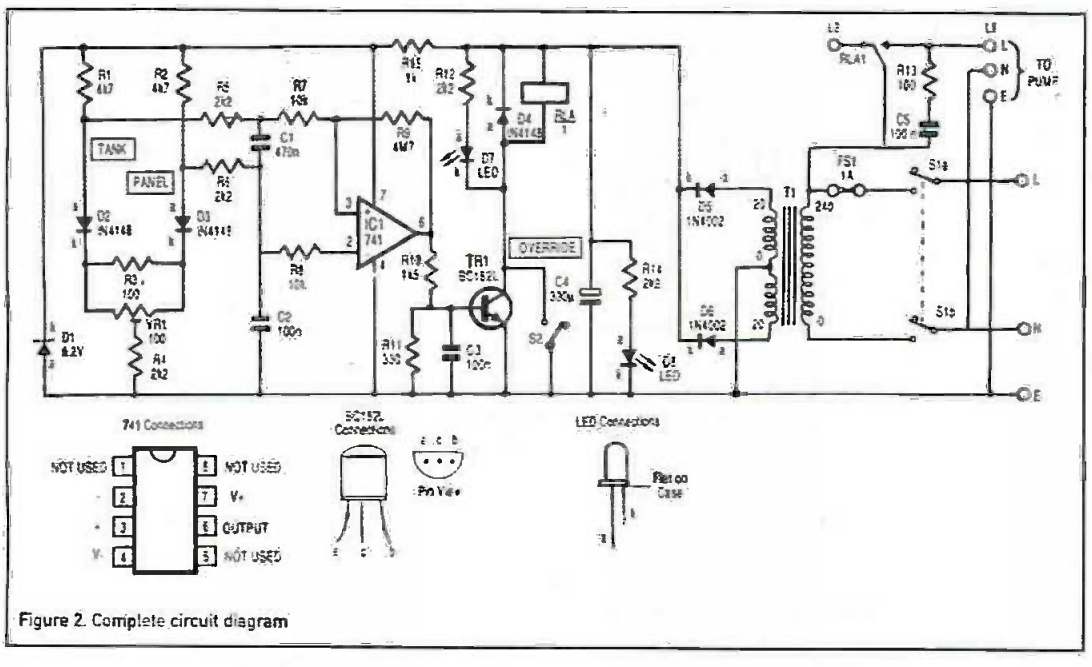


Figure 2. Complete circuit diagram

them with more cable later; or calculate first the distance you want to position the controller from the panel and tank.

The sensors themselves are 1N4148 diodes. Simply solder them to the end of each lead as shown in Figure 5. Seal the bare wire and joints with epoxy putty against water. This will harden in a few minutes.

Thread the two sensor leads through the grommet on the end of your box and connect them into the terminal block as shown in Figure 3.

Choosing the temperature difference

The size of the temperature difference between the tank and the panel that switches the pump on or off is controlled by the component called R9. This is a feedback resistor of the 741 amplifier. You can choose its specification to give a temperature difference as shown below:

SPECIFICATION	TEMPERATURE DIFFERENCE
3M3	10°C
4M7	7°C
10M	3.5°C

You may wish to experiment with installing different resistors at different values to find the one that works best for your conditions. Alternatively you could fit a variable resistor, and having found the optimum position, leave it there.

Test procedure

You're ready to try it out. Plug in the unit and turn switch S1 on. If it's all connected properly, the red LEDs should light up. Now switch S2 into the auto position. Take care. The fuse clips and components near the 3-way terminal block are now live, as is the back of switch S1.

Next, ensure that the two sensors are near to each other, and therefore at the same temperature. Turning the preset dial VR1 should cause the relay and the green LED to turn on and off. If it does, the next step is to find the correct point at which to set VR1. This is done by turning it until the relay just comes on. Then turn it back until it is just past the point at which the relay turns off. Five degrees of rotation past the turn off point is about right. Leave it there.

You're now ready to see if a temperature difference between the sensors turns on the switch. Find something hot like a soldering iron and hold it near or against the panel sensor. The relay should click on after a few seconds. If you then leave the sensor to cool down for a few minutes the relay should turn off. If it does all this you've succeeded so far. Now disconnect the unit from the mains. You may now install it.

Installation

In a typical solar heated system the solar energy collected by the panels is pumped to the pre-heat cylinder (see Figure 7). The pump is switched on by the solar panel controller. This pre-heated water is then drawn through the existing hot water tank.

The pump should be connected to your controller on the terminals marked L1, N and E on the controller's four way terminal block. Take note of the fact that terminal L2 is live when the green LED is off.

Now you can position the controller box. It should be in a visible and accessible position so the switching of the pump can be monitored. It should also be somewhere where the temperature won't vary widely. Don't put it in the attic.

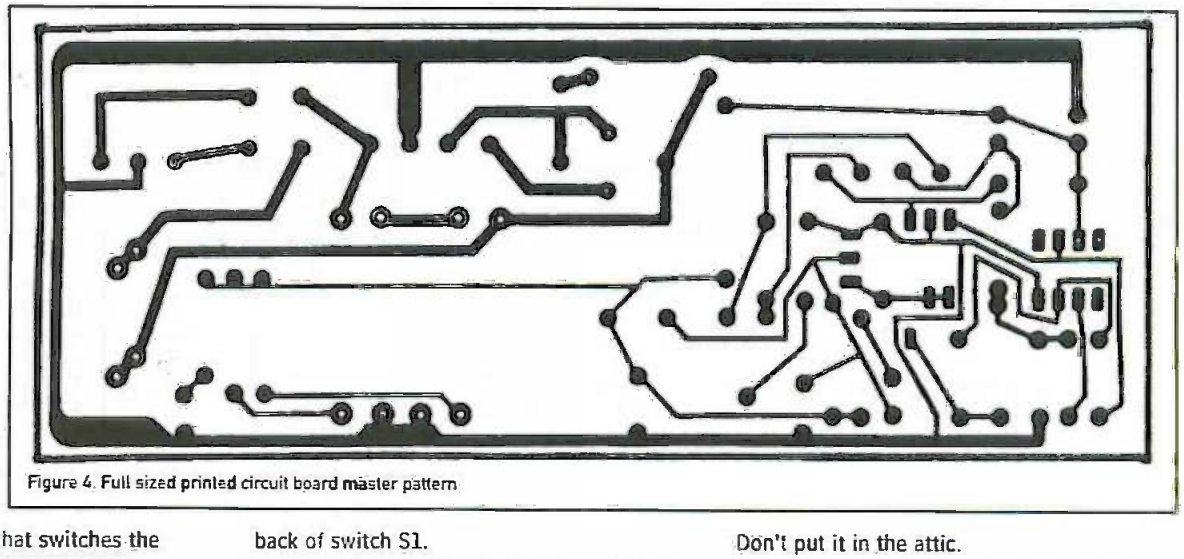


Figure 4. Full sized printed circuit board master pattern

It's now time to fix the sensors. If you don't get this right, the whole system won't work. Firstly, don't run the leads near mains leads, because they cause interferance. Fit the sensors in place with epoxy putty or silicone sealant and cover them with insulation, such as polystyrene. Figure 6 shows this arrangement. The tank sensor should be mounted on the pipe running from the pre-heat cylinder to the solar panels, and as near as possible to the tank. The actual connection flange is an ideal place.

The panel sensor goes on the outlet pipe inside the box of the last solar panel in the sequence. After the putty has dried, you're now ready to switch on, and the whole system should work.

Insert pic and caption Figure 7. A typical system design employing solar collectors to pre-heat water before the immersion heater or boiler finishes the job. This system is pumped and uses a solar controller.

For those looking for further information on this and related subjects, CAT is offering a number of books, products and courses to Electronics & Beyond readers. For further details and to order contact CAT Mail Order Department, CAT, Machynlleth, Powys, SY20 9AZ. Tel. 01654 705959 or visit the website at cat.org.uk and quote the reference E&B003.

Parts List

Resistors		
R1,R2	4K7	
R3,R13	100R	
R4,R5,R6	2K2	
R7,R8	10K	
R9	4M7	(see note)
R10	1K5	
R11	330R	
R12,R14	2K2, 0.5Watt	
R15	1K 1Watt	
VR1	100R cermet preset	
Capacitors		
C1	470nF capacitor polyester 100V	
C2,C3	100nF capacitor polyester 100V	2
C4	330uF capacitor radial electrolytic 40V	
C5	100nF suppression capacitor	
Diodes		
D1	8V2 zener diode	
D2,D3,D4	1N4148	3
D5,D6	1N4002 or 1N4007	2
D7	green LED (with clip)	
D8	red LED (with clip)	
Miscellaneous		
TR1	BC182L transistor	
IC1	LM741 op-amp	
RLA	10A single pole changeover relay, 24V coil	
T1	3 VA transformer, 240V primary, 20-0-20V secondary	
S1	d.p.s.t. rocker switch, 240V AC 4A	
S2	s.p.s.t. toggle switch, 30V DC1A	
FS1	1 amp fuse	
3 way terminal block		
4 way terminal block		2
p.c.b. terminal pins		10
fuse clips		2
plastic case		
rubber grommets		3
printed circuit board		
twin 7/0.25mm cable		
epoxy putty and (maybe) silicone sealant		

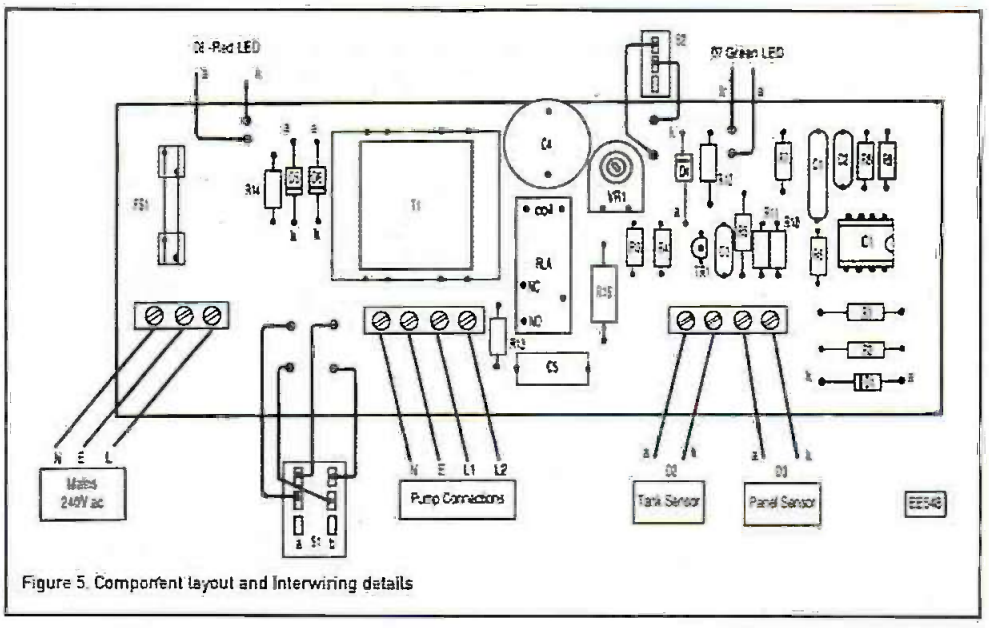
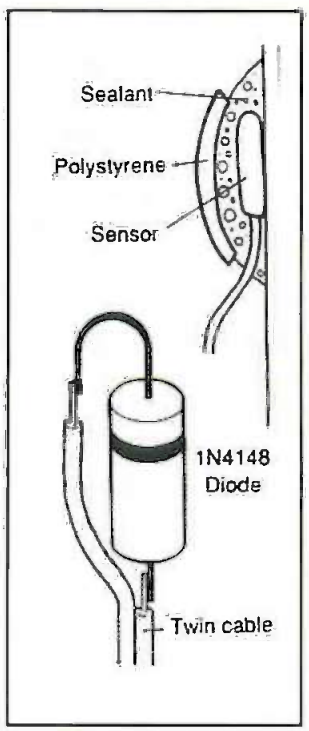


Figure 5. Component layout and interwiring details

Publications

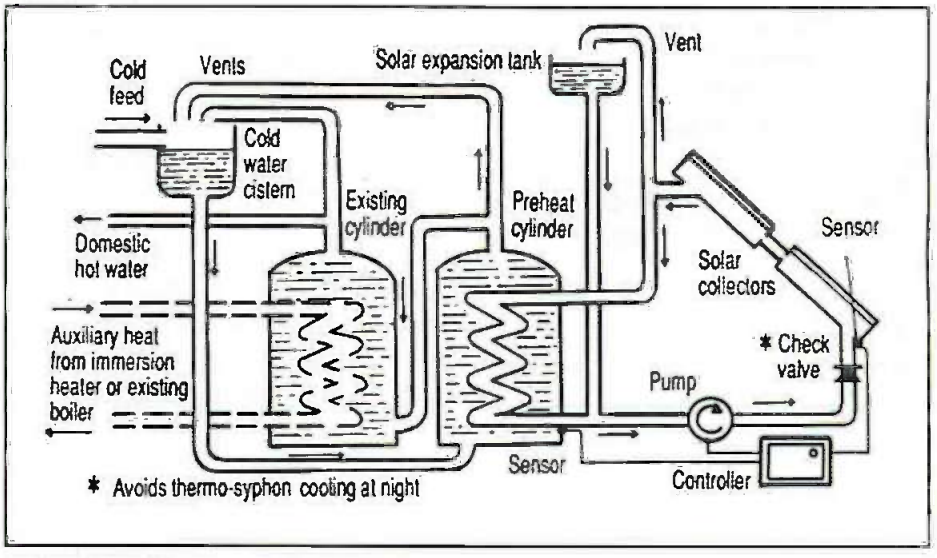
Tapping the Sun: *A guide to solar water heating, B. Horne, P. Geddes.*
Offer price £3.15 (£3.50 rrp)
All you need to know before buying or installing a solar water heating system. How it works...Types of panel...Costs and benefits...How to fit a panel into your plumbing system.



Solar Water Heating: *A DIY guide, Paul Trimby, 28pp*
Offer price £5.40 (£5.99 rrp)
This practical DIY guide is packed with photographs and diagrams designed to help you through the process from design to construction and installation. The panels described in the book can be made by anyone with basic woodworking and plumbing skills and also make ideal practical projects for schools and science courses.

Solar Energy: *a factsheet, CAT, 8pp, A4*
Offer price £2.70 (£3.00 rrp)
An introduction to solar power: covering passive solar building design; the collection of solar heat for storage and use as a low temperature heat for water and space heating.

Hot Water from the Sun: *How to construct your own solar panel, Jurgen Streib, 134pp*
Offer price £13.50 (£15.00 rrp)
The central idea of this book is that solar panels ought to be constructed in the respective countries where they are being used. Covers everything from building panels to testing their efficiency.



Solar Water Heating Resource Guide,
CAT, 14pp
Offer price £1.80 (£2.00 rrp)
Complete listing of consultants, manufacturers and suppliers, sources of information, products and courses...names, addresses, telephone numbers and websites.

Products

Clip Fin Solar Collectors
Offer price £4.19 each or £45.00 for 12 (£4.65/£50.00 rrp)
High conductivity aluminium sheet, designed to clip on to standard 15mm copper water pipe as part of a solar flat plate collector. This provides efficient transfer of heat to the water in the pipe, and makes DIY solar collectors easy to construct. Each fin measures 380 x 200mm.

Courses

(When requestion information or booking details please quote E&B003.)

Solar Water Heating Systems
October 5–7 2001
Fees: High waged: £230; waged: £170; non-waged/student: £120
This course is ideal for those who want to design or install a solar water heating system. Sessions will cover types of collector, energy storgage, plumbing and controls. There will be practical tuition on the construction of a collector and in-depth instruction on the design of solar heating systems.

Introduction to Renewable Energy Systems
September 24–27 2001
Fees: High waged: £230; waged: £170; non-waged/student: £120
This course will look at the potential for generating your own electricity from wind, water and solar power and also at the possibilities for reducing energy consumption. It will be led by CAT engineers and based in CAT's unique Eco Cabins, which have their own renewable electricity supply.

For £16.00 per year you can join the Alternative Technology Association, CAT's member organisation, which entitles you to quarterly copies of the journal, Clean Slate, a 10% discount on all CAT publications and other members' benefits. Contact ATA on 01654 705988, quoting the reference E&B003.

SHARP controller LH 79531:

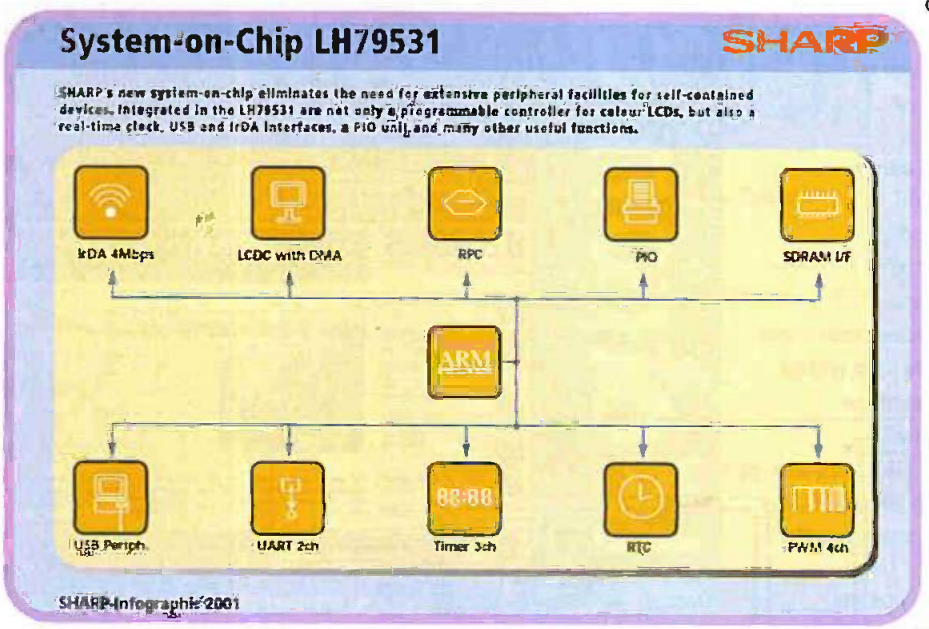
by Gunter Wagschal

a complete electronic vendor on a single chip

THANKS TO HIGH INTEGRATION, SHARP'S NEW LH79531 IS ABLE TO SAVE ON EXTENSIVE PERIPHERALS AND COSTS IN INDEPENDENT DEVICES. HERE GUNTER WAGSCHAL FROM SHARP MICROELECTRONICS EUROPE EXPLAINS WHAT THE CHIP IS, WHAT IT DOES, AND WHAT POSSIBLE USES AN INTEGRATED DEVICE SUCH AS THIS COULD BE PUT TO IN PRACTICAL TERMS.

High-performance colour display and speech output, even buying communications with mobile phones is nothing unusual anymore for modern automats: Those practical solutions can already be done with standard PC components. Although this is not always very customer friendly – whereas a windows error message might just make you shrug your shoulder or smile, a non functional ticket machine or a failing info board at the railway station can sure create some anger. Especially in tight situations. Only at first glance do the PC based automats save money: hardware and software costs – the high energy bill and the continuous need for maintenance results in higher costs in the end.

To avoid these problems SHARP have developed an embedded solution with ARM chips. The new LH79531 is a 32-bit ARM7TDMI™ SOC featuring an integrated programmable colour LCD controller supporting up to 1024x768 resolution, up to 64,000 colors and 15 gray shades allowing direct interface to STN, CSTN, TFT, and SHARP's Highly Reflective TFT, and DMTN Panels. So it is possible to connect an attractive colour display in the vendor machine. Moreover, the LH 79531 has more peripherals integrated on a chip than many PCs in several I/O chips: real time clock, DMA, USB- and IrDA interface with 4 mbps, PWM, dual UART and triple timer are only a few points to mention.



So an automatic vendor machine using the LH 79531 not only uses a lot less power than a PC solution, it is also complete from the beginning: No additional plug in boards are necessary for providing the necessary ports, infrared and USB are not only 'on board' but even 'on chip'. This will help a service technician to upload a software update via the USB or those who install the vendors to collect wireless via IrDA the records of operating hours, sales operations or uploading new prices. The same way mobile phones could be connected over IrDA for cashless pay, as soon as the corresponding standards are fixed.

The PWM/UART modules make it easy to turn the display into a touch screen. The PIO can address the ticket printer or receipt printer directly. The integrated programmable PLL oscillator generating system and peripheral clock cycles from a single inexpensive 32 kHz crystal leads to low power consumption at full 60 MHz performance. Thanks to power management the chip can be set to several energy saving modes. According to the actual performance requirements the system clock can be set via the PLL and independently the peripheral clock and the CPU itself to match the factors. Current consumption and system performance match the needs.

So a machine may look rather expensive at first glance compared to the old non-intelligent solutions, but turns out to be much less expensive in practical use. In case of failure or incursion the system may even call service or sentry itself. Not to mention much better customer service – which passport photo machine would you prefer: the one that just flashes you or the one that shows you the photo on the screen and asks if you like it that way? SHARP on the web: www.sharpsme.com

CONSTRUCTOR'S Corner

Microcontroller-based 4 Digit Counter Modules

by Peter Crowcroft and Frank Crivelli

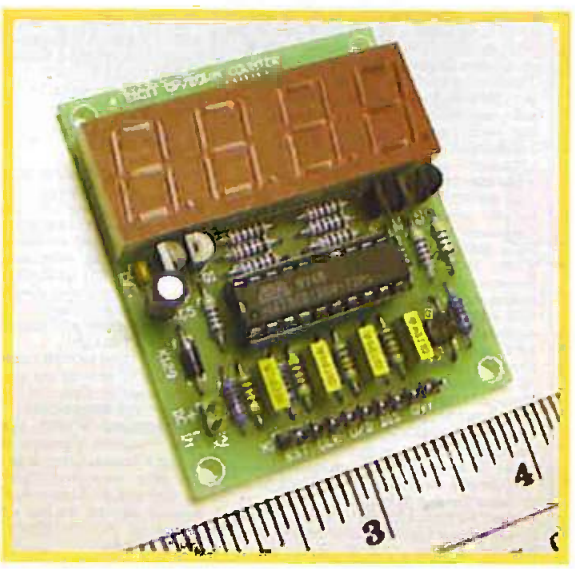
WELCOME TO OUR NEW HANDS-ON CORNER FOR ALL WHERE YOU CAN BUY AND BUILD YOURSELF A TOTALLY ORIGINAL ELECTRONIC KIT OR PERHAPS YOU WOULD PREFER TO CHOOSE THE PRE ASSEMBLED KIT OPTIONS AVAILABLE. WE AT ELECTRONICS AND BEYOND HOPE YOU HAVE LOTS OF FUN AND ENJOYMENT FROM THESE PAGES AND OUR AIM IS TO PROVIDE YOU WITH VARIETY EACH MONTH SO YOU ARE ABLE TO LEARN AS YOU MAKE THE PROJECTS.

Modern electronics is allowing products – consumer, industrial, scientific - to be produced with more features in smaller packages at less cost than ever before. Electronic Engineers must find new ways to meet these challenges. Not too long ago, the controller for an appliance like a washing machine or microwave oven would be a mechanical timer or perhaps discreet components (switches, transistors and 4000 series logic, etc). However, all these things take precious space and are difficult to design and update or reuse for different product models or revisions.

Today, these problems are neatly and cheaply solved with microcontrollers – single chip computers complete with IO pins, RAM, Program Storage (ROM) and sometimes other useful features like ADCs, UARTS and PWM drivers. One simply arranges for relevant inputs (switches and sensors) and outputs (motor drivers, LEDs and displays) to be connected to the microcontroller and write some software to manage the lot.

The space saving and cost effectiveness of these small wonders are excuse enough to use them. But when you consider the flexibility they provide to adapt the control system to changes in the device or consumer demanded functionality they are indispensable. It's simple, you change the software (which can often be done in circuit) and the same hardware will perform the new task.

There are very few fields left in electronic engineering where microcontrollers have not made their mark, so it is very important to Engineers to understand how to apply them in their designs and how to develop and debug their software. Luckily there are many sources on the Internet open to the Engineer and Hobbyist alike that provide free tools, examples and designs. The manufacturer of the microcontroller will have lots of details in the datasheet and application notes and so is a good place to start.



As an example of this great flexibility, this article presents two simple, low-cost, four-digit counter modules. One will count up or down and the other will count down in several user-defined ways from a preset value. The main difference between the modules is the software in the microcontroller.

The use of an ATMEL AVR microcontroller allows the circuit to be greatly simplified with no on-board crystal required, and a larger range of useful features to be provided then could be achieved with conventional logic circuits.

For instance if we wanted to implement a simple counter with conventional logic, we would need a counter for each digit (say 74LS192, a BCD Decade Counter), and then we would need to drive a seven segment LED display using a BCD to 7-Segment driver (74LS47). Straight away we have eight ICs (two per digit). Then we'd need some glue logic to hang everything together. Then we get a counter that can only count up. To fit this into a reasonable space we'd have to use a double-sided board with plate through holes because there are a large number of connections required between ICs, we might even need to go to surface mount components to reduce the size. It begins to get very expensive and complex, not to mention tedious (if not impossible) for the hobbyist to assemble.

With the microcontroller solution presented here, this complexity is reduced to one IC only and a handful of discreet components to condition the input and output signals, all on a small cheap single-sided PCB. All the hardware complexity has vanished into the software where finding and fixing errors is easy. As we shall see we also get the ability to change and add more useful features and modes of operation easily.

The Up/Down Counter (Kit 129) has an overflow output allowing multiple units to be chained together for greater counter range. The unit will count between 0000 and 9999, producing the overflow pulse when the count rolls over to 0000.

The Presettable Down Counter (Kit 154) allows the user to program a starting count and select one of four different operating modes which determine what happens when the count reaches 0000.

Circuit Description

Both modules are almost identical, the display driver, the power supply and the output are identical. The differences are

confined to the inputs and their 'meaning' to the microcontroller. Lets start by looking at the identical parts of the modules.

The counter modules are designed around an AT90S1200 AVR microcontroller from ATMEL (www.atmel.com). A detailed product datasheet is available from their website. This particular device was chosen because it has an internal R/C oscillator eliminating the need for an external crystal, simplifying the circuit and reducing component costs.

Name	Description
Reset	Reset the current value of the counter to 0000.
Clock	Increment (or decrement) the value of the counter. If the counter rolls over to 0000, an overflow pulse is generated. The clock input is debounced in software to prevent extraneous counts when mechanical switches are used. This is achieved by ensuring a high to low or low to high transition remains valid for more then 15ms. This means the maximum count rate is around 30 counts per second. The count is triggered on a high to low transition (falling edge)
Down	Controls the direction of the counter. When unconnected, the counter will increment, when driven low (grounded) it will decrement.
Disable	When grounded the counter will not count even if the clock input is being pulsed.
Overflow	This is an open collector output. When the count rolls over to 0000, it is pulled to ground by the circuit for approximately 25ms. This may be connected to the Clock input of the next module to create a counter with a larger range or used to drive a relay, indicator or other circuit.

Table 1.

The display unit is a four-digit, common anode, multiplexed, seven-segment LED display. This means that the LEDs in a single digit share a common anode (positive) connection. The cathodes (negative) of the segments (a, b, c, ... g, dp) are connected across the four digits forming a matrix.

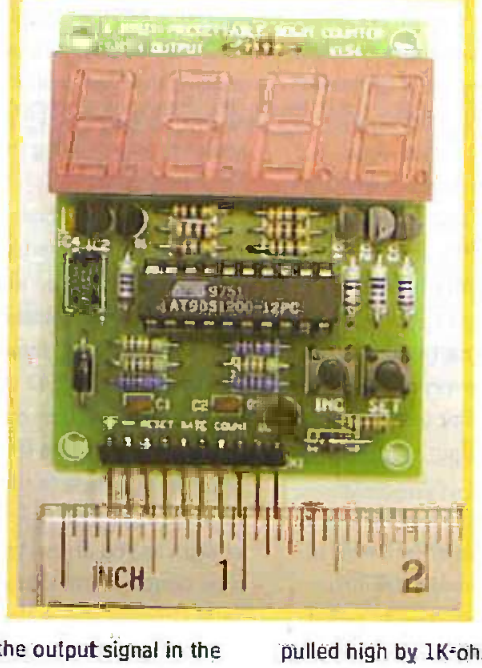
Multiplexing results is fewer connections and board space being devoted to the display and reduces the number of outputs from the microcontroller required to drive the display. However, the drive signals become more complex but this is relatively simple to achieve in the microcontroller's program.

Bits 1 to 7 of the microcontroller's Port B are connected via 270-ohm current limiting resistors (R1 to R7) to the shared segment pins. Four of the Port D bits are then connected to drive the four common anodes via Q1 to Q4, the PNP transistors. Resistors R8 to R11 protect the transistors from excessive base current which otherwise could destroy them.

To display the current count, the microcontroller cycles through each of the four digits one at a time, providing current to the anode of the digit by turning on the appropriate transistor (driving the base low). It then arranges for outputs connected to the segments it wishes to light to be driven low so that current can flow from the transistor, through the LEDs in the display and to ground via the microcontroller port. The segments it wishes to remain unlit are driven high.

After approximately 1ms, the display is extinguished and another 1ms delay occurs then the next digit is lit. This then continues for the remaining digits and the cycle starts again. Therefore it takes about 8ms to fully display the current count, which is much too fast for the human eye to discern so it looks like a constant display to us.

The software programmed into the microcontroller uses a timer that triggers an interrupt about every 1ms to achieve this. When the interrupt occurs the next display is set up or the current display is extinguished. This allows it to be monitoring the inputs without constantly worrying about handling the display, simplifying the design of the software.



Transistor Q5, an NPN device, provides an active low open collector output for the overflow signal in the up/down counter version and the output signal in the presettable down counter version. The remaining bit (Bit 0) of Port B drives this transistor via R18, a 1K-ohm resistor. Q5 is protected by Zener diode Z1 that will break down and conduct if the voltage across Q5 exceeds 33V or it will conduct if a negative voltage is applied to the collector. This is needed when driving inductive loads like relays as the back EMF generated by the collapsing magnetic field in the coil when the current is turned off can easily exceed the rating of the transistor and destroy it.

Power for the circuit is provided by an external 9 to 15 volt DC power supply and is regulated by IC2, C4 and C5 resulting in a 5-volt supply. IC2 is a 78L05 low current voltage regulator that needs about 2.2 volts of headroom to ensure regulation so you must ensure that the voltage supplied to it doesn't drop below about 8 volts. Diode D1 provides reverse bias protection in case the power supply is connected the wrong way around.

Now lets look at the input circuits for the different modules.

Up/Down Counter

Kit 129, the Up/Down counter has four inputs and one output. (see table 1)

The four inputs are all pulled high by the 1K-ohm resistors and have a low pass filter formed by the 27K-ohm resistor and 1nF capacitor to filter out high frequency noise from the line to reduce the chance of false triggers. This filter's time constant is approximately 20us and any pulses shorter then this won't make it to the microcontroller. A 20us time constant equates to a frequency of 50KHz. The inputs are also debounced in software with the level in the input needing to be constant for 15ms before it is recognised as a valid input.

Presettable Down Counter

Kit 154, the Presettable Down counter is a little more complex. It has two pushbutton switches added to its inputs. These are used to program the preset value and operating mode. This module has three inputs and one output. (see table 2)

Like the other module, the inputs are pulled high by 1K-ohm resistors. The Count and Reset inputs have the same low pass filtering applied with the 27K-ohm resistor

and 1nF capacitors.

The SET switch is connected directly to Port D, Bit 4 with a 1K-ohm pull-up resistor. There is no need for filtering on this input as the microcontroller will debounce it in software.

The INC switch is interesting as it is shared with the Count input. This is an example of making efficient use of the available inputs. This can be done because in set-up mode, no counting in done. This also means that the INC button can be used to decrement the counter when it is running.

Software

The software for the microcontroller is not supplied however this description is provided for those who are curious or want to have a go at creating their own.

The first thing the code does is set up all the inputs and outputs and initialises all the internal state. It then sets the count to the default value (0000 or the preset depending on the module) and starts the internal timer.

The timer is set to trigger an interrupt every 200us (observant readers will notice I said 1ms earlier, I lied for simplicity). When the interrupt occurs, the handler routine updates various internal counters used for debouncing inputs, output pulse timing and the display timer routines. If any of these counters reach zero they need attention and are processed. For example, every 1ms the display routine is called to update the display.

The main loop constantly monitors the inputs and sets up the debounce counters when they change. If a valid clock pulse is detected and the count isn't disabled a routine to either count up or down is called.

The count is stored as four binary coded decimal (BCD) values, so constant conversion is not required in the display driver routine. This is updated by the count up or down routines and if the value changes to 0000, the overflow output of Kit 129 is activated and a counter set up to turn it off in about 25ms. In Kit 154, the output is determined by the current operating mode.

The display update interrupt routine uses a BCD to Seven Segment conversion routine to map the 0-9 value of the digit being displayed to the correct output for driving the segments in the display.

The Presettable Down Counter also has a set-up mode that is entered when a high to low transition is detected on the Set input. This allows the preset count value to be set one digit at a time and the mode to be selected.

Name	Description
Reset	Reset the current value of the counter to the preset value.
Count	Decrement the value of the counter. If the counter rolls over to 0000, the current operating mode determines the output pulse and new count value. For more information see "Using the Modules". The count is triggered on the high to low transition. Software debouncing is optionally applied to the count signal using the Rate input. If it is enabled, it is identical to the Up/Down counter.
Rate	Select if software debouncing is applied to the count input signal. If high (by default) debouncing is applied, if driven low (grounded) debouncing is not applied. This is useful if the count is derived from another logic circuit that doesn't exhibit extraneous pulses like a switch can do. If debouncing is disabled, the count input can be clocked a lot faster. Note that this input is not debounced at all as it is meant to be set permanently.
Output	This is an open collector output. When the count rolls over to 0000, the current operating mode determines what this output does.

Table 2

Construction

Kit 129 and Kit 154 include all components, a high quality PCB and a pre-programmed microcontroller. All you will need is a power supply and a clock source.

Start construction by separating out all the components in to values, use the parts list as a guide. I'd suggest a fine conical tip on your soldering iron, as there are some small, closely spaced pads especially for the transistors. The PCB is very good and has a solder mask so it isn't too difficult to avoid solder bridges.

Start by installing the resistors. Pay particular attention to R4 as it is situated under the socket for the microcontroller. You may want to leave it for last and ensure the socket fits over it before soldering it and the IC socket in.

Next put in the capacitors, paying attention to C5 as it is polarised and laid over. I'd suggest that you bend the leads at a right angle and then insert into the board and solder to avoid having the legs too short to bend over later.

Install the two diodes next, ensuring that the stripe on the cathode (striped) end matches the stripe on the PCB overlay.

Now install the transistors and IC2. Don't get these confused, there are four BC557s (Q1 to Q4), one BC547 (Q5) and the 78L05 (IC2). Use the outline on the PCB as a guide for orientation. Q1 to Q4 and IC2 are close together and close to the edge of the LED display so get then as low as possible and as straight as you can so they wont get in the way. Double check that you don't have any solder bridges across the transistor pins as they are close together.

If you're building Kit 154, install the two switches. They will fit with the pins coming out towards the display and the connector.

Install the LED display; the decimal points go towards the microcontroller. Then install the two-pin header for power (Kit 129 only) and the ten-pin 90-degree header for the inputs and outputs. The kit also includes a socket for this header; this doesn't mount on the PCB but can be used to make connections to the completed module.

Install the microcontroller into its socket and you're done. Apply power to the unit and you should see 0000 displayed (this is the power on default for both modules. If you short the two count pins (or press the Inc button on Kit 154) the display should increment (or decrement).

If it doesn't work

Poor soldering (dry joints) is probably the most common cause of problems. Check all your joints under a good light; they should all be smooth and shiny. Resolder any suspicious ones. Keep and eye out for solder bridges and pads that you may have forgotten to solder as well.

Make sure that you inserted the diodes the correct way and that the microcontroller is also the correct way around and securely sitting in the socket. Also check the electrolytic capacitor C5.

Make sure that you didn't mix any of the transistors up and they are in their correct places. This includes IC2.

Use a multimeter to check the supply voltage. Measure it from the cathode (strip end) of D1. It should be at least 8 volts or IC2 (the 5 volt regulator) will have difficulties and not operate correctly.

Using the Modules

The counter module has three or four inputs and one output that are accessed via a ten-way header. The input lines are all active low, which means that grounding them preforms

their function. More correctly, each of the inputs is normally pulled high by the module circuitry and must be pulled low to become active.

Each of the lines has a corresponding ground pin beside it, simplifying the connection to a switch. The input lines may be connected to simple 'make' contacts, switches, relays or even open collector outputs from other circuits.

The module requires a 9 to 15 volt DC power supply and consumes between 20mA and 40mA, depending of the number being displayed. A small plug pack will easily supply enough power for several modules. Alternatively the module could be battery powered.

Kit 129, the Up/Down Counter is fairly straight forward. Just connect a switch to the count input and set the direction on the Down input and you're ready to go. However, Kit 154, the Presettable Down Counter, is a little more complex.

Connect the count input and output as needed, and then apply power to the unit. By default, it will display 0000. It will overflow to 9999 and continue counting down with clock inputs until it reaches 0000 again. This is Mode A, and it is the default mode. See table 3 for a description of each of the modes.

The two pushbuttons marked, SET and INC are used to configure both the preset value and the operating mode. The preset value is entered one digit at a time starting at the thousands and then the Mode is selected.

To enter the programming mode, press the SET button. The display will show the preset value for the thousands digit and the rest of the display shows a minus (-) sign. Use the INC button to select the required value then press the SET button to advance to the next digit.

Continue setting each of the preset digit values unit the last one is set. The display will now show the current operating mode with the letters A, b, C or d. Use the INC button to select the desired mode and press the SET button to accept it. This will also exit programming mode and the counter is ready for use.

Name	Description
Mode A	Count Stop, Output Hold. When the count reaches 0000, the output goes low and stays low. The counter stops counting. The counter must be reset to continue counting again and to reset the output. When reset the count is set to the preset value.
Mode B	Over-Count, Output Hold. When the count reaches 0000, the output goes low and stays low. The count will wrap around to 9999 on the next count input and continue counting from there. The output will remain low until the module is reset.
Mode C	Auto-Reset, One-Shot Output. When the count reaches 0000, the counter automatically resets itself to the preset value and the output pulses goes low until the next count pulse occurs.
Mode D	Over-Count, One Shot Output. When the count reaches 0000, the output goes low until the next count pulse occurs. The count will wrap around to 9999 and continue counting from there.

Table 3

Software Flexibility

To illustrate the power of using a microcontroller versus discreete logic circuit the following 'user requested' modifications have been made to K129 at no cost to the user since the change was very easy to do in software.

- Count by five instead of by one.
- Show digits 'upside down' so the PCB could be placed in a predesigned box upside down.
- Only display digits on a 'keypress' so that the kit could be more efficiently battery powered.

These were done by simply changing the software. Try doing that with discreet logic circuits!!!

Further Information

The following may be good starting points to find more information:

ATMEL (makers of the microcontroller used in this project) www.atmel.com
They have product datasheets for all of their microcontrollers with detailed information about using and programming them.

DIY Electronics (kit supplier for this project) http://kitsrus.com
They also have an AVR Programmer kit (Kit 122) and BASCOM Basic Compiler that are useful for people wishing to experiment with AVR microcontrollers.

Alternatively access www.avr-forum.com to find out the latest up-to-date information on the range of AVR tools.

Questions or comment about the Kit can be directed to Peter Crowcroft, peter@kitsrus.com Technical questions may be directed to the kit's designer Frank Crivelli, frank@ozitronics.com

Kit Availability

A kit of parts for Kits 129 and Kit 154 may be obtained from Quasar Electronics, and from Kanda/electronicsandbeyond.com

Mains Switching TIMER

by David Ponting

MAKING PRINTED CIRCUITS THROUGH THE PHOTOGRAPHIC PROCESS OF EXPOSING TO UV LIGHT THE SENSITISED SURFACE OF A COATED COPPER BOARD REQUIRES THE EXPOSURE TIME TO BE CAREFULLY CONTROLLED.

I have been making PCBs this way for many years now and have always set the exposure period with a mechanical, mains-driven timer. But my most recent board was spoiled by gross over-exposure caused by the not entirely unexpected failure of the somewhat ancient switch. It was clearly time to find a modern replacement.

This was surprisingly difficult. In fact I could not find a single commercial timer which would reliably and accurately control a piece of mains driven equipment for a period of time from a few minutes to an hour, and with an accuracy of +/- 1 second. It soon became clear that a switch with the particular features I needed was going to have to be homemade.

A number of recently published circuits I researched described timers with very accurate timing facilities but all of them involved the use of a microprocessor and/or a computer, pretty big sledge hammers to crack the nut I had in mind. In any case, how many of us have the finance, or even the

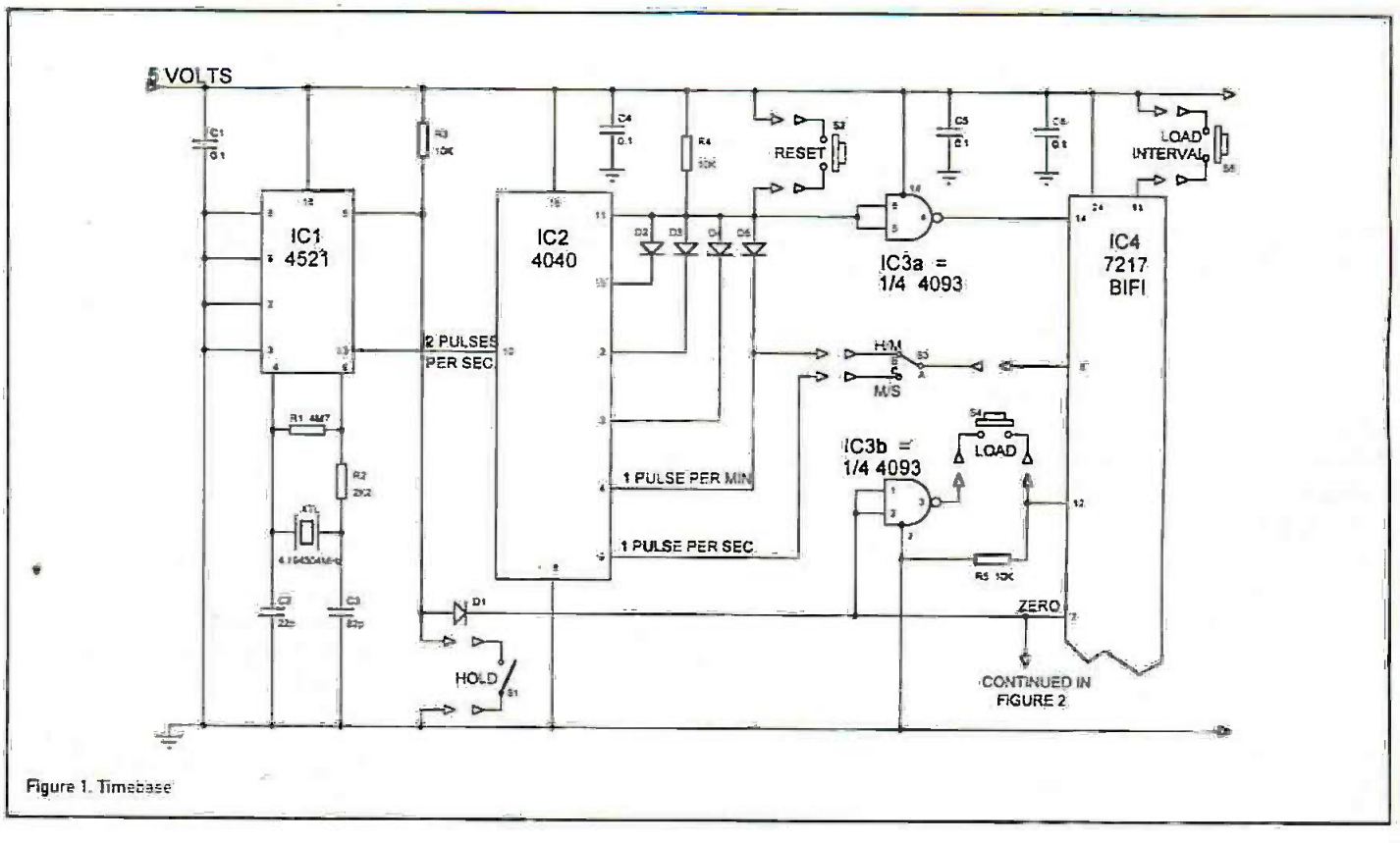


Figure 1. Timebase

room in our work area, to dedicate a computer to such a lowly task.

There had to be a simpler solution.

Looking through the various components' catalogues, I found that the 7217, an old but reliable workhorse timer IC, was still readily available. It seemed to be obtainable only in its 'BIFI' form but that was fine for my purpose since this designation means that the IC counts in sixties, and outputs its maximum count in the 5959 form rather than 9999.

So here was the foundation of a digital timer which could switch my UV light off after any exposure and have the accuracy and repeatability needed. Of course its use need not be limited to this single function. I foresaw many applications for a mains-switching timer.

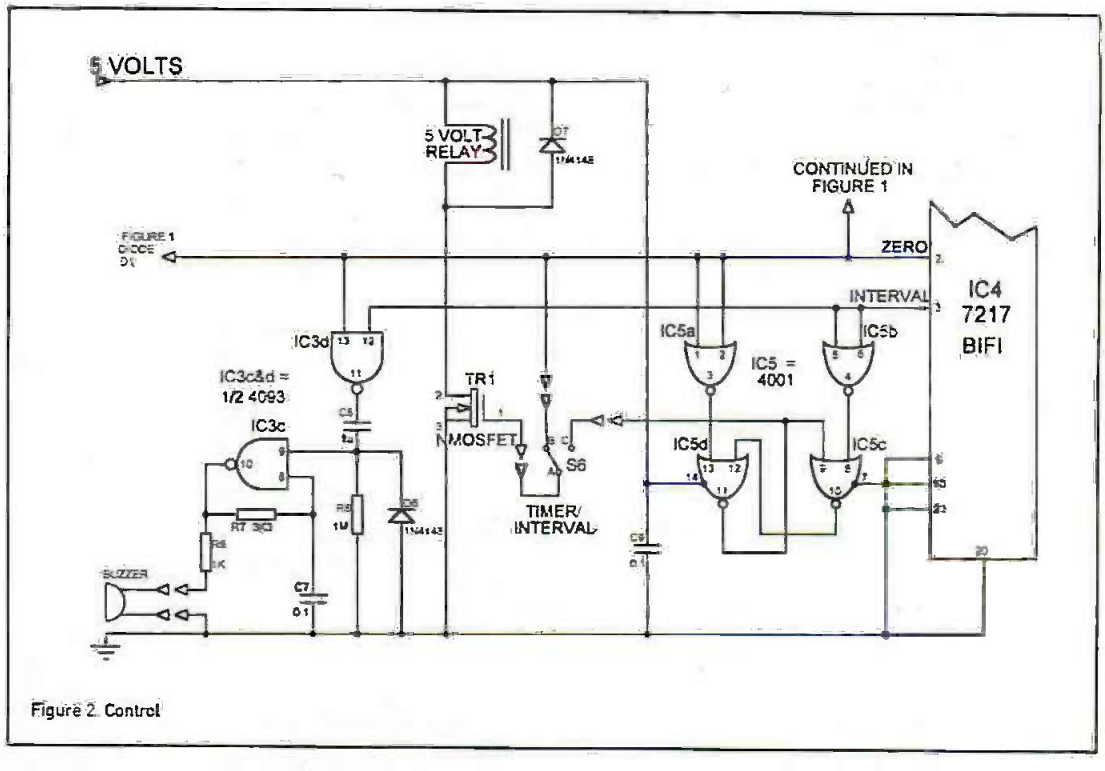


Figure 2. Control

How the circuit works

Pin 8 of the 7217 is its clock input and pulses at this pin are counted by the IC. Consequently the first thing needed is an accurate timebase to provide the necessary reference frequency. Such a timebase is shown in Figure1.

IC1 is a standard CMOS oscillator-and-divider chip which when used with a 4.194304 MHz crystal and wired as shown, will divide that frequency down to an output at pin 13 of two pulses per second. This is routed to IC2 pin 10, the clock input of a second divider chip. The output from pin 9 of this IC provides the input frequency divided by 2, which was all that was needed for my primary purpose.

However, to make the timer as universally applicable as possible, why not include as many additional features as feasible? This explains the further components around the rest of IC2's internal dividing chain which, when wired with the four diodes in the way shown, provides an output at pin 4 of the input frequency divided by 120. In other words IC2 outputs two signals: one pulse per second and one pulse per minute. The one-pole-double-throw switch S3 determines which of these provides the clocking signal into pin 8 of IC4.

All the internal counters of IC2 are reset

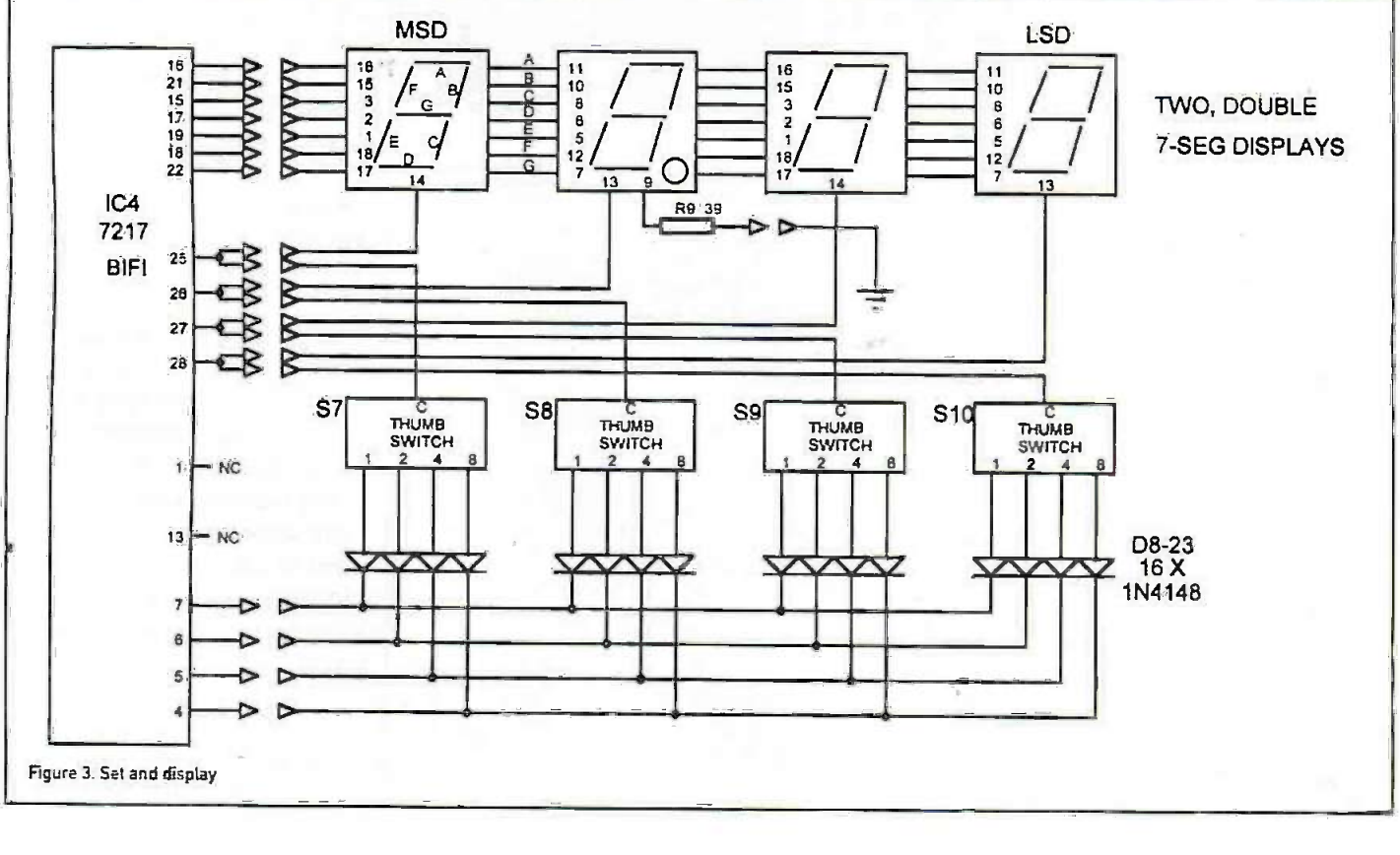


Figure 3. Set and display

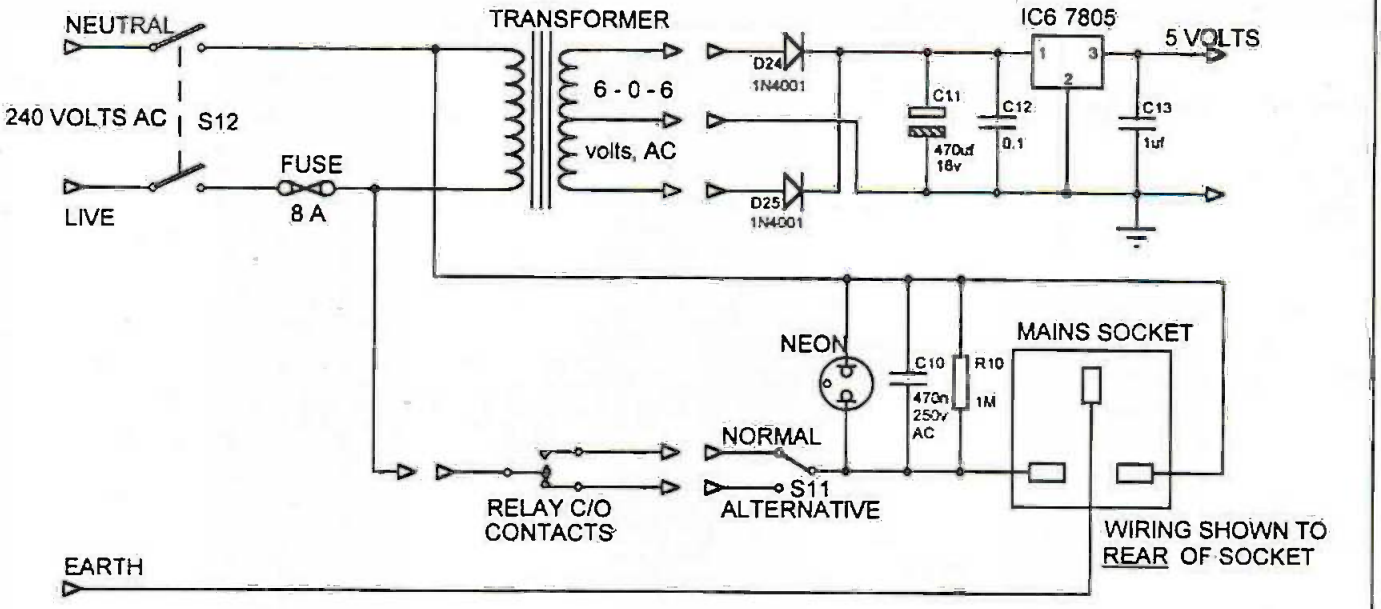


Figure 4. Power and mains switching

when its pin 11 (normally low via the diodes D2-5) is taken high. This happens when S2 is pressed. Whether pin 11 is high or low, its state is inverted by gate IC3a and routed to IC4 pin 14. This pin needs to be high when the 7217 is in its counting mode but resets all IC4's internal counters when taken low. So S2, with gate IC3a, provides a reset function for both IC2 and IC4.

On/off switch S1 resets IC1 by taking pin 5 low when the output of half-second pulses stops. But this switch has no effect on the current count of IC2, other than to hold that count exactly where it is. Releasing S1 will restore the output of IC1 and the count on IC2 will continue from where it was. So this switch produces a HOLD function for the timer.

Pin 2 of IC4 is marked ZERO and is one of the two major outputs from the 7217. The output at this pin is high all the time IC4 is counting down and only when the count reaches 00.00 does it go low. The purpose of diode D1 now becomes clear. While IC4 pin 2 is high, IC1 outputs 2 pulses per second. But when IC1 pin 5 is pulled low via D1 as the 7217 pin 2 goes low at 00.00, IC1 is reset and held so. Consequently all counting stops with the display at 00.00 and the timer is then 'at rest'.

Other than noting that gate IC3b

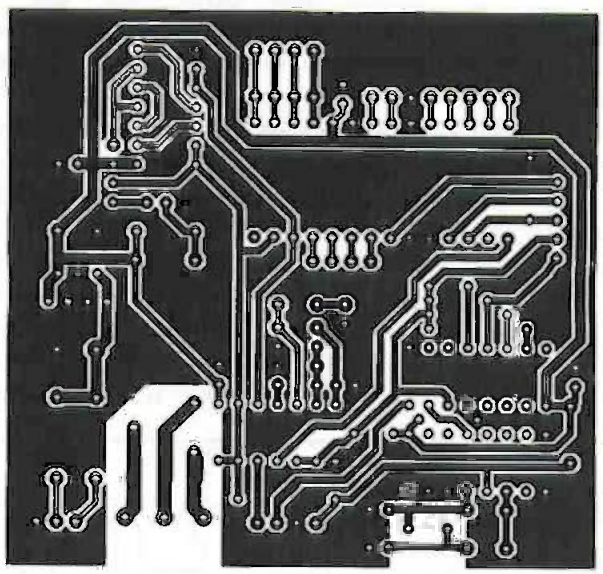


Figure 5. PCB track layout

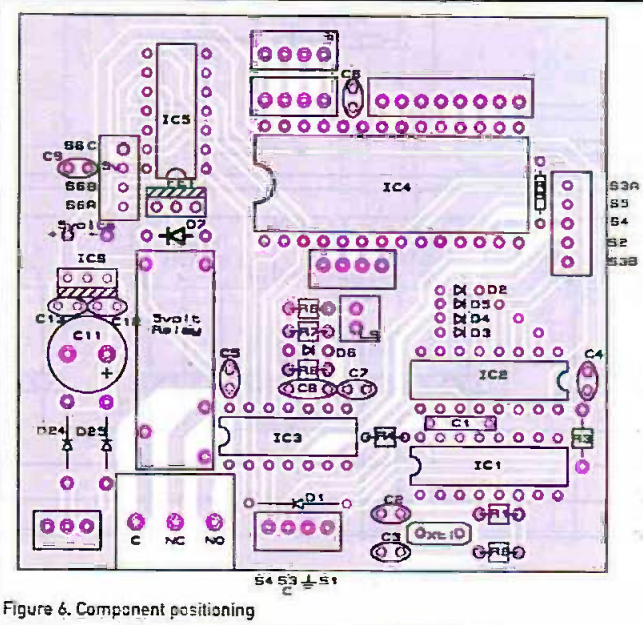


Figure 6. Component positioning

is wired as an inverter and hence the output at its pin 3 is always in anti-phase with the state of IC4 pin 2, let us delay discussion of switches S4 and S5.

Figure 2 shows some more of the control and output features. IC4 pin 3 is marked INTERVAL and is the second major output of the 7217. Normally a timer is expected to switch something on at the start of a timing period and switch it off at the end. Pin 2 provides this function. But the INTERVAL output at pin 3 allows a different switching sequence.

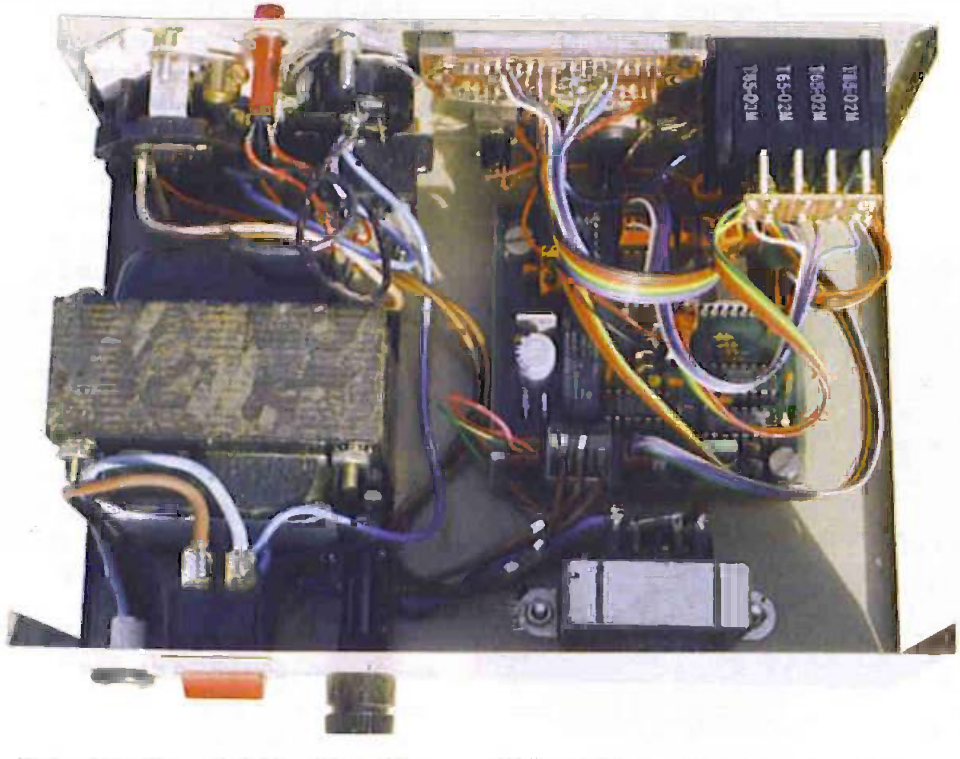
In the INTERVAL mode it is possible to choose a moment between the start and finish times when IC4 pin 3 changes state to provide an interim switching point. With the timer running or at rest, this INTERVAL pin is usually high. But when the chosen intermediate setting is reached during countdown, pin 3 goes low for just the length of one input pulse.

Now let us consider the effect on gate IC3d of the outputs from pins 2 and 3 of IC4.

After the timing period starts, both inputs of gate IC3d will be high and hence its output is low. When the 'INTERVAL' moment is reached, the input at pin 12 of the gate will go low, the output high and gate IC3c pin 9 (which had been low) will go high and remain so until capacitor C8 has charged via R8. The time-constant of these two components is

about 1 second and consequently IC3c is gated on for this time. As this gate with its components is configured as an oscillator, a burst of around 4KHz will reach the buzzer which will sound for about 1 second. Some time later the output of IC4 pin 3 will return high, the output of gate IC3d will go low and C8 will be discharged via D6. The buzzer will not sound again until IC4 pin 2 goes low at the end of the timing period.

The outputs of IC4 at pins 2 and 3 also control gates IC5a and b. The whole of IC5 is configured as a SET/RESET flip-flop with the output normally low from linked pins 9 and 11 of the combination. But if the 'INTERVAL' facility is being used this output will be set high when IC4 pin 3 goes high at the intermediate moment during the timing



period, and it will remain high until reset by IC4 pin 2 going low at the end of the cycle.

S6 provides the choice between the two timing modes. With pole A switched to B, the N-MOSFET, TR1, is on whenever IC4 pin 2 is high. In this position TIMER is being used; the relay is pulled in at the beginning of the set period and released at the end. But if pole A is switched to C, the INTERVAL mode is being used. Now the relay will not pull in until the interim point is reached and it will remain energised from then until the timer times out.

All of this may seem a little confusing now but should become clearer when the method for setting the on and off times is explained.

IC4 pin 9 controls the storing of the count, pin 10 the direction of counting and pin 23 the blanking or otherwise of the display. In this application they should all be wired low.

Figure 3 is the 'other side' of the 7217, showing connections to the setting switches and the displays. Four thumb switches are used to select the various times, and two, double, 7-segment, common-anode displays show the progress of the countdown towards 00.00.

When the unit is used in its TIMER mode, the period for which the load is to be switched on is set on the thumb switches and then loaded into the 7217's main register by taking IC4 pin 12 high (see Figure1). The LOAD switch, S4, can only take this pin high if the output of gate IC3b is high; this will only be so when the timer is 'at rest' with the ZERO pin 2 low. Immediately the LOAD switch S4 is closed, the thumb switch settings will appear on the display, the relay pulls in, and the countdown starts. At 00.00 the buzzer will sound and the relay drops out.

The INTERVAL mode is more easily explained with an example. Let us suppose that it is now 11am and we are going out until the evening. While we are away, we want a device switched on at 14.30 and be left on for three hours, switching off therefore at 17.30. So the timer which we will set running as we leave at 11.00 is to switch off completely at 17.30 having run for a total of 6 ? hours. But before we load 06.30, we should first set the thumb switches to 03.00, the interval during which the device is to be on. This setting is then loaded into the 7217's second register by taking IC4 pin 11 high via switch S5. (Note that nothing appears on the display to tell you that this interval has been stored, but it has). Then, when the full running time of 06.30 is set and loaded with S4 as we leave home, the countdown will start but without immediately switching on the device. In fact, 3 ? hours will pass before it is 14.30 and only then will the mains socket be switched live. At that moment the countdown will display as 03.00 and therefore the device will stay switched on for the required 3 hours.

It should be noted that when an INTERVAL time has been loaded into the 7217 by closing S5, this period remains in memory either until a new INTERVAL time is entered or the register is cleared by switching mains to the timer off and then on again. Consequently once an INTERVAL time is stored, the unit is always operating in the INTERVAL mode. If the timer seems to be buzzing at odd moments or timing erratically, clear its registers by switching the unit off then on again.

Both the displays and the thumb switches are multiplexed and IC4 pins 25, 26, 27 and 28 function as both inputs and outputs. The diodes connected to the thumb switches isolate the output of each as they are scanned and loaded but of course no such isolation is necessary for the displays. R9 lights the appropriate decimal point.

IC4 pin 1 provides a CARRY signal if a second 7217 were to be used and pin 13 allows the speed of the scanning oscillator to be varied. In this application both these pins should be left unconnected.

Figure 4 shows the power supply and mains switching. Little needs to be said about the 5 volt supply which is standard in every way. If a perfectly smoothed 5 volts DC cannot be achieved at a full load of about 100 mA, it may be necessary to use a transformer with a greater output voltage than 6-0-6 volts AC.

The mains-switching circuit does require some comment. Mains Live is switched by the relay's change-over contacts but these outputs are again switched by S11. In the NORMAL switch position as shown in the diagram, the timing modes are as has been described above. However, in the other position of the switch, S11 provides fully reversed switching times.

Independent of reversing the modes, S11 can be useful simply for switching the load on and off when the timer is 'at rest'. For example, if at night you wanted to set the unit to leave a light burning for some hours in the house while it is unoccupied, you would literally be in the dark while the timer was being set if the light could not be independently controlled via S11.

All of this is reason enough to explain why

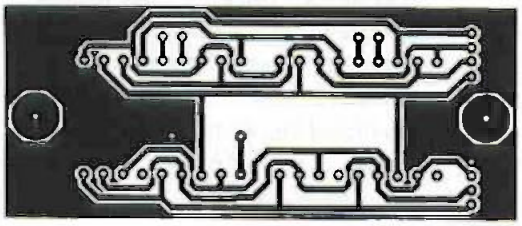


Figure 7. PCB track layout

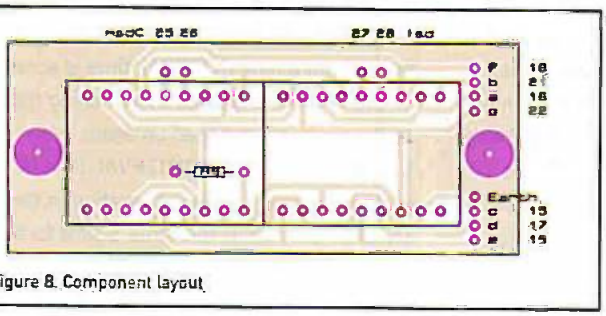


Figure 8. Component layout

a neon indicator needs to be wired across the switched mains output. Without an indicator there would be potential danger when something is plugged into the timer since it is not always easy to work out if the switched socket is already live or not.

The large capacitor C10 is also important, in fact essential if you will be using the timer to switch inductive loads. Without this capacitor it is possible at an inductive turn-off for the unit to experience a mains spike large enough to make the electronics re-trigger, taking the timer repeatedly through its timing cycle. On my prototype, I wanted not only a switched 240 volt socket but also one for120 volt mains. Without C10, the timer continually re-cycled due to the back emf created when switching off the internal auto-transformer used to produce this lower voltage.

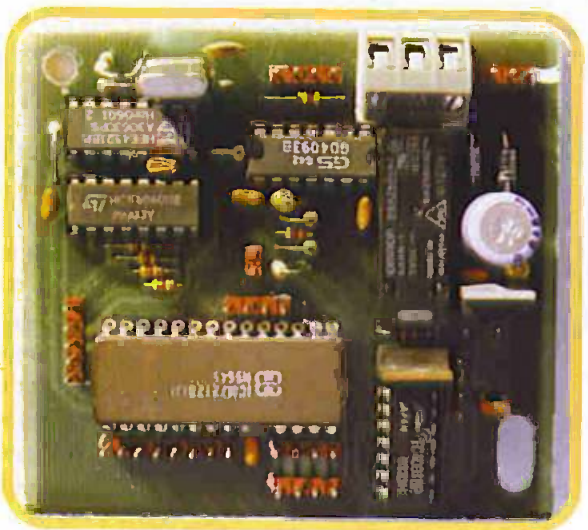
Finally, R10. This is a safety resistor used here to discharge C10 when power to the unit is switched off. Without R10, and even after the timer has been un-plugged for, say, 15 minutes or even much longer, C10 could still be carrying a lethal charge. If some load is always connected (as in my case where the auto-transformer is a permanent load) then R10 may not be necessary. But a resistor is only a few pence and for safety should always be fitted here.

That completes the description of how the circuit works and outlines various timing sequences which can be employed. There is one other mode not so far mentioned which may be useful. Using S6 to select INTERVAL but without closing S5 to load any period into the 7217's second register, the unit can be used as a standard, switchless countdown timer. All that happens is that the total time period is loaded into the first register by closing S4, the timer counts down to 00.00 and the buzzer sounds. With the control switches set as described here, any load already connected to the timer can be left plugged in as no power is ever switched to the mains socket.

Making the timer

All the components are standard and should be easily obtained.

Two circuit boards are required for the easiest construction of this timer: one for the majority of the timing components and another for the display. They need only be single-sided boards but require a fill power-plane to ensure that all the earth connections



are made. Transparency positives have been printed with this article should you wish to make your own PCBs. In addition, enlarged outlines of the boards are included to help ensure that all components, but particularly asymmetric ones, are correctly positioned before being fitted and soldered. (Figures 5, 6, 7 and 8).

It should be noted that an unusually large number of components such as switches and displays are off the main board and hence many inter-connections are required - 41 in fact. Connecting the mains Live to the board requires an appropriate screw block capable of handling the current being switched by the relay. (The recommended relay will switch up to 8 A). All the other connections can be made using standard, 0.1 inch PCB plugs and sockets whose outlines are shown on the main board graphic. I do strongly recommend that some sort of rainbow ribbon wire is used to avoid connection errors or at least to ensure that any made can be quickly corrected.

All DIL ICs should be fitted into appropriate sockets rather than soldered directly into the board. Please note that all these DIL ICs and the field-effect transistor, TR1, are static-sensitive and should receive minimum handling.

Two resistors and one capacitor are not fitted to the main PCB. R9 (39 ohms) lights the appropriate 'decimal' point in the display and so is connected directly to the display PCB. C10 (470n) is a somewhat special capacitor and only a Class X2 type designed to be connected directly across 240 volt AC mains should be used. R10 (1 Meg) is used to discharge this capacitor and can be soldered directly across C10's wire leads. This C/R combination should be fitted directly into the Live and Neutral terminals on the back of the mains socket.

The anodes of the 16 diodes, D8-23, are best wired directly to the 8,4,2 and 1 contacts at the rear of each thumb switch. The cathode ends of the diodes can then be commoned in four sections by soldering each of the 8, 4, 2 and 1 groups to the same tracks on a piece of copper strip board (see photograph).

Figure 9 shows a possible Front Panel layout with 7 of the control switches set in

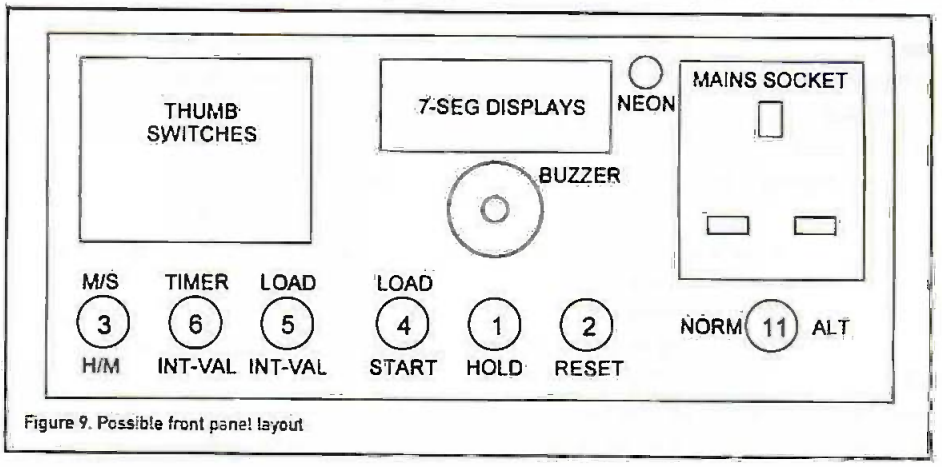
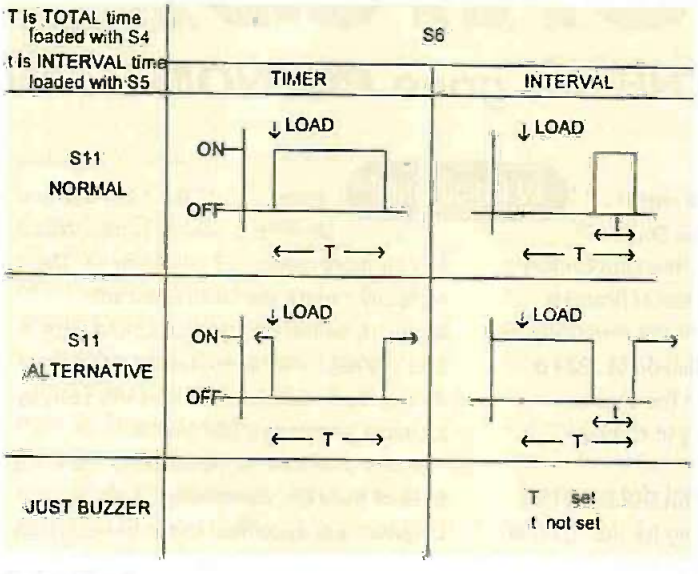


Figure 9. Possible front panel layout

two groups of three and one of one. Switches 1 to 6 are all small with the lever types operating up and down. Switch 11 is large and its lever operates from side to side.

With so many control switches on the front face I suggest that the input mains switch, S12, and the fuse holder be fitted on the rear panel, through which the mains lead also passes.



Using the timer

Set Switch 11 first and then consider each of the other switches in turn, reading in order from left to right on the suggested Front Panel layout.

Switch 11 is in its NORMAL position.

1. Do you wish to time in Minutes and Seconds or Hours and Minutes? Set Switch 3.
2. Do you want to use (a) the standard TIMER? or (b) the INTERVAL timer? Set Switch 6.

Then for:

(a) TIMER. (i) Set the Thumb Switches to the total time needed.
(ii) Ignore Switch 5 and press Switch 4.

The thumb switch setting will appear on the display. The socket will be switched on and the countdown will proceed to 00.00, when the socket will switch off.

Or for:

(b) INTERVAL (i) Set the Thumb Switches to pq.rs, the period when the socket is to be on.
(ii) Press Switch 5 to store this in the INTERVAL register.
(iii) Reset the Thumb Switches to the total period the timer is to run.
(iv) Press Switch 4.

The current thumb switch setting will appear on the display. The socket remains off but the countdown proceeds. When the display reads pq.rs the socket will switch on and remain on until 00.00 is displayed when the buzzer will sound.

3. Do you want to use the timer without ever switching mains to the socket?

(i) Switch the timer off and then on again to clear all registers.
(ii) Set Switch 3 for Minutes/Seconds or Hours/Minutes.
(iii) Set Thumb Switches to the total time period needed.
(iv) Set Switch 6 to INTERVAL.
(v) Ignore Switch 5 and Press Switch 4.

The thumb switch setting will appear on the display. The countdown will start and eventually the unit will time-out when the buzzer will sound. At no time will mains be switched to the socket.

4. The HOLD switch and RESET press button can be operated with the timer 'at rest' or at any time during the countdown, irrespective of whether the socket is switched on or off.

5. Switch 11 can also be operated at any time. This switch will reverse whatever the current state of the socket happens to be. Figure 10 shows graphically under what circumstances the socket is on or off when the various modes are being used. For example, with S11 switched to ALT(ERNATIVE) and using the unit as a TIMER, the mains socket is initially on, goes off as the set time is loaded, and switches on indefinitely after time T, when the unit times out. In the INTERVAL setting, with t loaded with press-button 5, the socket is on initially, remains on when the total running time T is loaded and the count down begins, and remains on until the interim moment is reached when it switches off for time t. At the end of the total timing cycle, the socket is switched live indefinitely.

6. Setting the first and third thumb switches to a figure greater than 5 and then loading this setting will cause the 7217 BIFI to mis-count.

Parts List

Resistors	
R1	4M7
R2	2K2
R3,4,5	10K
R6	1K
R7	3K3
R8,10	1M
R9	39
Capacitors	
C1,4,5,6,7,9,12	0.1
C2	22p
C3	82p
C8,13	1uf
C10	470n, 240vAC, Class X2
C11	470uf, 16 volt
Diodes	
D1-23	1N4148
D24,25	1N4001
Semiconductor	
TR1 N type, MOSFET	MTP3055A, or pin equivalent
Integrated Circuits	
IC1	4521 CMOS
IC2	4040 CMOS
IC3	4093 CMOS
IC4	7217 BIFI
IC5	4001 CMOS
IC6	7805 volt reg.
IC DIL Sockets	
Two at 14 pin, two at 16 pin and one at 28 pin	
Switches	
S1	Miniature Lever, On/Off
S2,4,5	Press to make
S3,6	Miniature Lever, SPDT
S7-10	Thumb Switches, 10 position, BCD
S11	Lever, SPDT, 240 volts, 10A
S12	Lever, DPDT, 240 volts, 10A
Relay	5 volt, 8A C/O contacts*
Miscellaneous	
Buzzer	Piezo Sounder
7-seg displays 1 and 2	Double, Common Anode
Fuse	8 amp, and holder
Transformer	6-0-6 volt secondary, ? Amp
Neon	240 volt AC
Mains socket	Standard surface type

PCB plugs and sockets, Case, etc

*This relay is in the Omron G6RN series and available from Farnell, order code 959-078.

What MONEY from ELECTRONICS?

1: THE dot.gone PHENOMENON

THE FIRST QUARTER OF THIS YEAR HAS SEEN THE SPECTACULAR CRASH OF MANY OF THE DOT.COM ORGANISATIONS AND RELATED TECHNOLOGY COMPANIES, SET UP AT THE BEGINNING OF THE INTERNET EXPLOSION. WHAT DOES THE FUTURE HOLD FOR BUSINESSES THAT - ON THE SURFACE AT LEAST - APPEAR TO HAVE NO BUSINESS WORTH THE NAME? MORE PERTINENTLY STILL, WHAT FUTURE CAN THERE POSSIBLY BE FOR OUTFITS WHICH ARE DEPENDENT ON SUCH BUSINESSES?

by Gregg Grant

Burnt Fingers, Burst Bubbles

The first half of this year has passed and with it the financial hopes of many new start-up businesses, especially in what - for want of an even more general term - I'll call electronics. By far the most spectacular of the failures have been in the dot.com sector, an area of the economy that was going to be the future, the very leading edge of what it's all about. Suddenly it's not even the past. What happened?

Almost exactly a year ago, this journal published the second part of my article Money From Electronics, in which I pointed out that some 11 Internet companies - recently floated on the London Stock Exchange and the Alternative Investment Market, (AIM) - had made some £1.1 billion for the 14 people involved. In fact, the market value of the Internet companies launched in the previous year was some £9.7 billion!

Since this sum was greater than the value of British Airways or the Royal Bank of Scotland - two of the truly major UK market-quoted businesses - how, I wanted to know, had this come about?

I was not the only individual asking this question it seemed: a number of financial analysts were also wondering how such businesses had risen so spectacularly. Were we seeing a repeat of the infamous South Sea Bubble, the 18th century's stunning piece of financial chicanery, or the marginally less crazy speculation of 1824 or even 1929? The answers weren't long in coming.

The Original dot.com Girl

Even allowing for the fact that some 75% of all new businesses fail, the collapse of the dot.com sector has had a style all its own. Undoubtedly the most visible of these burst bubbles had been last-minute.dot.com founded - amidst a welter of publicity - by Martha Lane Fox and Brent Hoberman. On the company's flotation, the shares rose an astonishing 28%, peaking at 487p per share. Lane Fox's stake in the company was valued at a cool £50 million or thereabouts, and all this on first year revenues of a mere £195,000.

When, however, the crash came it was every bit as spectacular as the launch. The shares at one point hit a low of 39.5p, before gaining some ground again. Presently, they hover around the 60p mark and Lane Fox's holding is now valued at a far more modest £5 million or so. The company - which markets restaurant bookings, airline ticket, holidays and gifts over the net - went even further into debt during the first three months of this year, by around a whopping £10.7 million.

A new chairman, in the shape of the former head of the Asda supermarket chain, Allan Leighton, was appointed to straighten things out. What had gone wrong?

Basically, along with many other dot.com outfits last-minute's business plan was a high risk one. Although its subscriber numbers have more than doubled to some three million, a paltry 1 in 10 of those who log on, actually buy the company's products. Hence the poor turnover, low income and - thus far - nil profits.

Another drain on the company's finances was the purchase of the French Degriftour company for £59 million. It also has a presence in other European countries, as well as joint ventures in Australia and South Africa. Although the company is optimistic that it can turn a profit by the end of 2002, its main business area is the on-line travel market, and this is an area that's getting

Name	Profession	Web Wastage
Delia Smith.	Television Cook.	£60million.
Gordon Ramsay.	Television Cook.	£5million.
Anthony Worrall-Thompson.	Television Cook.	£5million.
David Bowie.	Pop Star.	£30million.
Sir Bob Geldof.	Pop Star.	£5million.
Jim Kerr.	Pop Star.	£1.7million
Madonna.	Pop Star	£665,000.
Sir Alex Ferguson.	Football manager.	£10million.
Joanna Lumley.	Actress.	£5million.
Jonathan Ross.	TV Presenter.	£2million.

Table 1: The Celebrity Internet Farrago

tougher by the minute. In April this year for example, EasyJet sold over half a million tickets on-line, and their competitors - British Airways Go and the independent Ryanair - are close to that figure. Shortly too, the large national carriers are going to enter the market: whither last-minute dot.com when that happens?

The Easy Riders

Last-minute dot.com was by no means the only such outfit to reach financial meltdown, simply the most prominent. A moderate clutch of celebrities decided to either invest in the boom, or set up their own internet companies. Table 1 is a short list of people who, well-known in their own fields, decided to venture into a field they knew little - if anything - about. The results were - predictably - less than they'd all hoped for.

One city accountancy firm reckoned that Delia Smith's website for example - Deliaonline.com - was worth some £60million, and suggested that its creator bring it to the market. She did and now the site - which peddles recipes and football talk - is a pale imitation of what had been originally hoped for it. Yet the warning signs had been there since the beginning, for the site lost some £11,000 in 1999, before its Stock Exchange floatation.

Gordon Ramsay and Anthony Worrall-Thompson were two other catering stars who set up a website, this time Foodoo.com which, they claimed, would be THE site for food fanatics. The pair had originally hoped to float their creation for £100million or so. That didn't happen and when the accountants moved in, they found that not only were the accounts slack to the tune of £1.6million, but the staff claimed they were owed £80,000 and the assets amounted to a thin £130,000. Still, it WAS in cash!

Pop stars have fared no better than cooks in the dot.com gloss. David Bowie not only set up his own website, but also lent his name to another, the Bowiebank.com. This would provide customers with a credit card, cheque book, whatever. Now, 15 short months or so after the launch, the bank has collapsed but, had it been floated on the technology stock exchange Nasdaq, Bowie would have made a reputed £30million.

Sir Bob Geldof, Jim Kerr and Madonna also invested in dot.com sites and got their fingers burned. Others who also are somewhat wiser after investing are the football manager Sir Alex Ferguson, TV Presenter Jonathan Ross and the actress Joanna Lumley.

Why has this happened? In the case of the celebrities, it was simply the old, old story of the conman - or woman - conned. Their milieu of hype, spin and false TV bonhomie would - they fondly imagined - ensure that surfers would swamp their websites.

Where surfers raced to, advertisers would - the theory went - rapidly follow, resulting in lots of revenue, the site share price soaring and they - its sharp, ahead-of-the-game creators - becoming even richer than they already were. None of this of course happened.

In fact, so gloomy is the future for many of the internet set-ups, that the 'Sunday Times' newspaper predicted in a recent article that almost all technology shares are as good as doomed.

The dot.com sites however weren't then the only battle casualties of the technology share scramble. Among the most spectacular failures were the people who DID know what they were doing in this - frequently arcane - field: the software and hardware technologists themselves. Here too the shell-shocked, the badly crippled and the merely walking wounded could be seen, a select few of whom we'll look at next month.

Diary Dates

2 – 4 September. ExCeL, London.
ECTS – Computer & Video Games & Leisure
Tel: 020 8309 7000,
Fax: 020 8987 7521
www.ects.com

5 - 6 September. Business Design Centre, London.
Exhib-IT – IT Recruitment Exhibition
Tel: 01442 289 700
Fax: 01442 876 644
www.exhib-it.co.uk

11 – 13 September. NEC, Birmingham.
Total Marketing Solutions & The National Incentive Show
+44 (0)20 8910 7870

11 – 13 September. NEC, Birmingham.
The Recycling & Waste Management Exhibition
+44 (0)20 8277 5000

12 – 13 September. NEC, Birmingham.
Linux Expo 2001
00 33 1 43 458080

14 – 15 September. Olympia, London.
Visit – IT Recruitment
Tel: 20 8267 4000
Fax: 020 8267 4237
www.visit.haynet.com

18 – 20 September. Earls Court, London.
Geographic Information Systems Exhibition & Association for Geographic Information Conference
Tel: 020 8309 7000
Fax: 020 8987 7521
www.gisexpo.com

18 – 20 September. NEC, Birmingham.
e-Business 2001
Tel: 020 7596 5095
Fax: 020 7596 5098
www.ebusiness-nec.com

19 – 20 September 2001. ExCeL, London.
ECIF – Electronic Components Industries Fair
OnBOARD (Production Assembly Exhibition)
Tel: 01799 528 292
Fax: 01799 528 268
www.ecif.co.uk
www.onboard.co.uk

19 – 20 September. ExCeL, London.
MobileWorld Expo
Tel: 01923 676 867
Fax: 01923 676 747
www.mobileworldexpo.co.uk

19 - 22 September. Makuhari Messe, Chiba (near Tokyo), Japan.
World PC Expo 2001
http://expo.nikkeibp.co.jp/wpc/e/

21 – 22 September. Donington Exhibition Centre, Derby.
Leicester Amateur Radio Show
Tel: 01455 823 344
Fax: 01455 828 273

22 September. Assembly Rooms, Edinburgh.
Visit – IT Recruitment
Tel: 020 8267 4000
Fax: 020 8267 4237
www.visit.haynet.com

23 September. NEC, Birmingham.
National Vintage Communications Fair
Tel: 01392 411 565

24 – 27 September. Clarion Hotel Bay View, San Diego.
11th International FLOTHERM User Conference
www.flotherm.com/events/conferences/ususercon ference2001.htm

24 – 28 September. ExCeL, London.
European Microwave Week
Tel: 020 7861 6391
Fax: 020 7861 6251
www.eumw.com

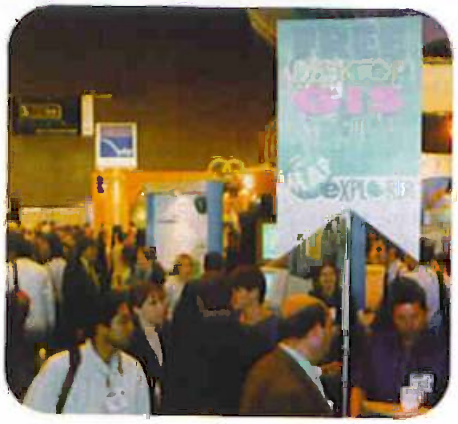
WHAT'S ON in Sept & Oct

Exhibitions

18 – 20 September.
Earls Court, London.

Geographic Information Systems Exhibition & Association for Geographic Information Conference

Tel: 020 8309 7000
Fax: 020 8987 7521
www.gisexpo.com



With the price of Geographic Information Systems (GIS) software and basic map and demographic data falling, more companies are utilising the technologies available and are discovering the potential of geospatial computing.

The Association for Geographic Information (AGI) is a not-for-profit organisation representing users and vendors of Geographic Information (GI) and GIS. Its members include government departments and agencies, local authorities, system and data suppliers and users from a wide range of commercial sectors including retail, finance, insurance and utilities.

The AGI Conference is twinned with the Geographic Information Systems Exhibition, which provides a valuable opportunity for existing and potential users to see Geographic Information Systems in action, as well as find out more about the business benefits GIS can bring to an organisation. There will be seminars, demonstrations and workshop programs, and over 130 of the key European vendors of GIS will be in attendance.

2 – 4 October. ExCeL London.

WorkPlace 2001

020 8910 7910
www.workplace-event.co.uk

This free exhibition is an event for anyone involved in the design and management of the workplace – something that covers large businesses, small businesses, or just the sole businessman or woman who uses part of his or her house as an office. Anyone who wants to buy furniture for the office or just pick up some inspiration is welcome to attend. Visitors are advised to pre-register through the website for their free tickets. This means you will save time and miss the queues when you arrive. An entry badge will be sent to you in advance of the show along with an information pack including a list of exhibitors, full show details and the seminar programme so you can plan your visit in advance.

3 – 4 October.
NEC Birmingham.

ProjectWorld.

020 8541 5040
www.imark.co.uk/proman

Formerly known as Project Management Exhibition, this is the 11th year of this, the largest exhibition in Europe for project management professionals. There will be over 50 leading consultancy, technology, tools and training suppliers, and you will be able to see around 50 live product demonstrations. There will be seminars and case studies and, of course, the ever present opportunity to network.

The four key questions to be addressed at the exhibition are listed on their web site as 'What's new in the industry?', 'What are the practical ideas and techniques that will assist you in your everyday work?', 'Who are the leading consultancies, technology and training suppliers?', and 'Who are the key players in the industry and what are they doing to achieve success?'

8 – 11 October.
NEC Birmingham.
Metals Engineering 2001.
01737 855 528.
www.dmgworldmedia.com

This five-yearly event has come around again for the fourth time. When last staged in 1996, Metals Engineering attracted over 15,000 metals industry buyers, including more than 4,000 key purchasers from five continents. The event is actually many different exhibitions under the same collective banner.

These exhibitions are:

- Aluminium UK.
- Castings International.
- Engineering Adhesives.
- Forging International.
- Furnaces International.
- Foundry International.
- MetFab UK Including Press Worker Show.
- Surface Engineering.
- Toolmaker Show.

Entry is free of charge as long as you register via the web site, where you can also find more specific information about all the exhibitions listed above, and also the seminars and conferences taking place over the four days of the event.

9 – 11 October.
Messe International,
Stuttgart, Germany.
Embedded Systems Conference (ESC) Europe.
020 7861 6330.
www.cliembedded.com/esce

According to its organisers, ESC Europe is the only European embedded event focused on delivering a top quality conference programme with an exhibit floor to demonstrate the most innovative products in the embedded arena. After two years in Maastricht, the conference has moved to Stuttgart, which the organisers consider to be a better option for its visitors because of its location and the prestige associated with the Messe International venue.

Keynote speaker will be Andrea Cuomo (see picture), VP of Advanced System Technology at STMicroelectronics. David Larner, Conference Co-Chair, says about Mr Cuomo 'We're delighted to welcome such a prestigious speaker to ESC Europe. Mr Cuomo is one of the industry's most prominent experts. Set in the heart of the electronics market, we, along with all the delegates are looking forward to hearing his thoughts and views on the latest embedded technologies and issues'.

New subjects in the programme this year include wireless and Internet connectivity, Java programming, C and C++, UML and Automotive design. The first day will consist of tutorials on areas such as Real-Time Unified Modelling Language, System Design and TCP/IP Networking. Alongside the exhibition, the last two days will hold classes on hot topics like Verilog HDL, Bluetooth technology, RTOS and UI for 3G Mobile terminals, and OSEK OS/OSEKtime.

There will also be a panel session on the final day entitled 'Hard cores Soft cores, What cores – the designer's dilemma'. Top experts to debate on the subject will be Kevin Kissell, Senior Architect at MIPS Technologies, Jim Turley, ARC's VP of Technology Strategy, Jean-Marie Rolland Chief Operating Officer of SuperH, Mat Newman, Senior VP of Technology at Celoxica and Jim Tully, Chairman of Data Quest.

14 – 17 October.
La Quinta Resort,
La Quinta, California.
Consumer Electronics Association (CEA) Industry Forum and Fall Conference.
Tel: 703-907-7600
www.CE.org

The CEA Industry Forum and Fall Conference is a consumer electronics event for industry networking, leadership and education. It will be a three-day event featuring discussions on digital television, emerging audio technologies, home networking, mobile electronics, wireless communications and consumer electronics accessories.

The Forum will also provide a more casual setting for executives to make strategic partnerships and connections within the industry. Some 300 executives from 125 consumer electronic companies are expected to participate in meetings, seminars, and association governance sessions.

Postponement

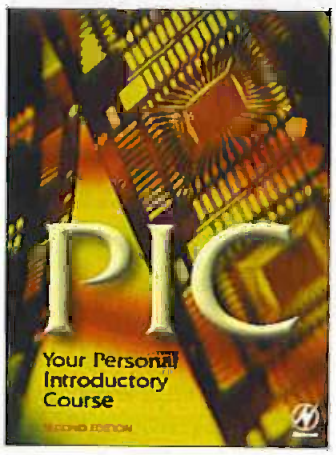
The two day Electronics Information Displays (EID) exhibition has been postponed from its previously announced start date of October 2001 (as listed in some other electronics magazines) and will now be held over 13th and 14th February 2002.

According to the organisers – Trident Exhibitions – the postponement decision was taken not for negative reasons but because the opportunity came up for them to co-locate the event with their other February events at the NEC, namely mtec (the exhibition and conference for Sensors, Measurement & Instrumentation), IPOT (Image Processing & Optical Technology), Machine Vision, Machine Building, Practical Vacuum and 3C (Contamination Control & Cleanroom Products).

We will bring you more on this event when it gets closer to the time. In the meanwhile, if you need to talk to anyone about the postponement, you can contact Louisa Pridham on 01822 614 671.

Please send details of events and exhibitions to jaldred@kanda.com.

Bookshop



PIC: Your Personal Introductory Course (Second Edition)

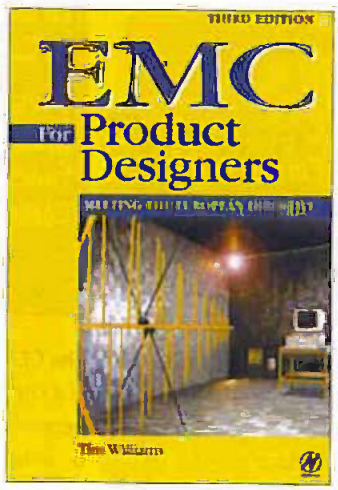
John Morton offers a uniquely concise and practical guide to getting up and running with the PIC Microcontroller. The PIC is one of the most popular of the microcontrollers that are transforming electronic project work and product design, and this book is the ideal introduction for students, teachers, technicians and electronics enthusiasts.

Assuming no prior knowledge of microcontrollers and introducing the PICs capabilities through simple projects, this book is ideal for use in schools and colleges. It demystifies the microcontroller with an emphasis on putting the PIC to work, through step-by-step explanations, not theoretical microelectronics: this is not a reference book – you start work with the PIC straight away.

The PIC5x series, P12C50x series, and P16C71 are featured, and the revised second edition covers the popular reprogrammable EEPROM PICs: P16C84/P16F84 as well as the P54 and P71 families.

The Author: John Morton of Cambridge University is an expert in PIC and is a very well qualified and popular speaker on the subject.

Pages: 288pp
Price: £12.99



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The Author: Tim Williams has worked for a variety of companies as an electronic design engineer over the last 20 years. He has monitored the progress of the EMC Directive and its associated standards since it was first made public. He is a member of the Institution of Electrical Engineers and now runs his own consultancy, specialising in EMC design and training.

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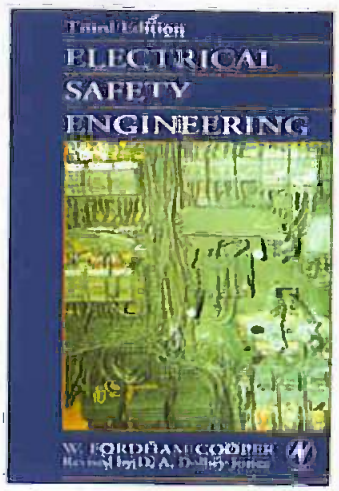

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The Author: In writing this book, W. Fordham Cooper drew on his long experience as HM Electrical Inspector of Factories and a consultant to the Insurance Technical Bureau. D A Dolbey Jones, who has revised this work for its third edition, adds his own insights gained as an HM Senior Electrical Inspector with the Health and Safety Executive, responsible for steering the project on the Electricity at Work Regulations and the official Memorandum of Guidance on the Regulations; and as a Senior Engineering Inspector with the Department of Energy (now the DTI).

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SONY VPL-CS3 Projector

THE VPL-CS3 IS A HIGHLY PORTABLE TRAVEL PROJECTOR DESIGNED FOR DELIVERING PRESENTATIONS WITH HIGH RESOLUTION AND THE MINIMUM OF FAN NOISE. IT WEIGHS LESS THAN 2.5 KG AND COMES WITH A PROTECTIVE CARRY BAG, ALTHOUGH THE LENS AND CONTROLS ARE PROTECTED DURING TRAVEL BY A PROTECTIVE FLIP-DOWN PANEL.

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The brightness of the image produced is 700 ANSI lumens – enough for screen sizes up to 2m width even in bright environments. The estimated lamp life for the lamp used in the VPL-CS3 is about 2000 hours. This is about 3 years, based on a usage of 2-3 hours per weekday.

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The after sales program provided by Sony is called PrimeSupport (available in the EU, Norway and Switzerland) and it promises specialist telephone support, a 1 year warranty, free dispatch of a loan unit within 24 hours should the product fail, and all repairs to be carried out by the original manufacturer.

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Full details about the projector can be found at www.sonypresentation.com/uk/ed, where you can also find details of a special promotion, open until the end of November 2001, offering a 10% discount off the price of the projector as listed above.

The CAT FEEDER

by David Ponting

THE TROUBLE WITH PETS IS THAT THEY TIE YOU TO THE HOUSE AND PREVENT YOU NIPPING OFF FOR THE ODD WEEKEND SIMPLY BECAUSE THEY NEED TO BE FED REGULARLY.

We have two cats. They are wonderful company and we wouldn't be without them for the world, but my wife and I are recently retired and it would be nice to exploit our new freedom and leave them for a few days at a time without having to rely on the kindness of neighbours to pop in every day to feed them. There is always a cattery of course but cats are unsettled by unfamiliar surroundings, and as pensioners, we cannot overlook the cost: two cats for a week, £65!

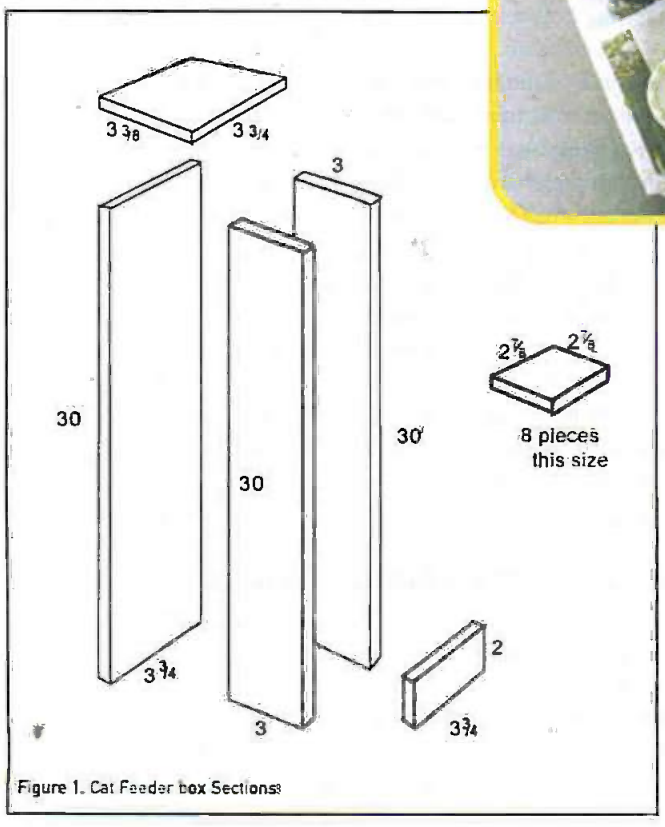


Figure 1. Cat Feeder box Sections

And so I investigated professionally made cat feeders at the local pet shop. Basically I found two kinds. The first had no more than two closeable compartments which could be set by a clockwork mechanism to open at different, predetermined times up to 36 hours into the future. It was made of light plastic and it seemed to me that a couple of hungry cats would have had it in pieces in no time flat.

The second type consisted of a dish divided into 4 quarters, each of which could be filled with food. An inverted bowl-like cover with a quarter segment cut away fitted on top of the food section, exposing a quarter of the food immediately. A clockwork motor rotated the upper lid very slowly indeed, exposing further sections as it wound down over a 36 hour period. This method gave three future feeds but its big drawback was that the rotation of the upper lid exposed the next meal infinitesimally slowly and my two cats were driven to desperation as the next segment came oh so slowly into smell and view. In fact they quickly found that they could tip the whole thing over and so get the lid section off anyway.

Consequently it became obvious that if my wife and I were going to get any holiday time away from our home we were going to need a bespoke cat feeder which would be substantial and reliable. But beyond that, it was essential that the cats could be fed over a much longer period than just a couple of days.

So what were our requirements? We started with something of a plus: our two cats had been properly brought up (from our point of view) and ate only dry food. Consequently in our cat feeder we had no need to keep future meals fresh and/or refrigerated. Further I took advice from our local vet and she was pretty clear that provided they have enough drinking water, dry food alone is a perfectly adequate diet for cats. She also said that if your cat insists that it will only eat the moist stuff, be reassured. However finicky it might appear to be, when your back is turned it will always eat (and enjoy) dry food eventually. In other words, if it is hungry enough to try it. So the design of our automatic feeder was to be built with only dry food in mind.

Secondly, as we have two cats, I arbitrarily decided that the maximum requirement was a feeder which would provide food for two cats for a period of up to a week.. As it turned out, building something to feed both animals for 8 days involved no greater complexity than feeding them for 7, so that became part of the specification.

Thirdly, as we normally feed our cats twice

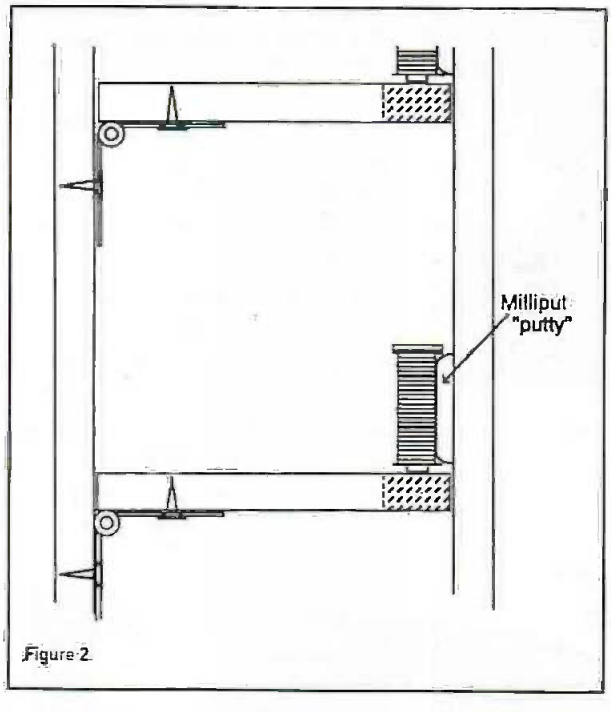


Figure 2

a day I wanted the feeder to have the potential to provide either a full meal for the cats once each day or half a full meal at 12 hour intervals. The latter would be an option to use when we were only going to be away from home for short periods. But for absences of more than 4 days, the feeder should be capable of providing a double, full-size feed just once in the day, and the cats would have to put up with that. Fortunately they do not squabble over their food and so can be fed together. And as most cats do, unless they are ravenous, they snack over a period rather than wolf everything down at once.

Having decided upon the general specifications, I started to think about the construction details.

I have no skill with wood. Simple electronics I can cope with but wood seems to split if I as much as look at it. So, as far as I was concerned, the general construction had to be straight forward and made from a very much more user-friendly material than wood.

Now, where some people have discovered Smirnoff, I have found 'BCE Cellular Extrusions' which seems to be a kind of highly compressed version of polystyrene. It is a most forgiving material designed apparently for use as 'Cladding, Trims, Soffits and Fascias' (whatever they are) and available from most good DIY, Hardware and Building Outlets. You can cut it, file it, drill it and tap it, and even if your woodwork is as bad as mine, this plastic medium remains infinitely understanding. In addition BCE is much more hygienic and easier to keep clean than wood or metal, in fact perfect for a food dispenser. It seems to be available in a number of different cross sections, sizes and angles but I could only find it in one thickness: 3/8th inch, which is fine for our purpose. But because of this, all the working dimensions of BCE sections used in the cat feeder are given in imperial rather than metric units.

The makers of dry food for cats recommend somewhere around 75 grams a day for the average adult cat and it so happens that the150 grams necessary for 2 cats will fit nicely into a 3 inch cube. And if your cat is too fat to be average, I suggest that you feed for the typical and enforce a diet while you are away on holiday.

The general shape of the feeder is a tube, 3 inches square in internal cross section, and of sufficient length to allow eight compartments to be created inside it. Each compartment needs to be separated from neighbours by hinged doors made of the same Cellular Extrusion. In use the compartments will be filled with food and the tube attached vertically to a convenient wall. In this position each door is held closed horizontally but at the correct moment and starting with the lowest, each can be released allowing the food in its compartment to fall out through the open lower end.

The overall height of the tube then must be tall enough to accommodate the eight, 3 inch compartments as well as the thickness of eight doors. However since the hinge of the bottom door has to be screwed to something, I increased the height of my tube a further 3 inches so that when the bottom door is hanging open, its lowest edge is level with the bottom of the tube. This results in an overall height of (8 x 3 inches + 8 x 3/8 inches + 3 inches) or 30 inches.

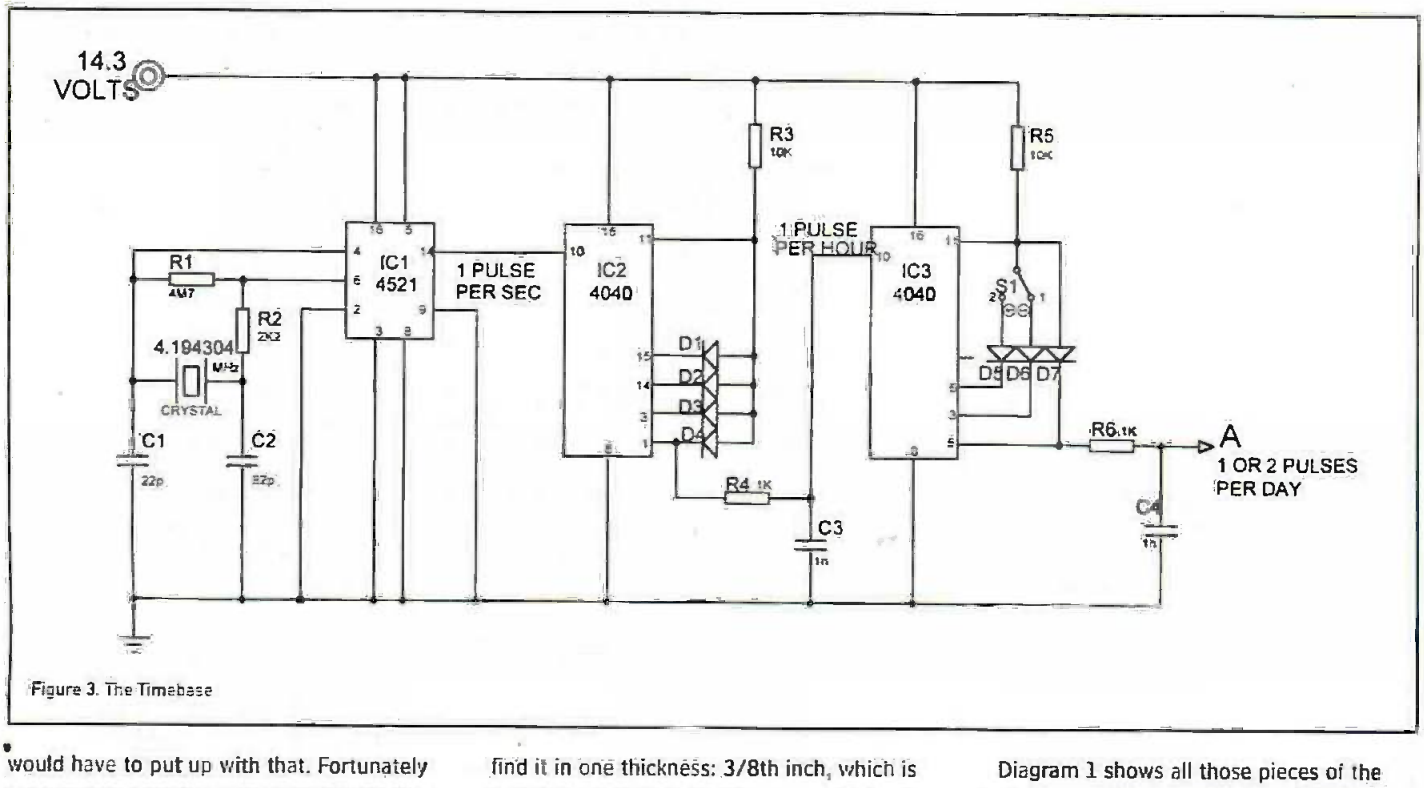


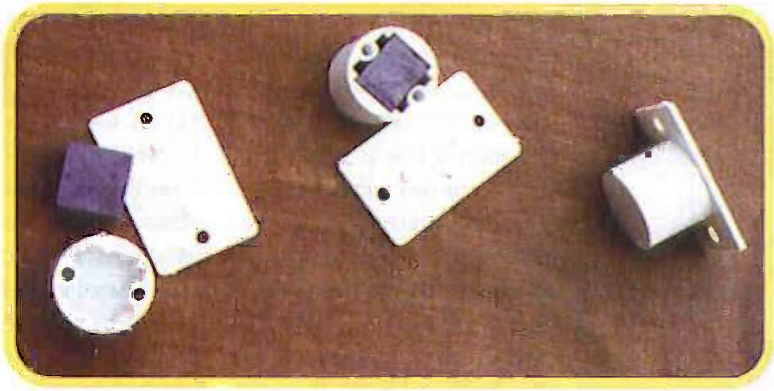
Figure 3. The Timebase

Diagram 1 shows all those pieces of the feeder box which are made from Cellular Extrusion. The back section of the tube is 3 3/4 by 30 inches and each side piece is 3 by 30 inches. The back section is screwed onto the rear edges of the two side panels, and the top is cut 3 3/4 by 3 3/8 inches to allow this piece to be screwed onto the top edges of

the back and both sides. The construction so far will be a long box with its lower end and front face open. To strengthen the base a small piece of Extrusion, 3 3/4 inches by 2 inches is secured in place across the bottom of the front face. All these pieces can be screwed together using 1 inch, No. 4 wood-screws. No countersunk holes need be cut as Extrusion is soft enough to indent as each screw is tightened. But for the moment screws should not be driven home completely as the remainder of the assembly will require that the side sections of the box be taken apart again for further work.

Finally, the eight hinged doors. These are to fit very loosely when they are held horizontal in the box. Consequently they should not be 3 x 3 inches but about 2 7/8 inches square. Then, using 3/8th wood screws, one face of each door is screwed to half a small hinge. When buying hinges check that they will turn very freely and, if necessary, open up the metal around the pins if they are too tight.

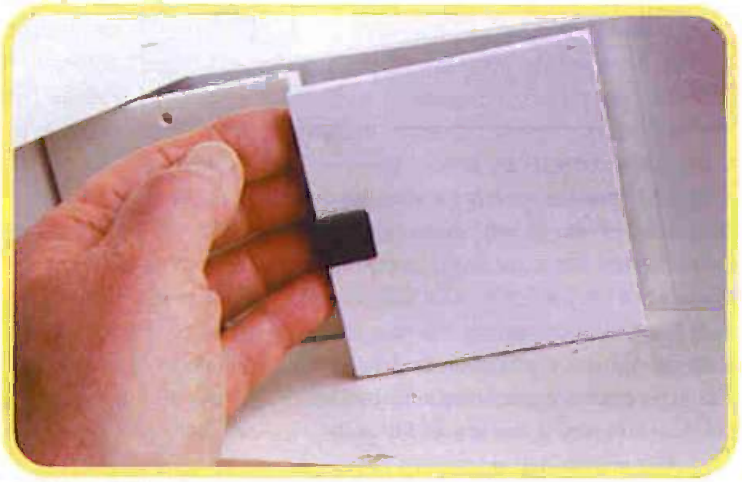
Small magnets are used to hold the doors closed. A very convenient source is the magnet which can be reclaimed from the round version of magnetic reed switches normally used as door-open sensors in a burglar alarm system. Each reed switch comes as a pair: the magnetic half is the one with no connection terminals. Conveniently the flat face peels away from the cylindrical section, revealing a small magnet only fractionally thicker than the material of the door. Cutting into the door edge a square which is slightly smaller than the magnet allows it to be secured in place just by friction. Magnets obtained from these reed switches may be square or rectangular but both types work.



The flat face of a reed switch peels away from the cylindrical section, revealing a small magnet.

However, before any magnets are fitted, get all eight together and stack them one on top of the other to ensure that each has the same magnetic pole uppermost. Then without turning them over, fit the magnets into their doors.

When all the doors have their hinges and magnets fitted, they can be screwed in place.



Check that each door is centred on the panel and rotates freely between horizontal and hanging (more or less) vertically

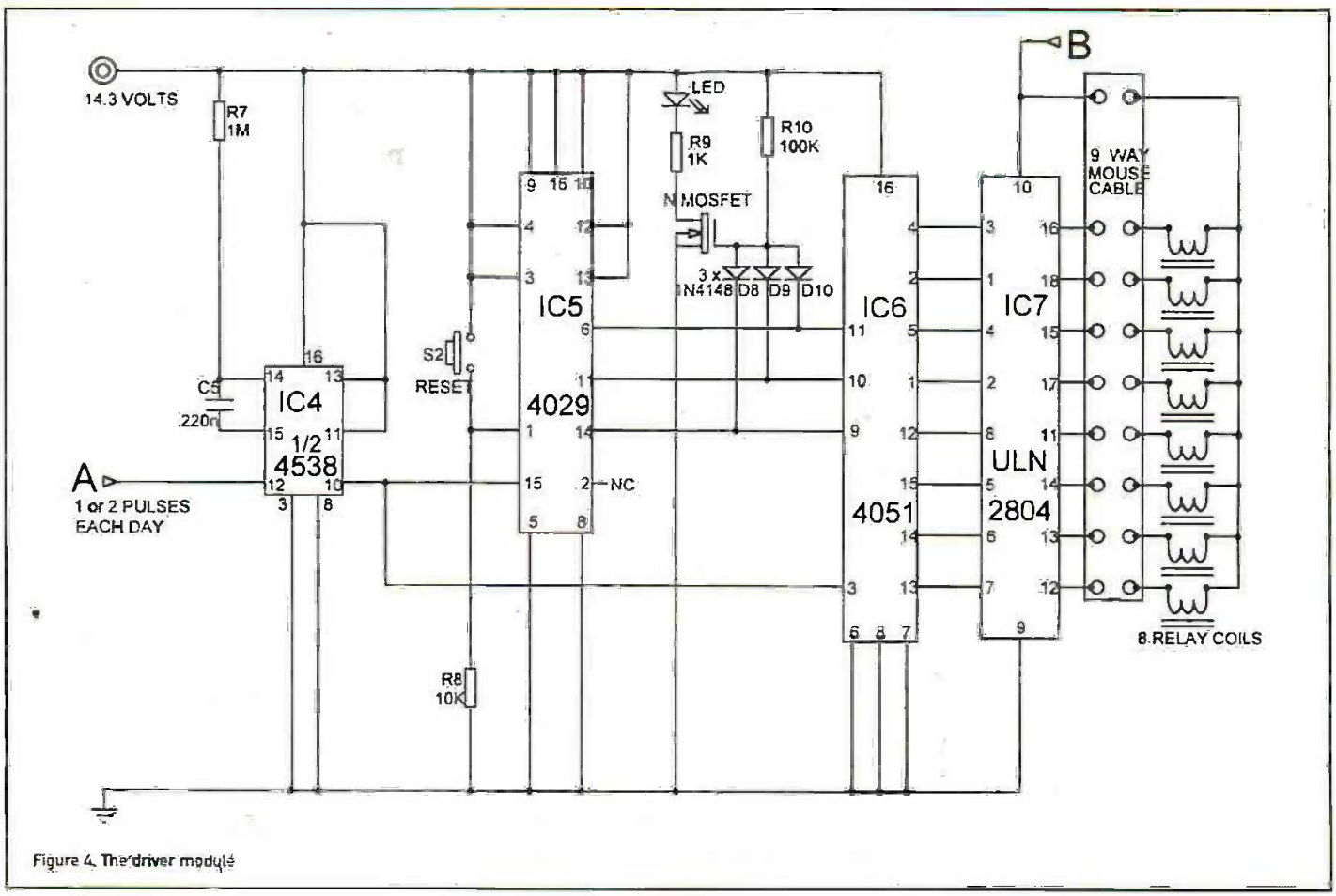
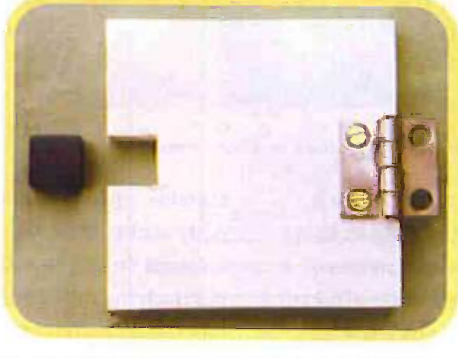


Figure 4. The driver module

Remove the left panel of the feeder box and mark its inner face with horizontal lines: the first 3 inches from the top, the second 3/8ths down from that line, then 3 inches from that line, then 3/8ths from that; and so on until 16 lines have been drawn. These represent the positions of the top and bottom faces of all 8 doors.

Now the second half of the hinges can be screwed to the inside of the left panel. The lines drawn should help to get all the doors fixed in the correct positions but it is probably worth mentioning that as the doors are to drop down by rotating in a clockwise direction as seen from the front, the hinge should be underneath its door when it is attached to the left side panel. Check that each door is centred on the panel and rotates freely between horizontal and hanging (more or less) vertically.



Cut the slot for the magnet undersize so it will just push in

Diagram 2 shows how the hinge is to be attached to its door and left side; the permanent magnets are embedded in the centre of the right edge of the door. The diagram also shows how each magnet is attracted to the core of an electro-magnet.

Further details about these and how the doors are then operated is given later.

That is most of the construction completed but before the rest is described, I want to get to the part I find much more interesting: the electronics. The project has been designed using only standard components which are easily obtained.

The complete circuit can be built on one, single-sided printed circuit board. There are no problems about making this PCB if you prefer to etch your own, but it does need to have a full-size earth plane in order that all ground points are connected.

For easier description, the circuit breaks down into three modules of which the first is the Timebase.

The feeder needs to be driven by a real-time clock in order that the cats are fed regularly at more or less the same time every day. IC1 is a CMOS 4521 oscillator/divider chip. Using a standard 4.194304 MHz crystal, the circuit set up around pins 4 and 6 outputs one pulse per second from pin 14. This is input into pin 10 of a CMOS 4040 chip used here as a programmable divider. When wired as shown, IC2 divides by 3600 the input frequency of one per second, consequently outputting from pin 1 a pulse every hour. R4 together with C3 forms a low-pass filter which suppresses any spurious switching spikes. The output of one pulse per hour is input into pin 10 of IC3, also set up as a divider. With S1 in position 1 it divides by 24 and in position 2 by 12. Consequently the output at A is either 1 pulse every 24 hours or 1 pulse every 12. Again the R6/C4 combination eliminates spurious spikes.

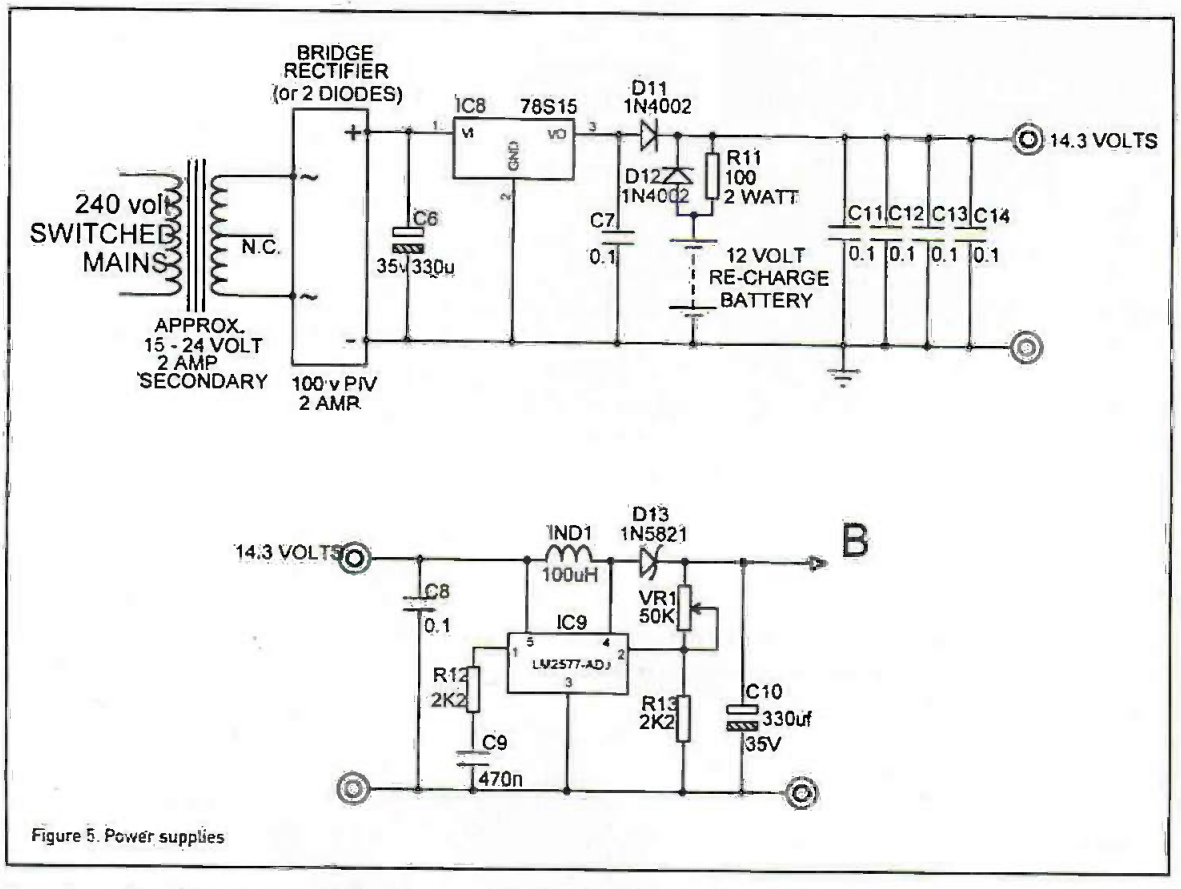


Figure 5. Power supplies

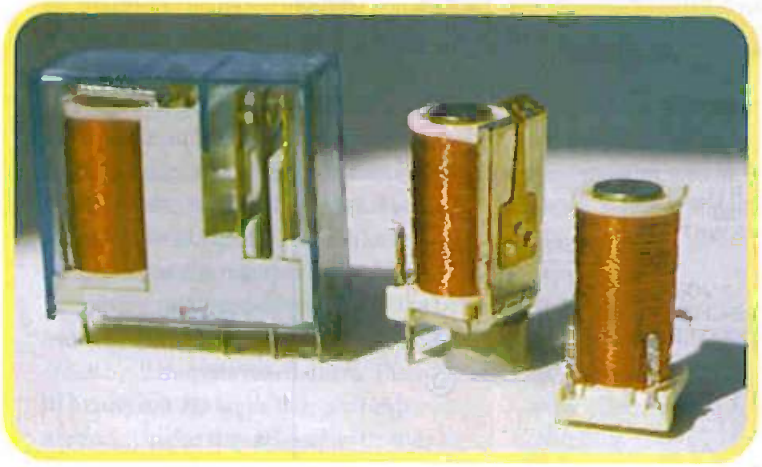
The 1 or 2 pulses per day from A on the Timebase Module connect to pin 12 of IC4, the input of one of two monostables in the CMOS 4538. On the rising edge of each input pulse, a clean, approximately quarter-second pulse is output at pin 10, the exact length being determined by R7 and C5, the timing elements for this monostable. Grounding pin 3 ensures that the second (and unused) monostable on board this chip is reliably switched off. The output pulse at pin 10 is sent both to IC5 pin 15 and to IC6 pin 3.

Dealing first with the CMOS 4029 Binary/Decade Up/Down counter. Holding its pin 9 high results in the counter counting in binary rather than decimal, and holding pin 10 high makes the IC count up. The binary total at any time is output from pins 6 (least significant digit, LSD), 11, 14 and 2 (most significant digit, MSD), incrementing from 0000 to 1111. For normal counting, pin 1 is held low by R8 but when taken high by pressing button S2, the total is reset to 1111 because all the 'jam' inputs (pins 4, 12 13 and 3) are held high. The maximum count for this IC is 1111 but in this application output pin 2 is left unconnected as we only need to use the eight numbers from 000 to 111.

Diodes D8, D9 and D10 together with R10 form a three input AND gate. Hence the N-channel MOSFET will only switch the LED on when the binary number from IC5 is 111. Consequently when Reset button S2 is pressed the LED will always light and we can be assured that the next pulse at IC5 pin 15 will increment the count to 000.

Whatever the binary output of IC5 happens

to be, this binary number is input into pins 11 (LSD), 10 and 9 (MSD) of Multiplexer/Demultiplexer IC6 which is used here as a one-pole 8-way switch. Depending on the binary number present on its pins 11, 10 and 9, common input pin 3 is directly connected to one specific output pin selected from 13, 14, 15, 12, 1, 5, 2 and 4: for example, 000 joins pins 3 and 13, 011 joins pins 3 and 12, and 111 joins pins 3 and 4.



The electro-magnet removed from the relay

All these separate outputs are connected to corresponding inputs on the high current driver IC7.

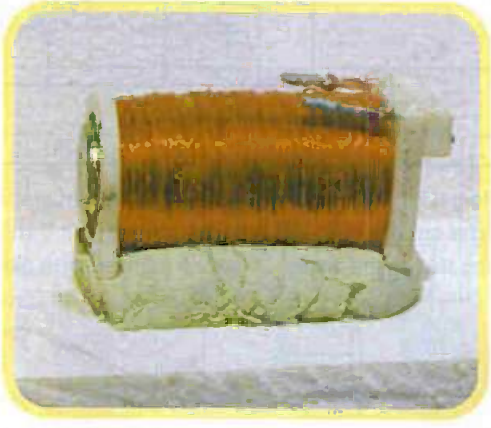
Now it is possible to see what happens to the quarter-second pulse from IC4 pin 3 into both IC5 pin 15 and IC6 pin 3. On the rising edge of this pulse the binary number being output from IC5 is incremented by 1. Immediately IC6 pin 3 is connected to a different output pin and the same quarter-second pulse is switched to a new input of IC7. This results in a high current quarter-second pulse from its corresponding output. It can be assumed that each new pulse from IC4 clocks the 4029 faster than the old output from IC7 can be operated So each new pulse triggers a high current output from the next one in line and there is no initial 'leak' from the previous output.

So now we are at the stage where we have to consider exactly how the doors of the feeder are operated.

I first looked at a number of mechanical systems using solenoids but besides the high cost of eight of them, I found that the cams and bearings which were needed to release the doors were difficult to cut and shape, not to mention the precision necessary to position and secure them if the mechanism was not to jam.

There had to be a simpler solution. Electro-magnets holding to small pieces of ferrous metal embedded in the surface of each door seemed a better idea but this appeared to have three serious drawbacks. First, to keep a door closed, current had to flow through its electro-magnet all the time until the door was released. Consequently the total current needed initially to hold all 8 doors shut was far too high for battery back-up which I intended to include in the design against the possibility of mains failure. Secondly, the easiest way to recharge the feeder with food was to disconnect it from the drive unit. Of course with no power supply the doors would not stay shut. Thirdly, I could not find suitable electro-magnets anywhere at any price!

I tackled the third problem first. Relays use electro-magnets and the ones in miniature relays I found the near perfect solution. They are small, relatively inexpensive and the relays are constructed so that the coil can easily be liberated. The electro-magnet in a 6-volt, 60 ohms relay coil, made by Finder (Part No. 4031-9006) is probably the easiest to remove from its case but a similar coil from almost any small 6-volt relay of this type will do. Better news still is that this kind of relay is frequently to be found in the lists of surplus items available from many suppliers: I bought all of mine at three for £1!



Use Milliput Putty to secure the electro-magnet

Having removed the electro-magnet from the relay, the only other preparation needed is to trim the supply pins which extend beyond the end of the coil and to cut away the flat vertical metal section that would otherwise run its full length. . This cut needs to be made with some care so that neither saw nor vice can damage the winding and the remaining tags of the coil.

Solutions to the other problems followed. It occurred to me that if a permanent magnet was embedded in the surface of the door instead of just a small piece of ferrous metal, the doors would stay shut without power because the magnet would hold onto the soft iron axis of the coil. Then, if a current pulse through the coil could produce a magnetic field strong enough to oppose that of the permanent magnet, the like poles created would repel and the door would open. And it did! However, to produce a large enough electro-magnetic field I had to use quite a high current, i.e. the 6 volt coil with a much higher voltage. In fact I found experimentally that I needed about 24 volts to produce a big enough reverse field for reliable release of the doors. Now I know that this sounds like poor practice but it really is not. Twenty-four volts applied to a 60 ohm relay coil makes it pretty warm but not hot enough to burn out even if kept connected indefinitely. In this circuit the burst of 24 volts at 2/5ths amp lasts for about a quarter of a second and produces no discernable increase in temperature.

So this solved both the other problems: no current is wasted in just keeping the doors closed, and they are held firmly shut without applied power while the feeder is being recharged with food.

The prepared relay coils should now be fixed into the feeder. Remove the right side panel from the box and mark horizontal lines across the inside face, with the first 3 inches down from the top, the second 3 3/8ths down from that, the third 3 3/8ths down from that, and so on until 8 lines have been drawn. Also draw one full-length vertical line to divide the same face in half. The 8 relay coils should be glued to this surface, each on the centre line and with the protruding end of its soft iron core level with a horizontal line. Probably the best way to glue the relay coils in the correct position is to use Milliput Putty which is prepared by kneading together equal amounts of yellow and grey putty sticks. When they are mixed so that no coloured streaks remain, use small amounts to attach the relay coils. The fact that using this kind of putty results in the coils being held well proud of the surface is in fact an advantage. Leave the putty to set hard for 24 hours and do not be disturbed if all the coils immediately spring off as soon as the board is subsequently worked on. Now that the rock hard Milliput has provided the coils with a flat surface they can all be immovably re-glued with a more elastic adhesive such as Bostik.

Drill small holes through the side panel close to where the coils are fixed so that two

power supply wires for each coil can be brought to the outside of the box. Then reattach this panel to the rest of the feeder and check that each door will be held closed by its magnet. It is also worth checking to see if a brief 24 volt pulse to each coil from a bench supply will release its door. If it fails to open, connect the supply the other way round but also note that if the magnets have been correctly fitted, every door should be released with its coil connected to the supply with the same orientation.

The transformer should be able to deliver 15 to 24 volts at 2 amps and the printed circuit board will allow the use of either a single secondary with a 2 amp bridge rectifier or two 1 amp diodes for use with a centre-tapped winding. The full-wave rectified output is smoothed by C6 and regulated by a 78S15 IC. This is the 2 amp version of the standard 7815. C7 largely eliminates high frequency ripple on the output of the voltage regulator.

As I mentioned above, quite early on in my thinking it had occurred to me what a disaster it would be if the mains supply failed at a time when a compartment door of the feeder ought to have opened. That one blocked door would prevent any more food from being dispensed. If mains failure happened early in a holiday period, the cats would really suffer. Consequently, proper battery back-up had to be incorporated into the design and had to provide sufficient power to run the whole system for at least a few hours. R11 allows the trickle charging of a maintenance-free, sealed lead-acid 12 volt battery of around 1 ampere-hour capacity. A fully charged battery of this type will drive the whole feeder for many hours. So if the mains supply is interrupted when the feeder is in use, the battery will take over and diode D11 will prevent the battery from discharging the wrong way back through the voltage regulator. At the same time D12 will short R11. This arrangement means that there will be no discernable power spikes or gaps within the system either at mains failure or on recovery. Note that the circuit is only fully off when both the mains and the battery are disconnected and if the feeder is to be left unused for a period, the battery must be unplugged or it could be damaged by too deep a discharge.

Note that D11 reduces the normal working voltage of the circuit to about 14.3 volts. This is a suitable voltage for battery charging but when the battery is the sole source of power D12 will reduce its output to about 13.6 volts.

A few (so far unmentioned) capacitors, C11-14, are distributed throughout the electronics to de-couple the system where necessary and to limit the harm that power interruption glitches might otherwise cause.

The second power supply is a DC-to-DC converter, employing a 5-pin IC very similar to, and just as easy to use as the familiar LM317 variable voltage regulator. Fixed voltage versions of the LM2577 are available but the -ADJ type allows the output voltage to be set by selecting the ratio of VR1 to R13: Output Voltage = 1.23 1 + (VR1/R13) . In general, input voltage to this IC can be anywhere from 3 ? to 40 and the output voltage can be set to provide up to 60 volts. The current should be limited to a maximum of about ? amp.

As there is around a 2 volt drop across each active switch in IC7 and my relay coils need 24 volts to open the doors, this DC-to-DC converter must supply about 26 volts. VR1 allows this output to be set. A critical component is D9 which must be a Schottky diode, the same or similar to the type shown.

The DC-to-DC converter is required to supply, albeit briefly, 26 volts at 2/5ths amp. Assuming that the converter is 100 efficient (and it will be nowhere near that!) the required input current at 14.3 volts will be nearly 3/4 amp. Inefficiency, together with the power requirements for the rest of the circuit, mean that occasional 1 ? amp surges occur. This accounts for the recommendation that the transformer should be able to supply 2 amps. The above might seem to imply that both D11 and D12 should be 2 amp diodes but this is not really necessary. The data sheet for the 1N4002 shows that it will carry 30 amps for brief periods and 2 amps for rather more than 2 seconds. Such diodes have to be designed in this way as they are often required to charge large capacitors which initially present a virtual dead short!

That completes the description of how the circuit works.

Diagrams 6 shows the bottom copper of the PCB, and Diagram 7 is included to help in the correct insertion of components. It is always good practice to turn pre-set variable resistors to their centre positions before they are soldered into a PCB and this is true of VR1 in this design. When the board is completely populated and being tested, check that with VR1 at its centre of travel, the voltage on pin 10 of IC8 is about 15 volts. Increasing the resistance of VR1 should increase the voltage to a maximum of

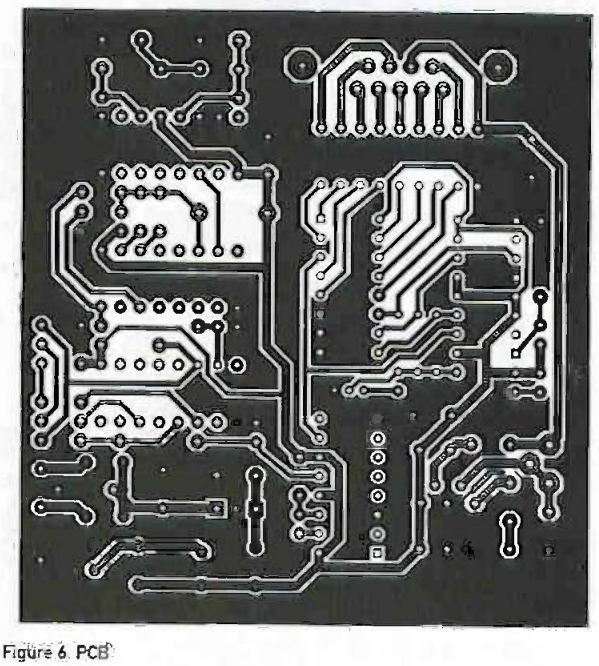


Figure 6. PCB

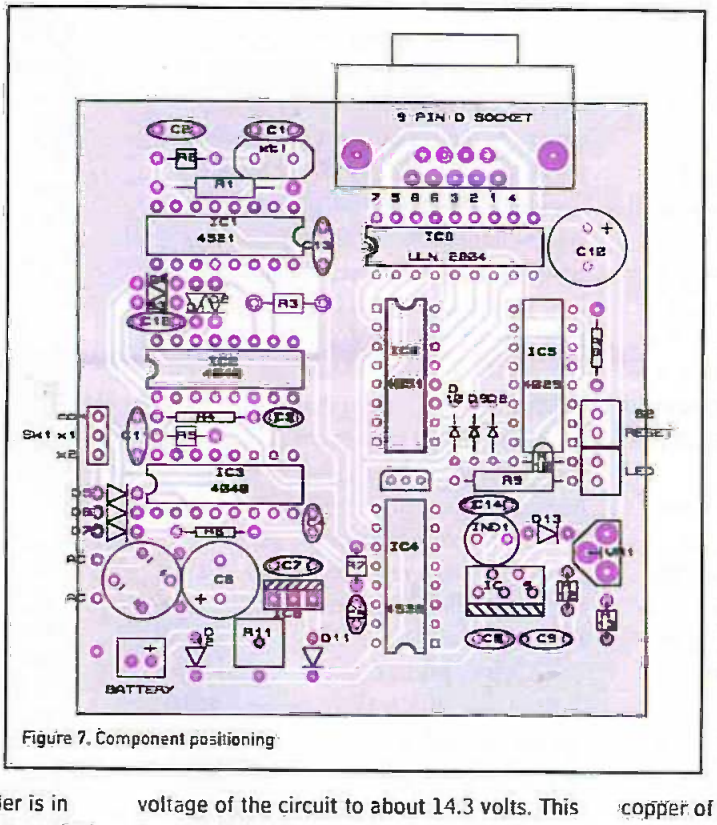


Figure 7. Component positioning

about 30. You may find your relay coils need a different voltage to the 26 volts which will reliably release the doors of my feeder. So when testing out your system, VR1 should be carefully adjusted to set the voltage at pin 10 of IC8 to just a little more than the minimum necessary to do the job.

On the PCB the outputs from IC7 terminate in a right-angle, D-type, 9 pin socket. All the wires from the 8 relay coils should be soldered to a similar socket fixed at the top of the right hand side of the feeder box. Wire up the relay coils to the socket preferably with rainbow wire so that connection mistakes are avoided. Ensure that when the PCB and the feeder box are connected by a standard 9 way, male-to-male serial cable, IC7 pin 10 will be common to all the coils, the first coil is also connected to IC7 pin 12, the last to pin 16 and all the others are correctly paired off in between. Also cover the surface wires on the feeder with a piece of plastic channelling to prevent the cats from playing with the otherwise exposed connections.

One of the things we have not so far considered is how the front face of the box will be closed off. I made a front panel out of 5 mm perspex so that I could see the doors opening and so be reassured that they were not jamming. If you want the same assurance, you will need to cut a piece of perspex which is 3 3/4 inches wide and about 29 inches in length. This means that when it is in position and butt-joins with the small piece of Extrusion at the bottom of the front face, the perspex will overlap the top of the box by about an inch. This exact dimension is unimportant but a little overlap at the top will allow a finger grip for removing the front face when it has been finally fitted.

In order to fill the feeder with food, this cover must be easy both to remove and replace but it also needs to be immoveable (from the cat's point of view) when fitted. I used two, 28 inch lengths of 3/4 inch angle-plastic, and cut (with scissors!) one face of each to be 3/8ths wide. With the feeder box horizontal the perspex was placed in position and small screws were used to screw the prepared sections of the angle-plastic onto each side face of the feeder, leaving the front panel trapped top to bottom by the 3/8th faces. Consequently when the feeder needs filling, the perspex can be slid out vertically from its side glides but is securely held in place when the feeder is in use.

And finally the electronics and back-up battery must be fitted into a suitable box which will provide access to the switches and the LED, as well as permit the serial cable to mate with the D-type 9-way socket on the PCB.

This is a simple circuit which does not allow the exact setting of the moment when the first door will open but as a rough guide it will do so about 6 hours after the unit is first connected to the power source if the option of twice-a-day feeding has been selected, and after about 12 hours if the cats are to be fed once a day. After the first door is opened, the rest will open at the same time (or times) on the following days.

It has been over six months now since I completed my cat feeder. As I explained at the beginning, my purpose in making it was to provide my wife and me with the opportunity to go away for a long weekend or even the odd week without having to inconvenience someone else with the feeding of our cats. However we soon discovered two things during the early days when the feeder was being fully tested with food but while we were actually at home. The first was that the cats quickly became familiar with getting their meals from the feeder and not from us; and the second was that they stopped bothering us at the times when we would otherwise have fed them ourselves. In consequence of this new knowledge, we now use our feeder all the time, whether we are away or not. Every four days the LED lights and the feeder is empty. After disconnecting the 9-way cable from the feeder, it is lifted from its screws in the wall, placed on its back and the front panel slid out. Then all 8 compartments are charged with food, the front panel replaced and the feeder dropped back onto its two retaining screws. With the LED still lit we know that the next pulse from IC4 will open the door of the lowest compartment and the rest will follow in due course. However, if for some reason the feeder needs to be recharged with food before it is completely empty, the Reset button must be pressed to light the LED and ensure that the next pulse is directed to the bottom door, when the first of a new set of 8 meals will be supplied.

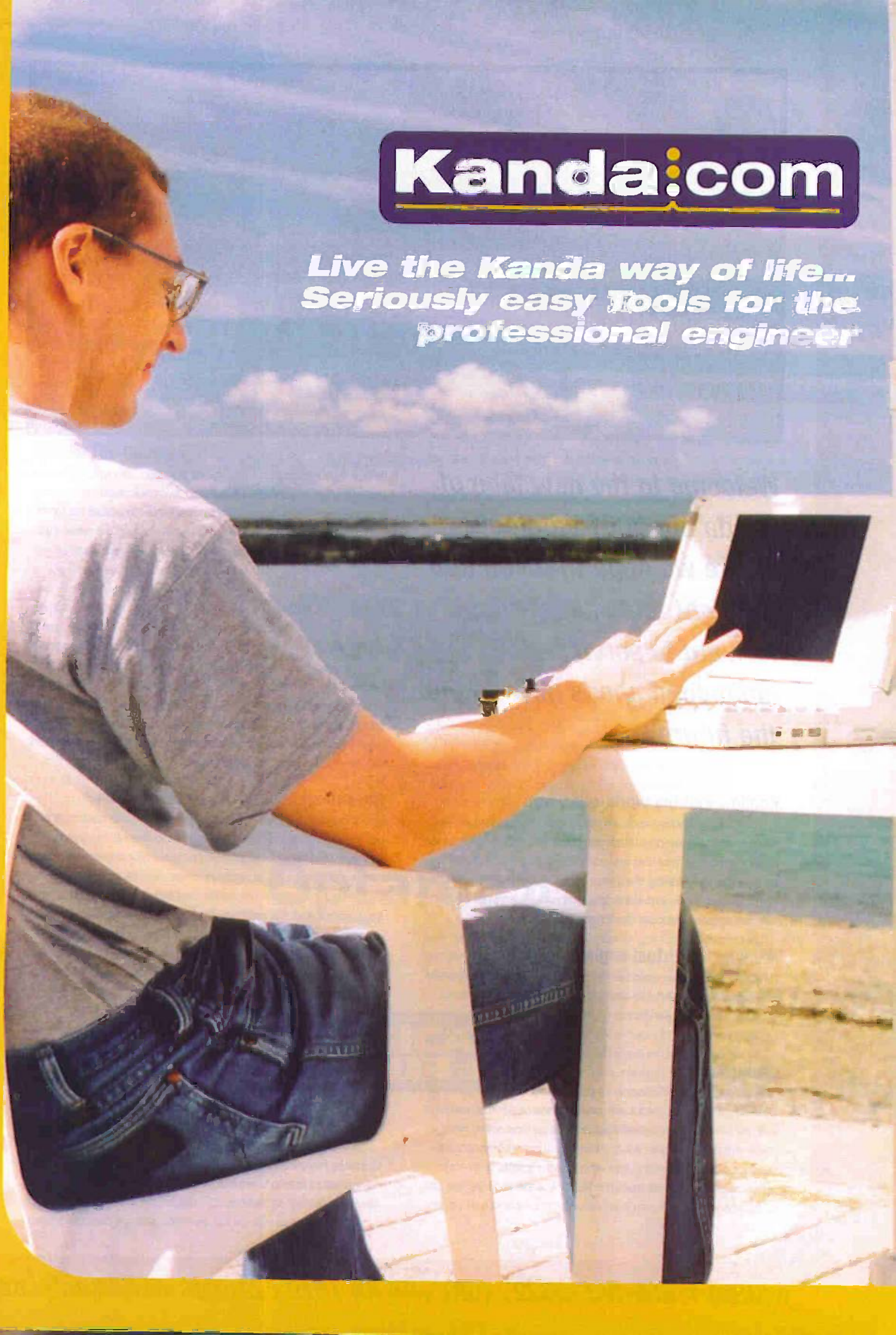
The feeder reliably takes care of feeding our cats for up to 8 days when we are away but I should also point out that they have the freedom of a cat-flap and therefore full access to the great outdoors from a protected space in the house. They also need and are given a very generous supply of water as well.

The full cost of materials and components for this project is about the same as boarding two cats in a cattery for a week. Consequently one week-long holiday and the feeder will have paid for itself!

Our cats have been wonderful friends to us but it is nice to get away from them and the house once in a while. The cat feeder has given us such opportunities. I hope that you will enjoy making your own feeder and then be able to experience the freedom that using it allows.

Parts List

Resistors	
R1	4M7
R2,12,13	2K2
R3,5,8	10K
R4,6,9	1K
R7	1M
R10	100K
R11	100, 2 watt
VR1	50K, vertical pre-set
Capacitors	
C1	22p
C2	82p
C3,4	1n
C5	220n
C6,10	330uf, 35 volts
C7,8,11,12,13,14	100n
C9	470n
Integrated Circuits	
IC1	4521 CMOS
IC2,3	4040 CMOS
IC4	4538 CMOS
IC5	4029 CMOS
IC6	4051 CMOS
IC7	ULN 2804
IC8	78S15 2 amp Volt Reg
IC9	LM2577-ADJ
IC Sockets	
16 pin DIL	x 6
18 pin DIL	x 1
Crystal	
X-tal	4.194304 MHz
Diodes	
D1,2,3,4,5,6,7,8,9,10	1N4148
D11,12	1N4002
D13	1N5821 Schottky
LED	5 mm. round, yellow
Bridge Rectifier	100 PIV, 2 amp (or 2 x 1N4002)
Switches	
S1	SPDT
S2	Press-to-make
Miscellaneous	
Transformer	15-24volt sec, 2 amp
Battery, sealed lead-acid	12 volt, 1.2 amp
9 way serial 'Mouse' cable	Male-Male
2 x D-range, 9-way sockets	Right Angled
8 x relays	6 volt coil
8 magnets	
Reed switches	
8 small hinges, etc.	


Kanda:com
Live the Kanda way of life...
Seriously easy Tools for the
professional engineer

Welcome to the new face of Kanda our 2001 catalogue where we hope that you find the right tools and we look forward to serving your embedded needs now and in the future

Kanda... and the world-wide web

We have a site dedicated to information on Kanda and an insight into the growing number of options in our product range plus here you will find that we are actually giving you down-to-earth advice on making the right choice! At www.kanda.com see our regular updates for details on product features and up and coming new product launches.

Kanda... the virtual engineering mall

Directly linked to the main site is our order site where you can make purchases 24 hours a day, anyday of the week.
Why not visit www.kanda.com and find the tool for your specific application

About Kanda

The company, its philosophy, its people and the latest up-to-date information on the future goals and vision for the future. We are committed to a friendly, personal service policy which means that we work as a team towards a common goal, customer satisfaction and this ethos pervades the whole organizational structure from the bottom to the top, we are committed to making you the customer happy and fulfil your needs by customizing our range to take into account the latest technological advances in the Micro-electronic industry of today and tomorrow... keeping ahead means looking ahead and that equals caring for all our customers whether they are small-time hobbyists or large multinationals... Our Tools make your life easy...

Product Line-up

Search for New Products and try out free demo versions which enable you to test whether the product is right for the project you are working on... we give you the opportunity to try and test before committing...
Download current datasheets and take the opportunity to compare the diverse range of products to suit every budget from the best of the international brands in the microelectronics industry today.....

Newsroom

See the latest Press releases and order your personal copy of our in-house professional magazine aptly titled Electronics and Beyond which pushes back the barriers of Electronics and takes you into green technology, to models, lego and meccano, into simple breadboard projects, simple micro electronic applications and the realities of becoming an electronic entrepreneur. Electronics and Beyond offers you the chance to find a job and have your project in print. Log onto www.electronicsandbeyond.com... See if you qualify for a sample copy!

Engineering Forums

We have a diverse range of Forum sites which enable you, the engineer to discuss the make-up and ideas for a myriad of applications of some of the worlds best devices from many of the worlds best silicon manufacturers such as Atmel, Mitsubishi, Ubicom, STMicroelectronics and Xicor

Our sites have been specifically designed to be easy to navigate and fast to download so go ahead and log on to www.kanda.com today!

Our vision

To become the virtual engineering mall for embedded systems tools by committing ourselves to growing and expanding our range through close working partnerships with our sales partners and customers.

Our Mission Statement

Kanda is committed to design excellence , our aim is to provide seriously easy tools which any engineer can handle and to build up our business based on the solid foundations created by an entrepreneurial ethos which pervades the company, its forward thinking philosophy and its commitment to becoming a world leader in providing a complete tool solution.

Kanda-The Company

Kanda is the brainchild of K and A which stands for Kevin Kirk and Adrian Wallis.

We are both from an academic background as former lecturers in Microelectronics and Computing, we decided to set-up Kanda in 1991. With over a decade of experience in the embedded marketplace and a step by step approach to design and development of new ideas and innovative products, we have been able to remain a friendly and approachable organisation with impeccable standards of quality and control. Our original products were industrial automation systems, primarily focusing on automated high speed welders and we produced a number of innovations in this area such as very high speed welding systems for chain making.

During the development of these systems, we were unable to find microelectronic development systems that were reasonably priced, reliable and which fitted together seamlessly. After spending many hours trying to marry incompatible emulators, compilers and programmers we decided the best option was to develop our own primarily for in-house use.

As word spread, more and more universities and colleges realized that our tools made sense until the education side of the business exceeded the industrial side so the business grew primarily around the academic market.

As our product portfolio increased and as we gained approval in the world-wide marketplace, we were commissioned to design and develop evaluation and training systems for numerous leading silicon manufacturers and we were then able to support new devices by providing easy-to-use tools at a reasonable cost. Many of these systems were produced under the customer's label, the best known of which was the Atmel STK200 which helped the AVR to become a force in the embedded industry. Over 35,000of our units have been produced to date and they still remain popular for their combination of simplicity and versatility, which stem from our company's educational roots.

The design and development of Starter Kits has meant that the company now has considerable expertise centred around in-system programming and we are now the dominant force in this emerging market, offering a wide range of high speed and flexible products in cooperation with a number of first-class silicon manufacturers.

Utilizing our educational and industrial background we have had the capability to source and supply to you the engineer with a comprehensive range of the best tools in the world today from market leaders such as Softec, IAR and Gaio. We can provide you with up-to-date information on full product ranges and can customize your tool needs by selecting the best options from our pic'n'mix toolchain.

In mid-2000 we acquired Logical Devices, a Denver based programmer manufacturer, who are market leaders with more than 20 years of experience in programming tools and the extensive range covers mini to hand-held to In-System Programmers to Gang Programmers and a comprehensive UV Eraser portfolio of quality industry standard products.

ELECTRONICS and BEYOND

Further growth areas have included the development of a publishing company called Electronics and Beyond which produces books and a full-colour monthly industry standard magazine available any where in the world.

We have recently acquired an embedded software house called Optama which primarily develops embedded software tools-see www.optama.com for more detailed information

In addition we run a website design house which is geared to providing tailored e-commerce solutions for the world's leading silicon manufacturers.(need the website logos) The Kanda umbrella also designs and maintains websites for a number of leading silicon manufacturers such as ST, Atmel, Mitsubishi, Ubicom and Xicor. It has been the recipient of a number of prestigious awards in the last few years, primarily for innovation, marketing (sponsored by Microsoft), e-commerce and export achievement.

Optama

Kanda is now poised to move into the next phase of its growth strategy, we are committed to providing technical support plus a friendly CRM policy ensures a smooth, efficient service. We have the ability to provide you with a total service in different time zones through our UK or US base and this ensures that you can order and receive delivery with minimum lead times.

LOGICAL DEVICES

Kanda, as a global organisation looks forward to the next decade of growth, innovation and progress as the best embedded solutions company for seriously easy tools.

So why choose Kanda?

Pic'n'Mix Tool chain

- Selection of Tools for all applications
- Project shopping
- World class brands

Tailored Solutions

- Trained advisors
- Selective Buying advice
- Latest Technology simplified
- Friendly & Approachable personnel
- Quality & Service assurance
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utilizing the Kanda range is that all Universities, Colleges ,Schools and Students world wide receive an educational discount on Kanda Evaluation Tools. Ring us for more details on +44(0) 1970 621030 or in the US on 303-456-2060

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- 24 hour order placement facility

*subject to status and credit check

Quality counts for more

At Kanda, our dedicated production team work closely with our in-house Hardware and Software engineers to ensure that a product evolves from a pure idea into a practical, easy-to-use tool with the engineer as the focus.

Quality Assurance & Control

Our quality controllers ensure a product is checked and inspected before it leaves the building and we are able to make sure your products are fully compliant with international standards as we have an EMC chamber on site and qualified personnel dedicated to giving you perfect products.

Kanda supporting the Environment

Kanda is dedicated to looking after the environment in which it operates. The factory is situated in the heart of a valley and operates a strict recycling policy in order to keep the countryside green and clean.

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At Kanda we aim to provide you with practical, down-to-earth advice on any query you have and we can offer you a personal service on both sides of the Atlantic.

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sales@kanda.com

Over the phone:
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If you have a question then you can email it, fax it or ring the Technical support team on **+44 1970 621041** or in the US on **303-456-2060** and we can provide an answer just like the one below don't hesitate ask.

Understanding your needs

Our Field sales and trained telesales team can give you tips on the best product for your particular application or budget and taking the time to listen means we also learn from you and can serve your interests to the optimum.

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Our International distribution centre run efficiently by our experienced personnel who are responsible for monitoring, packing and despatching your order. Based on site to ensure a smooth and efficient flow of products, we have the capabilities to track your order at any stage in the ordering process ensuring maximum support and reliability for you, the customer.

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From the beginning to the end of any project, Kanda provides the total solution

Our Tool chain means you move in the right direction through the stages of:

- Training & Evaluation
- Development
- Production & Field

The Kanda Tool Chain

In this season's catalogue we feature 2 of our most popular product ranges:
Starter Kits for every budget and every application from simple development boards to evaluation tools to FPGA's...
Programmers & Burners featuring the popular In-System Programmers designed in partnership with many of the leading silicon manufacturers in the world today

If you need more information or assistance with the tools in our complete range then contact Sales on +44 (0)1970 621030 or for the US on 303-456-2060 or for more data log on to www.kanda.com for full up-to-date product information and Technical support online.

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Starter Kits

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At the beginning there is the...Starter Kit

Every professional engineer needs to be able to quickly evaluate a new device with minimum cost and carry out simple development tasks using it. A simple, easy to use Starter Kit is the ultimate training tool, which provides an evaluation platform for testing your particular choice of silicon.

The Kanda Range of Starter Kits for every application and every budget... variety and choice of professional evaluation tools... simple easy evaluation tools for any application... for a wide range of devices.

ALL products come complete with:

- Free Technical support via telephone, fax, e-mail & web
- 90 day warranty after purchase
- Comprehensive Information package

The ST Evaluation solution

ST Microelectronics work closely with Kanda and we have developed a high class evaluation series of tools for basic to advanced applications designed around the ST7 device. From the starter kit, through evaluation boards to In System Programmers and Gang Programming solutions, all equipment supplied by Kanda is ST approved.

ST7 Starter Kit

The ST7 Starter Kit provides you with everything you need to immediately start designing, developing and evaluating applications at a reasonable cost.

Each Starter kit comes with a pre-programmed device. It demonstrates the key features of the ST7 using the on-board hardware resources (push buttons, LED's, buzzer etc) Instructions are performed on the PC, I/O's on the Starter Kit (In-Circuit Simulation)

ST7 Starter Kit Package

Starter Kit board
Flash sample devices
Power Supply (US,EU,UK)
Parallel port interface cable
CD-ROM
User Manual
Software
Personality keys(emulation and programming keys)
Registration card

Features

ST7Flash, OTP and EPROM development environment
Supports 32 or 42 and 56-pin devices
Programming IDE, Application Builder, Full Function Editor
In Circuit Simulation
Professional Assembler

Supported Devices	Order Code	Price $	Price £
32-Pin EPROM and FLASH	ST7KND1-KIT2*	160	115
42/56-Pin EPROM and FLASH	ST7KND2-KIT2*	160	115
*-EU, -UK or -US Power Supplies	Supports Win95, Win98 &Win2000		

ST7 Boards

For fast project development, we also supply target boards for 32-pin and 42/56-pin ST7 devices. We have specially designed these boards for use with the ISP and they are ideally suited for ST7 projects. All the oscillator selections of the ST7 family of devices are fully supported, unlike other ST7 solutions. Included with each of the evaluation boards are schematics providing a full reference design for implementing your ST7 project.The on board features include, an Analog reference for Analog to Digital conversion, LCD contrast, etc. All ports and pins brought out to standard pitch headers (0.1") to a user configurable matrix area. Fully isolatable switches and LEDs using the onboard jumpers. The standard Kanda box header connection for serial In-system programming is included for easy programming. These boards can be purchased on their own or with an ST7 In System Programmer.

Item	Order Code	Price $	Price £
32-Pin Board	ST7KND-EV1	$99	£71
42/56-Pin Board	ST7KND-EV2	$99	£71
32-Pin Board with ISP	ST7ISP32	$125	£89
42/56-Pin Board with ISP	ST7ISP42/56	$125	£89
Both Boards with ISP	ST7ISP+	$198	£142

ST7 Motor controller Kit

Kanda's new comprehensive motor controller development kit makes controlling brushless DC motors simple, using the ST72141 microcontroller.

Just three EASY steps:

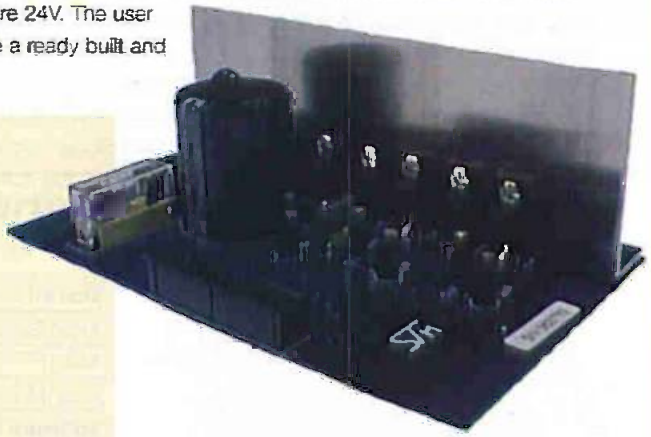
Step 1: Become an expert by practising with the supplied default motor at 24V

Step 2: Test your own motor, and work out your parameters

Step 3: Program your ST device with selected parameters and monitor the results

- This board can be used with the ST72141 emulator

The system and controller works from 12V to 300V, but the motor and power stage supplied are 24V. The user can modify the power stage to accept a 300V motor or can purchase a ready built and tested 300V power stage board from us.



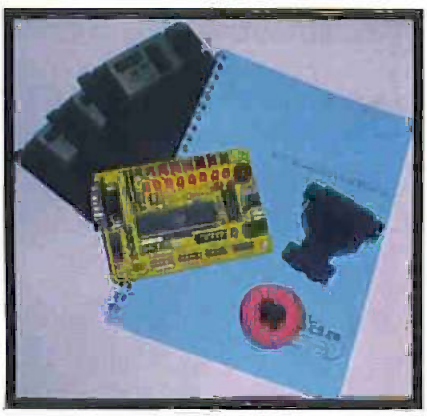
Package

Programming Board
Controller board with pre-programmed OTP chip
Power stage (3-phase wired) low Voltage or High Voltage
24V BLDC fan motor with standard load
15V Mains adapter
Parallel port cable
26-way ribbon cable with IDC connection
Blank EPROM chip
PC communication adapter
Manual on control theory, motor control and other essential information

Features

Simple Software Wizards
Application Builder
Assembler
Simulation Environment
Built in Programmer

Item	Order Code	Price $	Price £
Motor Controller Kit – EU PSU	ST7MTC2/EU	$695	£496
Motor Controller Kit – US PSU	ST7MTC2/US	$695	£496
Motor Controller Kit – UK PSU	ST7MTC2/UK	$695	£496
300V Power stage	ST7MTC2-PS300	$135	£97



8051 Workshop

We also supply Ceibo, Phyton and Raisonance emulators for 8051 series. see our website www.kanda.com for details.

A complete low cost starter kit for engineers and students working with 8051 devices. The system uses Atmel AT89 series microcontrollers – serial programmed 8051 type devices with on-board flash memory – to give you instant reprogramming and simple ICE. This is a brilliantly simple yet complete development system.

Order Code	Price $	Price £
STK8051	99	71

Features

- Application board with LEDs, switches, speaker and RS232 connector plus easy accessible port pins.
- In system Programmer
- Single step In Circuit Emulation
- 51 series Editor, Assembler and linker
- Sample device

For more products in our range of Starter Kits please call sales directly or log onto www.Kanda.com

Xicor Development Systems

The Xicor Development Kit provides a complete development environment for Xicor products. The Kit comes in separate versions for each Xicor device type, but cost- effective software upgrades are available once you have one kit. The three kits support Xicor System Management, Mixed Signal and RF devices. All development kits feature a powerful, intuitive graphical interface that allows designers to quickly configure the user programmable features of Xicor's products.

The System Management Kit

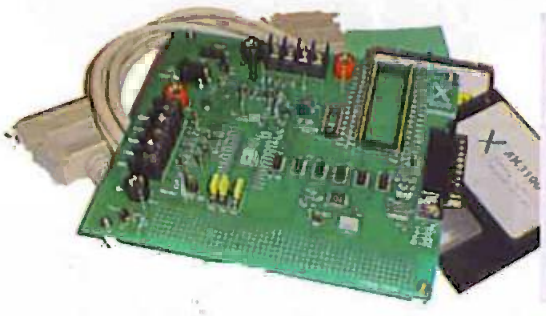
This kit provides a common platform to support all Xicor real time clock and CPU supervisor products. You can program low voltage sense trip points, real time clock alarm levels, and write to the integrated EEPROM memory. A user matrix section allows you to implement key sections of your design and explore design tradeoffs.

The Mixed Signal Kit

This kit provides a common platform to support all Xicor XDCPTM and programmable analog products. You can program XDCP resistance values, op amp gains, comparator threshold levels and other key analog parameters. A user matrix area is included. Supplied with the X9250 device module as target silicon. Mixed Signal Software features Simple 'analogue' feel software with sliders and switches

The RF kit

A special RF design kit provides all of the features of the mixed signal design kit plus a unique pre-configured RF board to allow customers to optimise Xicor mixed signal products in RF applications. The X9250 device module is provided as the evaluation silicon.



Xicor Kit	Order Code	Price $	Price £
Xicor System Management Kit	XSMP001	$199	£142
Xicor RF Kit	XRF001	$199	£142
Xicor Mixed Signal Kit	XAMS001	$199	£142
Software Upgrades			
Mixed Signal Software	SWXAMS001	$49	£35
System Management Software	SWXXSMP001	$49	£35
RF Kit Software	SWXRF001	$49	£35

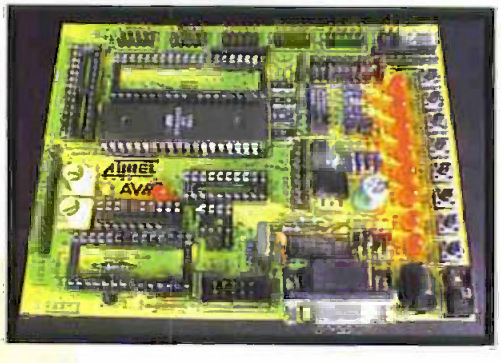
AVR Microcontrollers

Kanda have for many years worked closely with Atmel to produce quality starter kits and in recent years have added their own particular features to make a unique and very popular range of Starter Kits. The success of the STK200 was the result of Kanda's commitment to design excellence and its ability to orientate one kit to support an ever increasing number of features whilst retaining ease of use, coupled with high levels of quality control and reliability in the manufacturing process.

STK200+ Atmel AVR Starter Kit

The best Starter Kit ever...

The STK200 designed by Kanda for Atmel was the most successful starter kit EVER produced. One of the most popular and best-sellers of the Atmel Starter Kits comes with the value added pack software as a total package. Over 30,000 of the STK200 have been sold world-wide, now Kanda have enhanced the design to include more features of this simple but effective tool for AVR.



Package

STK200 Board
Access to all peripherals inc. ADC and UART
LCD interface
3.3V/5V operation
Brownout circuitry
Manual on CD

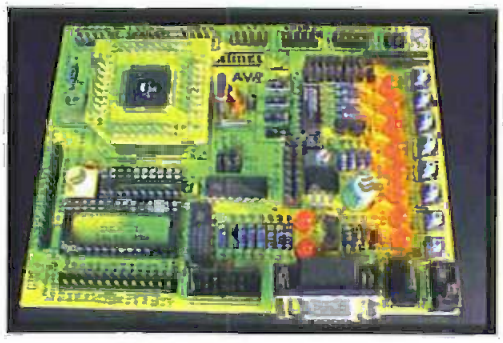
Features and Benefits*

Classic Hardware
AVRISP In System Programmer
Application Builder gives you instant source code templates and code examples
Assembler
Emulation includes a Debug package using the same hardware as ISP
Includes IAR Assembler & Simple In-System Debugger
Simple ICE

*For improved device programming support and faster programming times + WinNT/Win2K/WinME Support also check out the AVR PSI ISP which is compatible with this development board.

STK300+

The STK300+ is a complete low cost system for the Atmel ATMega AVR Range of Flash 8-bit in-system programmable RISC microprocessors & includes Application Builder Software.



STK300 Board
ATMega Builder Software
LCD external RAM provision
RS232 & ADC connection
Switches, LED'S & Power
External Reset
Dual Voltage operation
Brown out detection
Real time clock crystal

Supports
Atmel Atmega 103/L
Atmel Atmega 603/L

AVR Kit	Order Code	Price $	Price £
STK200+ For Classic AVR	STK200PLUS	$59	£42
STK300+ For MegaAVR	AVM0029	$79	£57

*For improved device programming support and faster programming times + WinNT/Win2K/WinME Support also check out the AVR PSI ISP which is compatible with this development board.

PLD Starter Kit

All you need to learn, teach or develop designs using Programmable Logic Devices. Complete hardware and software package for training and development. This package is used extensively by universities all over the world to teach logic and then move to practical implementation using PLDs. It also acts as a pretty neat development environment.

Item	Order Code	Price $	Price £
PLD Starter Kit	ATM014	$299	£214

Package

1x ATF16V8
1x Device programmer
1x Training Board
1x Parallel Connection Board
1x Get going with PLD's Book
Kanda PLD Programming Software
Kanda/Atmel CUPL Interface

Programmable Devices

ATF16V8B & C
ATF22V10B & C
ATF20V8B & C

The Ubicom Range
Debugging the SX range

UBICOM™

In-System Debugging allows the whole development process to be carried out on the same desktop, so you don't need constant hardware and software changes-just plug and go. The project-based IDE makes version control and code organisation quick and easy.

Features

Application Builder:
uses simple wizards to create all your set-up code including ports, timers and interrupts, as well as device configuration (FUSE/FUSEX).

Assembler:
Built-in Assembler is called with only 1 mouse click or key press so you avoid DOS prompts
On-screen error listing and highlighting in your source code means bugs are fixed easily.

Emulation
Debugger uses the emulation functions of the SX chips giving genuine emulation on your target instantly.

Benefits

Small 60x55x16mm
Flexible: Parallel & Serial Port connection
Comprehensive: Programs all the features of all the devices
Easy, intuitive development

Device Support

SX18AC
SX20AC
SX28AC
SX48BD
SX52BD
Win95,
Win98,
Win2000 & WinNT

Item	Order Code	Price $	Price £
SX-In System Debugger	SX-ISD	$99	£71

Ideal for use with SX Evaluation Board to give known target hardware

SX Evaluation Board

The Scenix SX Evaluation Board is designed to provide a cost effective platform for developing applications with the SX series high-performance communications controller. This evaluation board is specifically made available to serve as a target environment for demonstration and development of Virtual Peripheral* software modules.

Ideal for use for SX Debug

see Optama SX C compiler on www.kanda.com

Starter Kit	Order Code	Price $	Price £
SX In System Debugger	SX-ISD	$99	£71
SX Evaluation Kit	EPAK-SXEVAL01-03A	$89	£64

Networking and Connectivity

SX Stack Kit

Ideal for implementing Internet Access in a simple application – make you project talk to the web.

The SX-stack is a configurable combination of standard Internet protocol layers optimized for the SX series communications controller. Supported Internet protocols include PPP, TCP/IP, HTTP, SMTP and POP3. It provides the end-user with hands-on experience using the SX-Stack's iSX Web Server and eSX E-mail Appliance configurations. The iSX is an embedded Web server that implements the hypertext transfer protocol(HTTP) and is capable of communication with any Web browser. The eSX offers e-mail appliance functions, with SMTP and POP3 protocols used at the application layer.

Package

SX-Stack (iSX Web Server and eSX E-mail Appliance) Demo Board
AC Power Supply
9-pin-to-9-pin serial cable
CD-ROM containing iSX/eSX source code files, support files and documentation
User's guide

Ethernet SX Stack Evaluation Kit

Ideal for simple Internet connectivity with network capability, using 10-BaseT.

The Ethernet SX Stack is a configurable combination of standard Internet protocol layers optimized for the SX communications controller. Supported Internet protocols include TCP, UDP, IP, ICMP, DHCP, ARP, HTTP, and STMP. The purpose of this evaluation kit is to provide the user user with hands-on experience using the Ethernet SX Stack. The kit includes an integrated web server and email appliance provided through implementation of the HTTP (Hypertext Transfer Protocol) and SMTP (Simple Mail Protocol) application protocols. ARP (Address Resolution Protocol) and DHCP (Dynamic Host Control Protocol) protocols are implemented to deal with addressing issues specific to the Ethernet environment. The SX communications controller's in-systems programming feature enables the device to be reconfigured easily for one of several implementations. To download your own material to the demo board's EEPROM or to evaluate other stack application variations, you need SX DEBUG or SX ISP to reprogram the SX device.

Features

- Ethernet SX Stack Demo Board:
- SX52BD 50 MHz communications controller
- Realtek 10Base-T (IEEE802.3) Ethernet device for physical and MAC layer support
- 32kB EEPROM memory chip for storing web content
- 24-pin wide-body DIP socket for Scenix' JVM (Java Virtual Machine) application prototyping and expansion
- Two RS-232 communication ports
- Clock circuit, power and transmission status LEDs, RESET button
- I/O and Demo support:
- Thermistor for "remote" temperature sensor demo
- LED control via buttons on embedded web server page
- 20 I/O pin expansion header for customer application usage
- TCP/IP Stack and Application Layer Software

Starter Kit	Order Code	Price $	Price £
Ethernet SX Stack Evaluation Kit	EPAK-TCP/ETH01-02	$199	£142
SX- Stack Kit	EPAK-TCP/PPP01-03	$149	£107

For CAN Starter Kit & Module solutions call sales or visit www.Kanda.com for the latest demos and datasheets

Introduction

Programmers and burners is a large section so we have broken it up into the following categories:

- In System Programmers
- Universal Programmers
- Gang Programmers
- EPROM Erasers
- Programming Adapters

In System Programming

ISP (In System programming) is a popular new way to burn microcontrollers and other programmable logic devices, (Some manufacturers also call it ISD/ISR or ICP).

ISP is also associated with Flash technology, which allows you to erase and re-program a microcontroller many times; this simplifies the design stage and adds flexibility to production and update phases.

ISP removes many of the restrictions associated with using & burning microcontrollers. Using ISP you can now:

- Burn a device quickly without removing the device your project or have to use a UV eraser etc.
- Perform firmware upgrades in the field
- Customize your firmware with Serial Numbers, Calibration Data this could be integrated into production statistics etc..
- Download test & diagnostic routines prior to shipping your product.
- End of line customization – regional product variations and different product configurations can now be changed after production.

Some ISP implementations also have In-System debugging extensions to simply the design and debug process.

Kanda provide a range of ISP solutions to fit every need from development through debugging and production to field upgrades.

PC Based ISP Solutions

Kanda have a range of cost effective PC based ISP burners for a variety of different microcontroller families and different PC connection options.

All programmers use logical devices sophisticated ISP software.

The user interface has been carefully designed to provide "easy operation", coupled with advanced features for the power user. The COP8 ISP gives you save and load options for all your settings and files, making it simple to restart after a break. The standard erase, read, program and verify functions are available via single mouse click or keyboard shortcut and Auto-program makes repetitive device programming really easy.

The programmer includes Kanda's hex file editor, which allows you to edit and view your file prior to programming the device. This is useful for making small changes to your program code outside of your development environment. Verification after programming or verifying a device against a file is simplified by color-coding to give an instant visual check. And no more worries about your file type as the editor Auto-detects different file formats including Intel Hex & Motorola S Record.

Order Code	Description	PC Connection	Operating System	Device Range	Price $	Price £
ST7ISP32	ST7 ISP & 32 pin evaluation board	Multiconnector	Win9X/ME NT4/2000	ST72104,215,216, 254,124,314,334 and ST72171K2	$125	£89
ST7ISP42/56	ST7 ISP plus 42/56 pin evaluation board	Multiconnector	Win9X/ME NT4/2000	ST72104,215,216, 254,124,314,334 and ST72171K2	$125	£89
ST7ISP	ST7 ISP	Multiconnector	Win9X/ME NT4/2000	ST72104,215,216, 254,124,314,334 and ST72171K2	$45	£32
AVRUSB	AVR ISP SUPER	USB	Win9X/ME 2000	ALL AVR ISP DEVICES	$149	£106
PSI-ISP	AVR ISP	PRINTER PORT	Win9X/ME NT4/2000	ALL AVR ISP DEVICES	$125	£89
AVR-ISP	AVR PSI	Multiconnector	WIN95/98/3.1	ALL AVR ISP DEVICES (EXCLUDING ATMEGA163, ATMEGA32, ATMEGA161, TINY12,TINY15)	$39	£28
SX-ISP	SX ISP	Multiconnector	Win9X/ME NT4/2000	SX18/SX20/SX52/ SX48/SX28	$55	£39
COP8ISP	COP8 ISP	Multiconnector	Win9X/ME NT4/2000	COP8CBR9, COP8SBR9	$129	£92

Multiconnector

Some of our desktop ISP solutions feature the multiconnector. This unique design features a 9-pin serial port and PC printer port connections, allowing you to attach the ISP to either port.

ISP Connector

A well-designed ISP connection is vital for programming reliability. The layout and pin usage of the ISP connector will change depending on your target microcontroller.

The 10 pin connector has interleaved ground lines to give better noise immunity and allow the use of longer cables. The cable supplied as standard is over a metre in length, giving you flexibility in use.

The connector diagrams for our supported targets are shown below:

Scenix, COP8, Atmel, ST

USB Connection

The AVR-ISP Super utilises the USB port, what are the advantages of the USB port?

As increasing numbers of PC's are fitted with a USB port as an industry standard, connecting to your PC via the USB port enables you to keep your serial and parallel ports free in addition you benefit from USB flexibility and speed.

Older PC's can easily be modified using a plug-in card to provide quick, easy upgrades. The USB port can operate at up to 12Mbits/s giving you a great advantage as programming times are increased enormously.

USB is supported under Windows 98/ME/2000.

Updates are available from Microsoft to USB enable Windows 95 & NT4, however we can not offer technical support on these platforms.

Keyfob Field Programmers

The ultimate programming tool for microcontrollers, in the field or on the production line - so easy a child can use it! The smallest stand-alone programmer available, just load it once and then program target devices again and again and again.

You require just one starter kit for your PC and you can load as many keyfobs as you need. Just connect the starter kit to your printer port and run the master software. Select your program file, device type and Fuse settings and now you can load the keyfobs with your program or test code in seconds. As the Keyfob is battery powered during load, you don't need any power supplies or cabling, just plug a Keyfob into the simple adapter supplied. Once a Keyfob is loaded, it is completely portable and can be used where you need it, not where your PC is located.

Think how often you need a simple upgrade to a vending machine, slot machine or other equipment such as lifts, security controls or medical equipment - simple, except it is hundreds of miles away. The rugged design and simple operation of this unique programmer means that you can "let the Keyfob do the walking" by sending the Keyfob rather than an expensive engineer. The Keyfob includes a 12V battery so your target system does not have to be powered for occasional programming although you will need power from the target for multiple programming to save battery life.

In order to configure the keyfob you need a Keyfob starter kit. This contains the PC Software & Connection lead required to setup your keyfob.

Keyfob starter kits contain a Keyfob, PC Configuration Software, Connection lead and an adaptor.

Order Code	Description	Device Family	Price $	Price £
ST7KF0010	ST7 KEYFOB STARTER KIT	ST7 ISP DEVICES	$99	£69 (?)
KF0010	AVR KEYFOB STARTER KIT	AVR ISP DEVICES	$165	£115 (?)
KF0040	AVR KEYFOB STARTER KIT + 5 KEYFOBS	AVR ISP DEVICES	$399	
COP8KF0010	COP8 KEYFOB STARTER KIT	COP8	$165	
COP8KF0040	COP8 KEYFOB STARTER KIT + 5 KEYFOBS	COP8	$399	

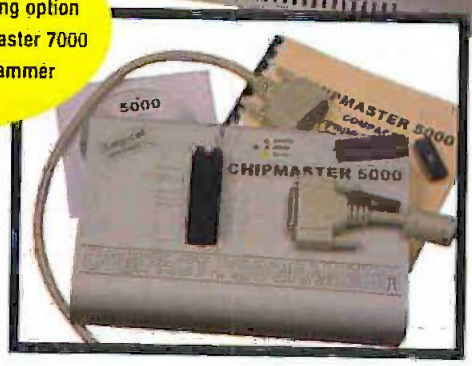
Additional Keyfobs Packs

Order Code	Pack Quantity	Description	Device Family	Price $	Price £
KF0030	5	Additional AVR Keyfobs	AVR	$299	£209 (?)
KF0020	1	Additional AVR Keyfob	AVR	$99	£69 (?)
COP8KF0030	5	Additional COP8 Keyfobs	COP8	$299	£209 (?)
COP8KF0020	1	Additional COP8 Keyfob	COP8	$99	£69 (?)
ST7KF0020	1	Additional ST7 Keyfob	ST7	$50	£35 (?)

Universal Programmers
Chipmaster 5000 & 6000 Series

Designed for both laboratory and mass-production applications the ChipMaster supports a wide range of different devices, including PAL, GAL, CPAL, EPLD, PEEL, MAX, MACH, PLSI, microprocessors, EPROM, series EPROM, PROM, and Flash memory.

For an advanced universal programmer with gang option please see the Chipmaster 7000 in the Gang Programmer section



Features

- 48 pin ZIF with insertion, contact checking
- Self program w/ statistic reporting for mass production
- Support 3.3 V low voltage chips
- Program 8-Mbit Flash within 60 seconds
- Windows 3.x, Windows 95, NT4 and DOS
- User configurable voltages and multiple verify passes

The chipmaster's on-board intelligence reduces system overhead to a minimum. Program an 8-Mbit EPROM in less than 80 seconds. (depends slightly on the processing power of your PC & Chipmaster Model) The ChipMaster is faster than its competitors and is much more productive with today's high-density, multi-megabit memory devices. The chipmaster performs device insertion and contact checks before it programs each device. It can detect poor pin contact and devices inserted upside down or in the wrong position. Protect your pocketbook by preventing expensive accidental chip damage.

Name	Order Code	Number of Devices Supported	Socket Configuration	Price
Chipmaster 5000	PROCM5-000	1,200	1 x 48-pin ZIF	$695
Chipmaster 6000	PROCM6-000	3,000	1 x 48-pin ZIF	$1,195

Shooter III

Gang Version available soon please call for details

FEATURES

- 'Dumb Terminal' operation through PC Serial Port.
- Use a Car Charger
- 1+hrs of battery operation with power saving sleep
- Master/Slave socket configuration for quick copies.
- Host-free operation, no software needed.
- Recent selection memory.

Hand-held chip programming system that allows the user to copy EPROM's in Stand Alone (Copier) mode or to download a file from any computer with an RS-232 port. Making a copy of a chip has never been as simple. Place a chip in the Master socket and a blank in the Slave, select the target device from the Shooter's in-system library of over 300 devices, press copy, and you're done. All that power in the palm of your hand, Shooter III measures a mere 8x4x2 inches. Shooter III has two 32-pin ZIF sockets capable of supporting 16k to 8-megabit devices.

Field Service Pack

The Shooter is also available as a field service pack, containing the Shooter III, PalmErase EPROM eraser and a shoulder/hip-pack to carry them around in.

Name	Order Code	Number of Devices Supported	Socket Configuration	Price
Shooter III	PRG-SH3-000	Over 300	2 x 32-pin ZIF	$375
Shooter III Field Service Pack	OPT-SH3-FSP	As Shooter III		$465

Gang Programmers
Softec MP8011A

Gang programming system for the ST7 & ST6 range of microcontrollers. This programmer supports all ST6 & ST7 devices using a modular programming head system. When you need to use a new package or device simply purchase a new set of programming heads. The unit supports 8 programming heads allowing you to program 8 devices concurrently.
The system is supported under Windows 95/98/NT/Me/2000 and requires a printer printer port. The system is fully upgradeable and software updates are available from the manufacturers website.
The main unit is supplied with the programmer base unit, power adapter, a parallel cable, a test board, the user interface software and user's manual. At least one programming head is required for operation.

Product	Description	Order Code	Price $	Price £
Softec MP8011A	Gang Programming System for the ST6 & ST7	MP8011A	$745	£539

Programming heads priced from $55. Please call or visit our website for a complete list.

Husky LC

Rugged, reliable and easy on the pocket book, The Husky LC's are the ideal for development and production cycles for a wide range of devices. The Husky LC's are custom configurable designed to provide flexibility for the amount of devices you can program at one time, and the size of the devices programmed. Depending on the configuration you choose the LC's can program up to 4, 8Mb 32-pin parts.

Features

- Programs EPROMS, FLASH, OTP'S
- 4 x 32 pin ZIF Sockets
- Supports Flash 28Fxxx and 29Fxxx
- Intel, Motorola, and binary file support
- Supports High Speed Serial RS-232
- Windows 3.1/95/NT or DOS User Interface.
- Remote Command for Sun or Mac PC
- Low Cost and Compact Design

The Husky LC is available in a variety of memory and socket configurations allowing you to choose the most cost effective configuration for your needs.

Description	Memory	Num of Sockets	Part Number	Price $	Price £
Husky LC	1 Meg	1 Socket	PROHUL-D11	$445	£317
	1 Meg	4 Socket	PROHUL-D14	$545	£389
	4 Meg	1 Socket	PROHUL-D41	$545	£389
	4 Meg	4 Socket	PROHUL-D44	$645	£460
	8 Meg	1 Socket	PROHUL-D81	$645	£460
	8 Meg	4 Socket	PROHUL-D84	$745	£532

Chipmaster 7000

The Chipmaster 7000 is a software expandable universal device programming workstation that supports a wide variety of programmable devices in addition to the capability of testing digital ICs.
The Chipmaster is the most sophisticated low-cost programmer available today. A unique hardware/software architecture enables the Chipmaster to easily grow in support and engineering software design capabilities as quickly as your device library requirement.
The state-of-art universal programmer offers you the most advanced programming facilities with the user-friendliest interface. Since each pin is software addressable, new part numbers are being added to the list of supported devices through software upgrades. No new hardware to buy! It will prove to be one of the most reliable and long lasting instruments.
The optional gang module allows you to program 8 x 32-pin devices with very fast programming times. For example, you can download, program, and verify eight 8-Mbit Flash Memory (28F800) in approximately 160 seconds. There is also an optional ROM emulator module that supports devices up to 4-Mbit.

Name	Order Code	Description	Price $	Price £
Chipmaster 7000	PROCM7-000	Chipmaster 7000 programming system	$995	£710
CM7 Gang Module	OPT-CM7-8G	8 x 32 pin gang expansion module	$595	£425
CMD Rom Emulator Module	OPT-CM7-ROM	ROM Emulator expansion module.	$395	£282

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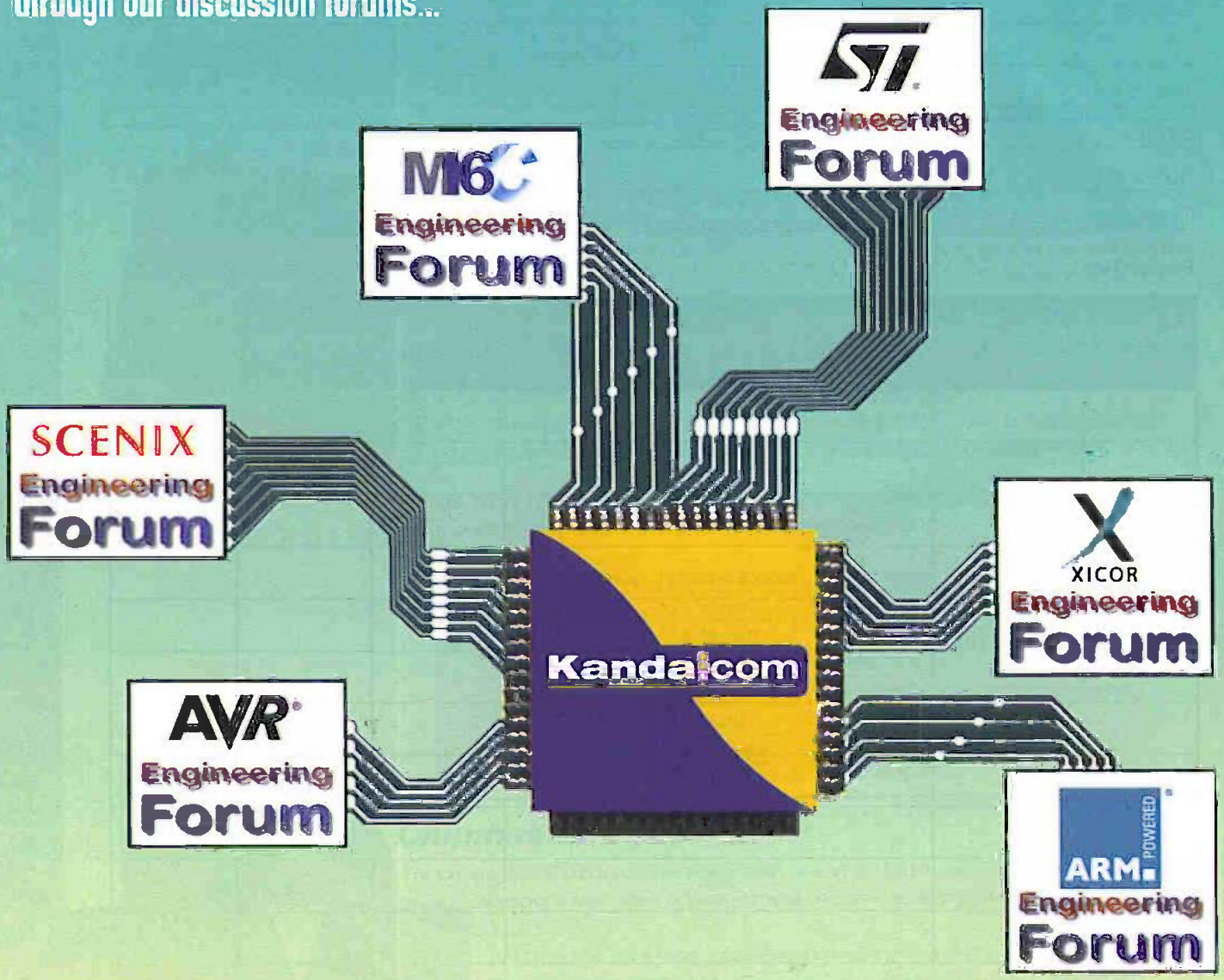

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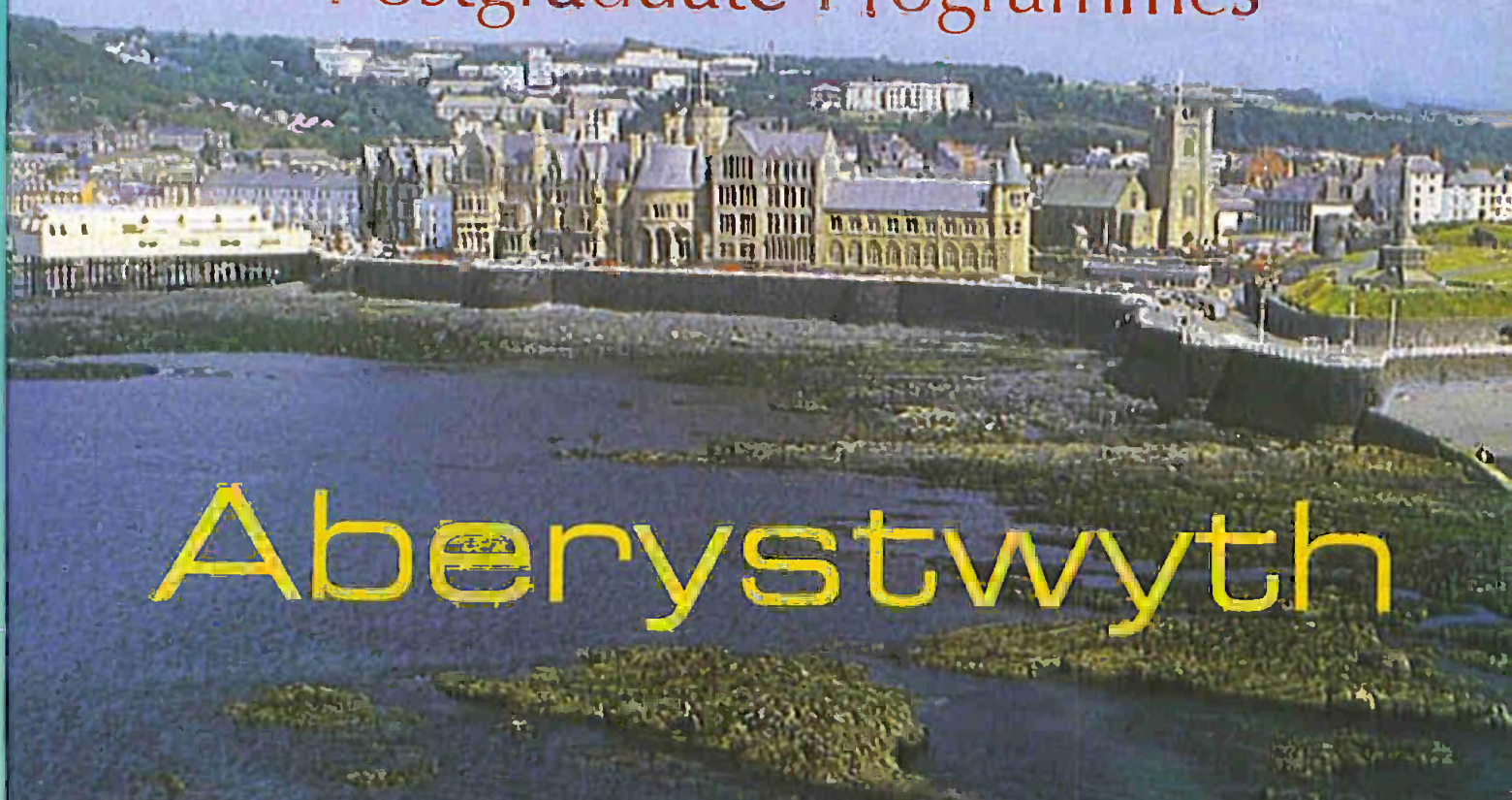

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Powering THE INTERNET

An Introduction to UPS

PART 3 ENSURING A HEALTHY POWER SUPPLY BY USING THE CORRECT PULSE RATE

by Shri Karve

In the last of his articles on Uninterruptable Power Supplies, Shri Karve of MGE UPS systems examines the pros and cons of 6-pulse rectifiers versus 12-pulse rectifiers in the battle to ensure high quality power for today's demands.

Although a marginal factor over the past decade, the amount of harmonic current disturbance experienced by electrical installations is increasing continuously. This rise can be tracked to the vast growth in computer use, telecommunications and power electronics, all of which represent non-linear loads that cause harmonic disturbance. This phenomenon concerns most of today's electrical distribution systems, whether in the commercial, industrial or residential sectors, and has a negative effect on most installations including assembly lines in factories, data processing equipment, and co-location sites.

The eroding quality of electrical power should be of great concern to all end users. If we take, for example, the ISP sector, downtime caused by low quality power could potentially cost £millions. A simple power spike could easily cause an ISP's servers to fail and the knock-on effect to users would be catastrophic. Entire businesses could be off-line for lengthy periods of time with a potential loss of earnings measured in £millions.

How to 'Rectify' Harmonics

The presence of harmonics in the upstream circuits is due to the fact that UPSs use a rectifier to draw power from the input AC distribution system. The rectifier charges the battery at a constant voltage plus supplies DC power to the inverter. Without the necessary conditioning equipment, harmonic disturbance re-injected in the mains will ultimately affect other sensitive equipment sharing the same network. Figure 1 illustrates the typical configuration of a UPS system.

Traditionally, UPS vendors use either 6-pulse or 12-pulse rectifiers to covert AC to DC. The 12-pulse rectifier is achieved through the combination of two 6-pulse bridge rectifiers and a phase shifting transformer. However, due to a significantly higher component count than the 6-pulse rectifier (an extra rectifier and a phase shifting transformer), the 12-pulse rectifier suffers reduced reliability and lower efficiency when compared to its 6-pulse counterpart. The mean time between failure (MTBF) is of critical concern when selecting a UPS system; the higher the MTBF the better, as this obviously means that the UPS will function efficiently for longer periods between repair. Unfortunately, the 12-pulse rectifier demonstrates a relatively low MTBF when compared to the 6-pulse.

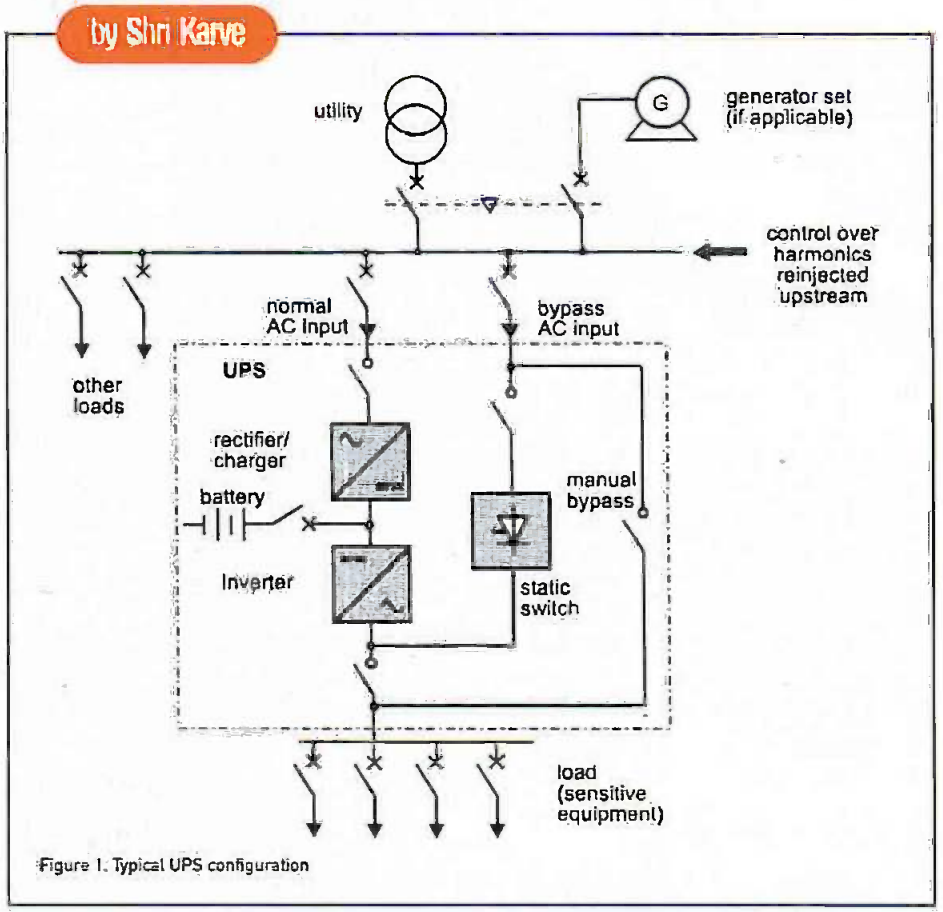


Figure 1. Typical UPS configuration

More, or Less?

Reliability is just one concern when considering the best ways to reduce harmonic distortion. To allay such problems and fears, UPS vendors must implement more efficient systems to reduce total harmonic distortion (THDI). One must remember that it is the rectifier that causes a great deal of harmonic distortion. Generically, the total harmonic distortion current (THDI) of a 6-pulse rectifier is around 35% while the 12-pulse commonly experiences THDI of approximately 12%. Both values fall well short of current standards for the maximum THDI - IEEE 519-2 (USA) stipulates that the THDI level must not exceed 5.5%. Therefore, to limit THDI levels in either scenario, one must implement a harmonic filter. The typical dominant harmonics for a 6-pulse rectifier are 5th and 7th (6±1) whilst for the 12-pulse are 11th and 13th (12±1). However, with the 12-pulse rectifier, one must also address the 'skin-

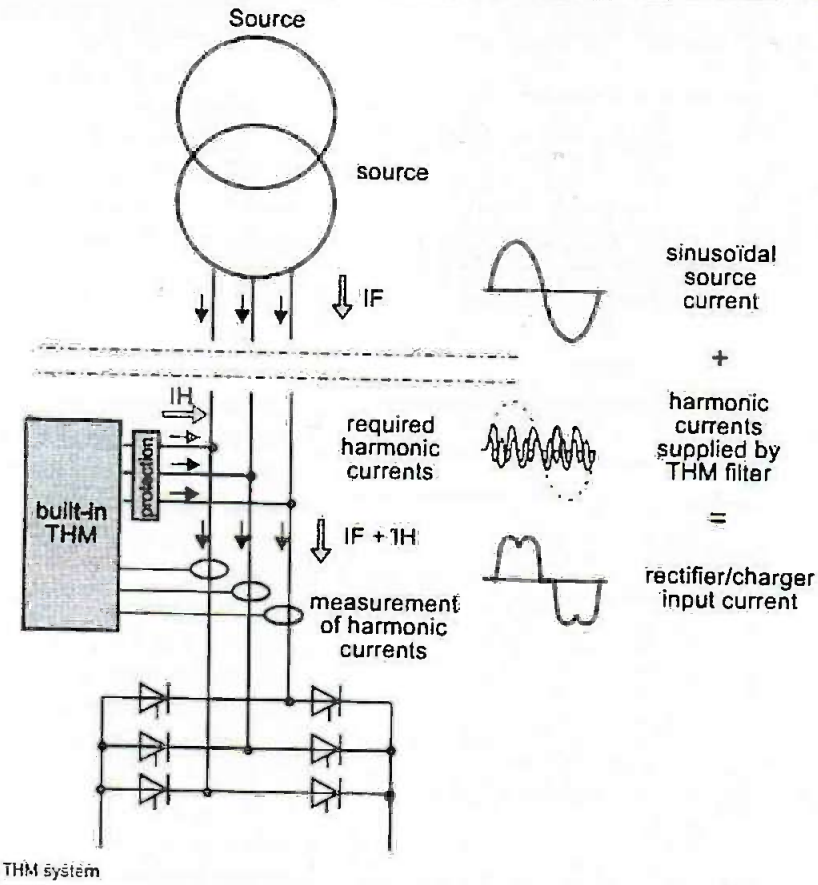


Figure 2. THM system

effect' { $d = 1/2\pi\sqrt{\rho \times 10^5 / f}$ } [a] phenomenon, which reduces the penetration depth of current flow at higher harmonic level, e.g. if at 50 Hz. the penetration depth is 9.3 mm then it will be reduced to a level of 2.8 mm at 550 Hz (11th harmonic). Figure 2 illustrates the components involved in a typical UPS with THM in dealing with harmonic distortion, and highlights how the THM system eliminates the corresponding harmonic currents depending on the harmonic spectrum of the rectifier current.

In essence, one must weigh up the benefits of utilising a 6-pulse rectifier with a single additional filter plus increased reliability to reach the desired 5.5% THDI, or a 12-pulse rectifier with the same additional filter. However, the 12-pulse rectifier has a much higher component count, which equates to a drastically lower MTBF value. To this end, to achieve the same 5.5% THDI, one must realistically choose a 6-pulse rectifier due to its far superior MTBF.

Harmonic Filters

Traditionally, 12-pulse rectifiers were implemented in the past due to poor availability of high quality harmonic filters. Today, however, the choice is far greater, allowing the 6-pulse rectifier to come to the fore. There are four main types of harmonic filter:

1. Series Connected Choke

This is the most economical and most utilised option throughout variable speed drive (VSD) applications. The choke is connected in series with the VSD, thus reducing THDI from 67% (a raw 6-pulse rectifier) to approximately 35%. However, this technology is very basic and less effective at lighter loads, therefore not employed by the majority of UPS vendors.

2. Phase Shifting Transformers

This solution utilises multiple 6-pulse or 12-pulse rectifiers, with phase shifting transformers situated between rectifier units. For example, if two 12-pulse rectifiers are phase shifted, THDI is reduced to c.7%. For two 6-pulse rectifiers, this figure equates to c.10%. However, other design criteria need to be analysed when evaluating such a solution:

1. Skin effect, as the phase shifting will create higher harmonic resultant currents (11th & 13th and 23rd & 25th), depending on the bridges being phase shifted.
2. Inherent inrush current required by the phase shift transformer.
3. Additional physical space required for the transformer and external logistics, e.g. extra heat generated.

Number of UPS units	Dominant harmonics	Phase shift	Redundant operation	Downgraded operation *
			Sn to Sn	Sn
2	12k +/- 1	+ 30°	< 10%	30%
3	18k +/- 1	+/- 20°	5%	13%
4	24k +/- 1	+/- 15°, + 30°	< 3%	12%
5	30k +/- 1	+/- 12°, +/- 24°	< 3%	9%
6	36k +/- 1	+/- 10°, +/- 20°, + 30°	< 3%	7%

* Downgraded operation = UPS-unit failure or disconnected for maintenance.

Table 1. THDI levels with phase shifting transformers

3. Passive LC Filters

This is the basic harmonic filter, specifically tuned for certain harmonics utilising a combination of chokes and capacitors. Typically, for 6 pulse rectifiers, LC filters can reduce THDI from 35% to 5.5%, whilst 12-pulse is reduced from 12% to nearer 6%. Passive LC filters are a popular and common solution used throughout the UPS industry, but it cannot be ignored that the filtering achieved is directly related to the percentage load that is presented to the UPS, i.e. the higher the load, the lower the THDI (inversely proportional). Similarly, this has an impact on the input power factor as seen on the mains side.

4. Active Harmonic Filters (Conditioners)

This is perhaps the optimum solution, as it reduces the inherent weaknesses of most of its predecessors. In effect, due to the fact that the active harmonic conditioner is a current injection device, it is not dependent on magnitude of UPS load current but purely cleans harmonic pollution between the 2nd and 25th harmonic. With the correct selection, THDI levels can be maintained at c.4% irrespective of load and other criteria (this exceeds the requirements of industry standard EN61000-3-4).

Another advantage of the active harmonic conditioner is that it can be installed as a retrofit, and has no risk of resonance. Utilisation of an Active Harmonic Filter does not have any detrimental effect on the MTBF value of the system, since it is a parallel

device. Despite the higher initial capital outlay required to install such a device, the return on investment (ROI) is achieved through its ease of installation, superior performance and reduced footprint – some vendors now manufacture UPSs with integral active harmonic conditioners reducing footprint size even further. Such a device more than exceeds today's pollution standards and pre-empts future regulations, whilst offering fast-switching and rapid reaction within two cycles, thus delivering a total harmonic management (THM) solution. (see table 2)

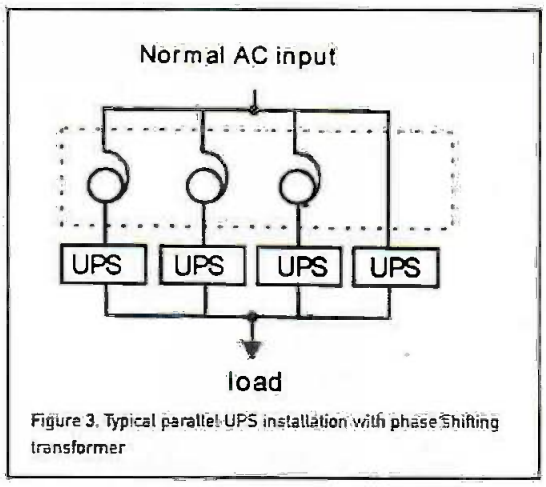


Figure 3. Typical parallel UPS installation with phase shifting transformer

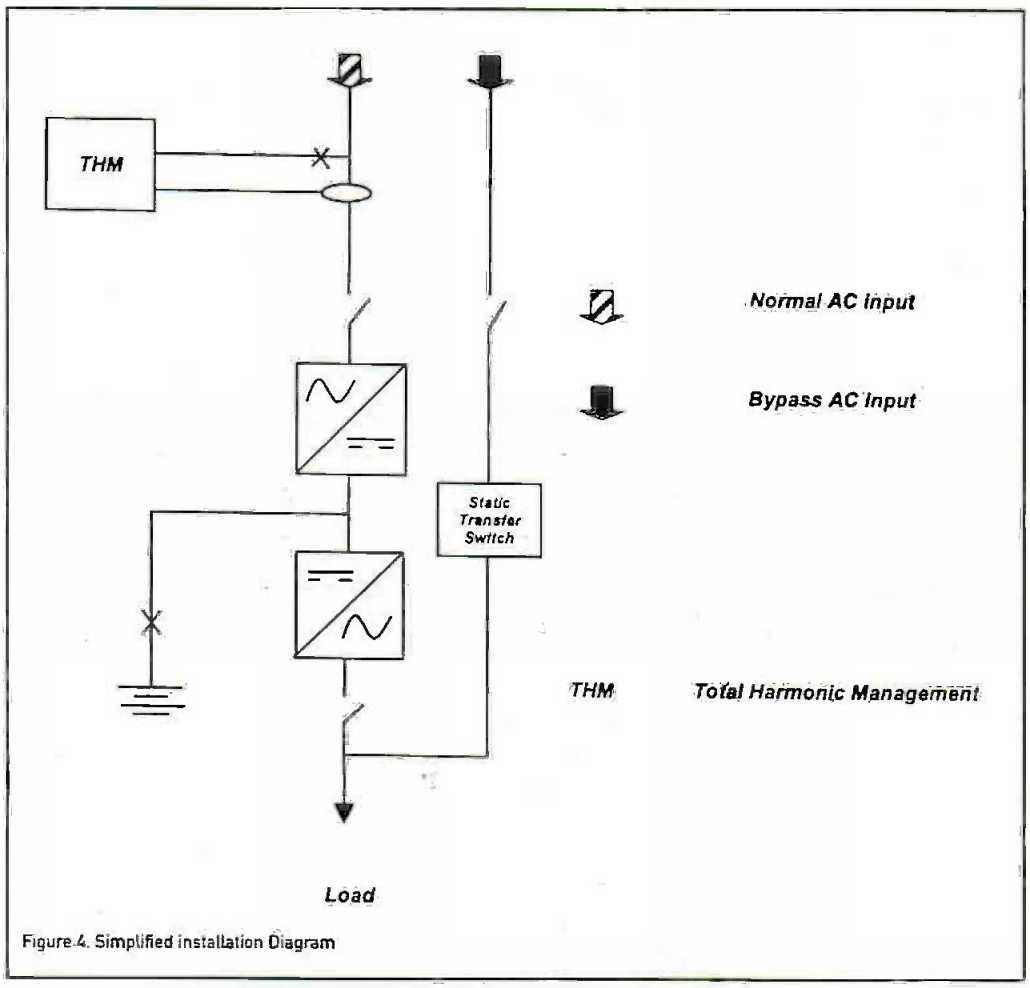


Figure 4. Simplified installation Diagram

Conclusion

With demand for power growing at such a rapid rate, the technology employed to cope with harmonic distortion and to protect this power must evolve at an equally fast pace. Simultaneously, strict pollution standards dictate that THDI levels cannot exceed 5.5%, thus creating a more stringent benchmark for UPS vendors.

Traditionally, UPS vendors chose 12-pulse rectifiers to convert AC to DC current, but with this practice came low reliability. Despite the relative efficiency of 12-pulse rectifiers (c.12%), the consequence of their high component count was a low MTBF, higher running cost and risk of Skin Effect on cables.

Hk	% H1				
	Limit of IEC 61000-3-4	Without filter	LC Filter	12-Pulse	THM
H3	21.6%	-	-	-	-
H5	10.7%	32%	2.9%	2.8%	2.5%
H7	7.2%	3.5%	1.9%	1.5%	1.5%
H9	3.8%	-	-	6	-
H11	3.1%	7%	3.8%	9.1%	2%
H13	2.0%	2.7%	1.9%	4.7%	0.5%
H17	1.2%	2.5%	1.7%	1%	1.1%
H19	1.1%	2.1%	1.3%	0.7%	0.9%
HDI	25%	35%	6%	10%	4%

= Non Compliant Figures

Table 2.

With its lower component count and higher MTBF, 6-pulse rectifiers offer end-users far greater efficiency and effectiveness. In relation to THM, combining 6-pulse rectifying technology with active harmonic conditioning produces reduced THDI levels and equally important, yet more difficult to quantify, enhancements in the end users' peace of mind.

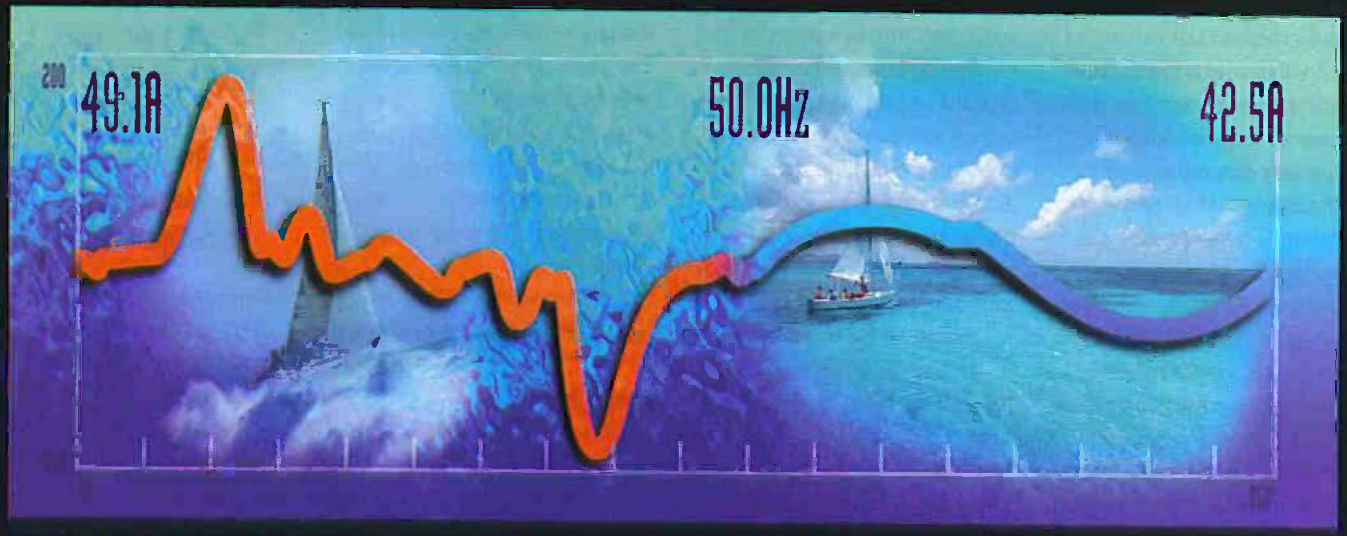
As for the future, with the advent of more efficient 6-pulse rectifiers and integral active harmonic conditioners reducing physical footprint and capital outlay, official pollution standards can be met with relative ease, whilst providing low THDI.

About Shri Karve

Before joining MGE UPS in 1992, Shri held sales management positions with a number of dynamic and static UPS manufacturers. With a BSc in Electrical Engineering, his career path developed from design engineering, where he spent eight years designing rotating machines, motors and alternators. Considered today as one of the leading authorities on UPS and active harmonic conditioners, Shri is frequently asked to speak at international conferences and symposiums, and has published many papers that include power quality problems and the use of active power conditioners for total harmonic management.

1. d = depth of current penetration in mm, f = frequency in Hz, ρ = resistivity of conductor

Handling harmonic distortion is now plain sailing... Sinewave



No modern business environment, with its computers, lighting communications, air conditioning and pumping systems can weather this electrical storm indefinitely and inevitably, traditional solutions are costly and difficult to implement.

Now, SineWave, the revolutionary harmonic conditioner, signals an end to 'dirty electricity' and the arrival of a guaranteed, fit and forget solution.

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Air Your Views

Wireless of Yesteryear

Dear Mr Holmes,

I found your article very interesting as I used to try repairing similar radios in the 1950 – 1960 period as an ex RAF trained radio mechanic and worked on aircraft radio systems. At that time there were a lot of American and British radios which were basic 110 volt radio sets. All filaments totalled 110V and the excess voltage was dropped on the 'mains input' lead', a very dangerous practice which today would be banned by the health & safety agency.

I confirm that in most cases most of the sets I got working again had to be totally rewired and in the case the input lead replaced by a vitreous enamelled dropping resistor mounted on the chassis. The reason for most of these refurbished sets was the very high cost of new radios. A 3 waveband long medium short wave, mono audio radio set with 1 watt?? Audio o/p used to cost £15 – £20 when a working wage was £5 – £7 with overtime, equivalent to £600 – £700. Another problem with these ancient sets today was that the bandwidth of the early superhets were too wide for the increasing number of stations on the medium wave. In aircraft radios this was overcome by the double superhet.

I repeat I am enjoying this article as at 68 yrs I can remember actually burning my hand on a 25z4 yes in a 110 volt line Rx made in the US!!

D. J .Mann, Middlesex.

'Revelation'

The new format is a revelation. I'm also well pleased with the general mix and technical proficiency of the articles. The added Sci-fi is also a plus as it has long been a favourite of mine.

Might I suggest an addition of Satellite T.V. articles. I would even offer myself as a possible author of same. Home brew systems are a favourite of mine, and I would love to see the simple and easy ways of installing your own motorised dish given a wider platform. The possibilities for viewing don't end with ITV Digital and SKY you know.

Plug for my own hobby horse over, congratulations on an excellent facelift for an old friend. Makes her look years younger you know and you can't even see the scars.

David W Nash (via Email).

Some Responses From Our Reader Survey

Alternative Technology

Interesting Reading. (E. Standcliffe)
Rubbish. (A. J. Witney)
Unusual to see in an electronics magazine, but a welcome addition. (J. F. Standish)
It's good to see topical articles that explain what's going on and why. (David Clark)

Projects to Make

Not enough – where are the PCBs? (R. P. Horsley)
This is the one. More Circuits. (A. J. Witney)
Simple circuits are especially good – suggestions for strip board layouts or simple PCBs would be of additional help. (David Clark)
I like the range – you have a good variety of projects. (Les Carling)

Ideas into Profit

Rubbish. (A. J. Witney)
Interesting and enlightening. (David Clark)
Not for me, I'm afraid. (Les Carling)
As someone who is self-employed with a small business, this is what I like to see. (J. F. Standish)

Electronic Themes

Meccano -- Takes me back a few years. Useful Websites! (E. Standcliffe)
1. Excellent. (B. J. Culley)
More history articles. (Ken Greenfield)
Maybe. (A. J. Witney)

Micro electronics

Maybe. (A. J. Witney)
Keep it simple. (R. P. Horsley)
Articles needs better introductions, otherwise fine. (Les Carling)
The 'how it works' articles are interesting and useful. (David Clark)

Contributors

Ray Marston articles are always of interest. Robert Penfold projects is a YES. (A. J. Witney)
Nice to see so many familiar names in the magazine even after all this time. It's the names that keep me buying it. (Gary Emerson)

Reader Profile Survey

If I am lucky enough to win the prize draw how will you know where to send the prize? The survey does not ask for my name & address !*?;!* :-(.

Anonymous

Oops. Yes, that was a big mistake on our part. The competition is still open and we have provided an amended reader profile survey in this issue. Anyone who has sent in the July survey without adding a name or address to it is, of course, welcome to send in the new form.

Kanda, CAT and Criticism.

You have asked for readers' views on the new look EAB, and I have to say I am not impressed. I seem to have bought a subscription to the Kanda Systems in house magazine. At least 10% of the pages are advertisements for Kanda Systems, and Kanda Systems gets further mentions at the end of some articles.

There also seems to be an increasing amount of articles concerning CAT – an organisation which I feel has not had an original idea in its life. It trawls the world for ideas and puts them forward as new and green.

Roger Hine, Fairbourne, Gwynedd.

All magazines have advertising – some more than most. E&B has recently increased its number of pages from 72 to 80, without any increase in the price. In July there were 6 pages of adverts (not counting inside & outside back cover), and so the magazine is if anything better value for money in this aspect than it was before. Occasionally, a member of staff at Kanda Systems may write an article for the magazine, and this might result in the company being mentioned in that article, but here at E&B we bring you projects that require components from any source, not ones that can only be obtained through Kanda. We value our policy of providing a fair system ensuring your right to choose who you purchase components from. We hope that we are providing you with your magazine not our magazine, if you get my meaning

The Editor.

If you have any views or queries, then send them in to:

**Air Your Views,
Electronics And Beyond,
17/18 Glanyrafon
Enterprise Park,
Aberystwyth,
Ceredigion. SY23 3JQ.**

Alternatively, you can fax them to 01970 621 040, or e-mail them to jaldred@kanda.com.

Discussion Point

'CROSSED-WIRE' EMAIL
BY JONATHAN ALDRED

email@secure?.com

Is the email system as secure as we think it is? I don't know – personally I have been using email, on and off, since those days (not so long ago) when presenters on the television still had to explain to the viewers the nature of that strange technological phenomenon called the Internet. Sure, I have received electronic junk mail and had emails bounce back on me, but these are just two of the things you come to expect after a while. Security is something you can never be sure about, but nevertheless is an issue that goes further and further to the back of your mind as experience shows you that what you send from point A to person B does arrive because even if you do not get a reply from B, at least you are not getting any unexpected replies from lunatic C. People might spy on or intercept emails in film and television fiction, but in real life it is something most people will not even think twice about.

Recently, however, I did get an email from lunatic C – and this is how it happened:

My father (person B) had just signed up with Hotmail and his next action was to send me an email to tell me about it. He also wanted to ask me about digital cameras, because he had seen some in a sale in town. I replied to his message and he, in turn, replied to mine. This third email, however, was not from his address. It had [Re: Digital Cameras] in the subject line, so I naturally assumed it must be from him and that he had replied from someone else's computer. For all I knew, he was in an Internet café or sending them from a friend's house. I clicked the reply button and asked him what was going on. The reply I got this time was from the real owner of the email address, and it was less than polite (and that's putting it mildly). I was annoyed at this, but didn't respond because the last thing I want is to get a string of abusive emails from someone who came across in his letter as being a short tempered and nasty minded lunatic.

But when I talked to my father later on, he told me he had been on the same machine all the time without getting up or logging out. So what had happened? Apart from the subject line, the only thing both emails appeared to have in common was that they both ended in @hotmail.com. It would appear that I had somehow been the victim of a 'crossed-wire' email. This is something I had never heard of before, so I went onto the Forum at www.electronicsandbeyond.com and placed a message asking if anyone else had experienced anything similar.

Within a day, I got a reply from reader Ian King, which said the following...

'I used a work laptop from home recently. When I logged into the e-mail system and sent the mails one did not get to its destination. I had a mail a few days later from a complete stranger who had received my missing mail in error. The e-mail system is therefore not secure at all.'

This prompted me to send off a letter (yes, by email) to Hotmail, telling them that I was going to write about it in the magazine and giving them an opportunity to respond. They did respond, but judging by the reply I got it did not seem that they had read my email properly at all. Here is the main body of their letter...

'Hello,

Thank you for writing to MSN Hotmail.

If your father's name is being used in conjunction with a Hotmail account that you did not establish, we need a statement from you denying any involvement with the account and or knowledge of who registered the account. In other words, you should state: 'I did not create this account. It is being used to impersonate me. I have no knowledge of who created this account.'

We need documented proof of the impersonation or misrepresentation of you on Hotmail. If you don't have an actual e-mail message, please send us a detailed written explanation of why you believe that you're being impersonated.

[...] As soon as we have all the information, we will take appropriate action against the account for violating our Terms of Service.

So, not very helpful then.

In all reality I knew I wasn't going to get a 'we're ever so sorry' message from Hotmail, but I at least expected them to answer my question and tell me what they think might have happened.

I think what I was cross about most in this instance was that lunatic C was not to know that I was 27 not 7. Also, what if I had been giving out personal information – my credit card number for example? What if I had given out details of when I was going to go on holiday and leave my house unattended?

I'd like to know what you think. Is the email system secure? Have you had any similar experiences? What about the impersonal nature of email – does it encourage people to be aggressive over even the slightest thing? What is the strangest response you have ever had to an email?

Write to me though Air Your Views or the new-look Forum at www.electronicsandbeyond.com. My email address is jaldred@electronicsandbeyond.com

Have you got any thoughts you would like to share with us in a discussion point article? If so, send them in to Air Your Views – Discussion Point, 17/18 Glanyrafon Enterprise Park, Aberystwyth, Ceredigion, SY23 3JQ.

Event Review: ROBOTS@WAR3

Saturday 30th June 2001

by David Jones

Robotic fighting has been the latest in 'up and coming sports' to influence the nation as a whole. Since it hit the screens back in 1998 the quantity of combat robots throughout the United Kingdom has grown at a phenomenal rate. One of the most amazing effects is the way it captures the imaginations of the several million armchair roboteers. Combined with this it seems to have no age boundaries, and very few pastimes can make such a bold claim.

Live robotic fighting sprang up in deepest Wales during late 1998. Once started there's no stopping it! The roboteers love it as it provides a safe and controlled area for testing their robot to the full. Naturally you find out your robot's limits with something that fights back, as the few remaining parts of the inanimate garden fence is no longer seen a challenge!

Robots@War sprang up with its first competition in the hot summer of 1999. Seven robots took part, and all had a memorable day. It was held in aid of Wilson's school, Wallington, Surrey, and the competition was held in a small arena within the school's grounds.

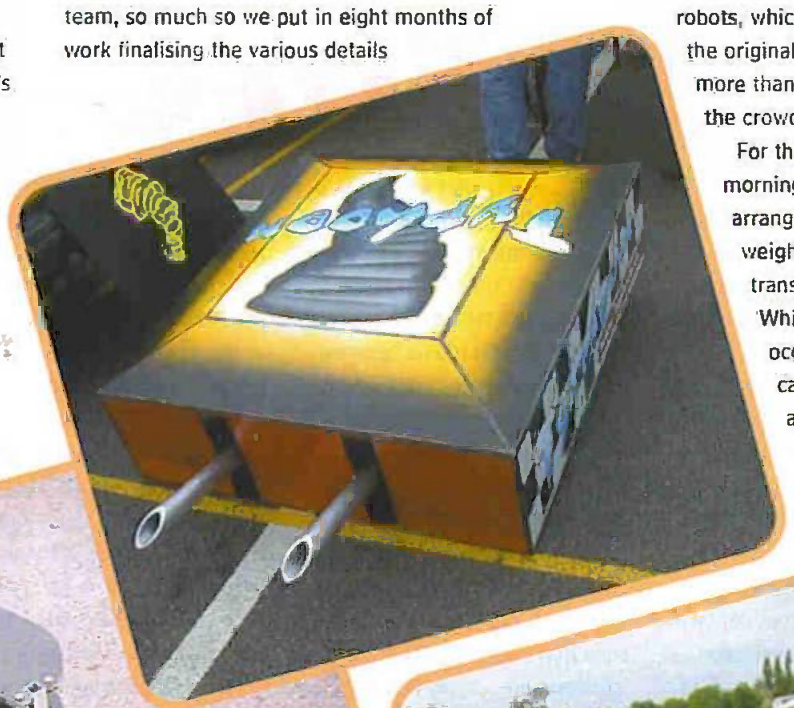
2000's event was to be bigger and better and this was stunningly achieved. Over thirty robots took part of mixed weight categories, ranging from 150g to 80 kg. The constant drizzle of rain let us down after the prior year's scorching weather, but all held their spirits high.

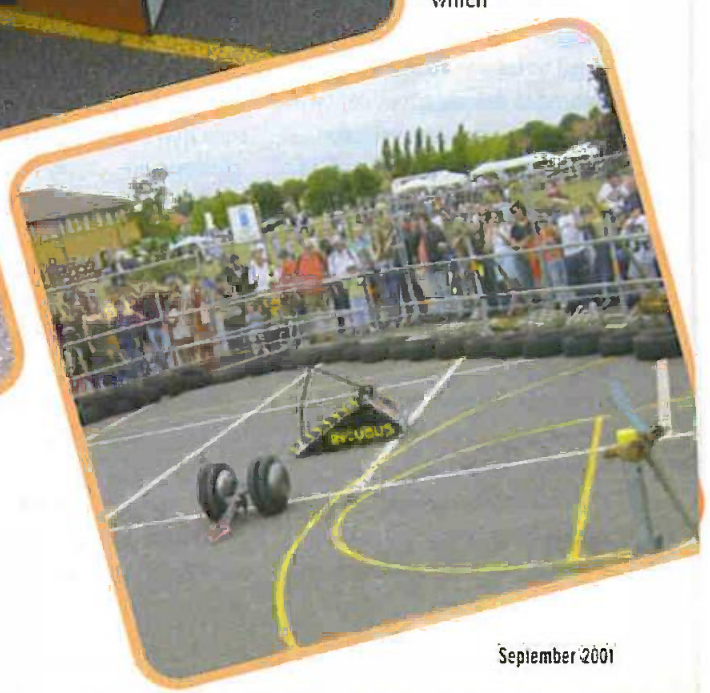
The success of 2000 and requests from roboteers inspired the whole organising team, so much so we put in eight months of work finalising the various details for 2001. The result was called Robots@War3.

No one had ever run an open-air event on this scale before, and we were still sitting on a very steep learning curve, taking note of any mistakes from prior years. There were to be two massive arenas, with ample room for staging and control desks. Combined with this we had to find a way of happily parking over a hundred robots. After several planning meetings all the details were finalised.

The day started out very early and as the sun rose higher into the sky you could feel it was to be another glorious day. Roboteers were arriving most of the morning from all over the UK, and some from as far a field as the Netherlands. In total we had almost 65 robots, which was lower than the original estimate, but still more than plenty to entertain the crowds.

For the remainder of the morning matches were arranged according to weight class and transmitter frequency. Whilst this was occurring testing was carried out in the arenas to perfect all these delicate robots, many of which





had never fought before. This was a major leap forward from testing in your back garden.

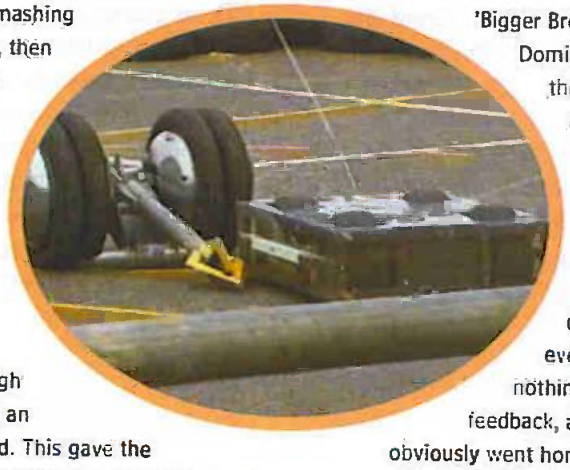
As the matches started getting drawn up on the fixtures board, tension was at a high, as everyone wanted a nice easy match! The fights were designated as 'one on one' and only the winner goes through to the next round.

Final preparations and battery changeovers were carried out before the first match began. The Discovery Channel was in attendance and had the film crew running around attempting to capture the madness.

Safety checks were completed to ensure the crowd was to be kept safe during the combat.

So at noon with the roboteers tanked up on tea and stuffing more bacon rolls down their necks for energy we began the combat.

Each fight lasted five minutes, and in no time at all the bodywork was smashing to the floor. It's a strange sight watching people happily smashing others' creations, then shaking hands in delight afterwards. The first set of rounds was highly entertaining and the crowds loved it.



Half way through the second round an interval was called. This gave the roboteers time to recharge, and also a much appreciated opportunity for some of the knocked out robots to display their creations to the onlookers.

An old hovercraft was dragged in as a sacrificial object, it took three of us to drag in and was soon thrown about as if made of polystyrene. The words of the commentator summed the demolition up, 'roboteers zero, and hovercraft one'. Maybe there is a lesson in this for all those prospective builders?!

Fights continued in the baking sun long into the afternoon, culminating in a fantastic fight between 'Dominator 2', and 'Bigger Brother'. Finally Dominator 2 ran out of the will to continue and lay on the warm asphalt while Bigger Brother did a victory dance.

It's been three days since the event and I have had nothing but positive feedback, as everyone obviously went home with another memorable day in his or her mind.

All that's remaining for me to do is move the five tonnes of railway sleepers, together with the tonne and a half of concrete blocks back to the compound we borrowed them from, not to mention the tyres...

A huge debt of thanks must be given to MACT Scaffolding, Travis Perkins, Sutton & East Surrey Water, The Discovery Channel, Wilson's School, The school's Combined Cadet Force, and a very special thanks to my team, who helped make the whole day a reality.

So what's next? Our next event is being held at Danson Park, Kent on the 14th and 15th July 2001. This should be another day to mark down on the calendar!

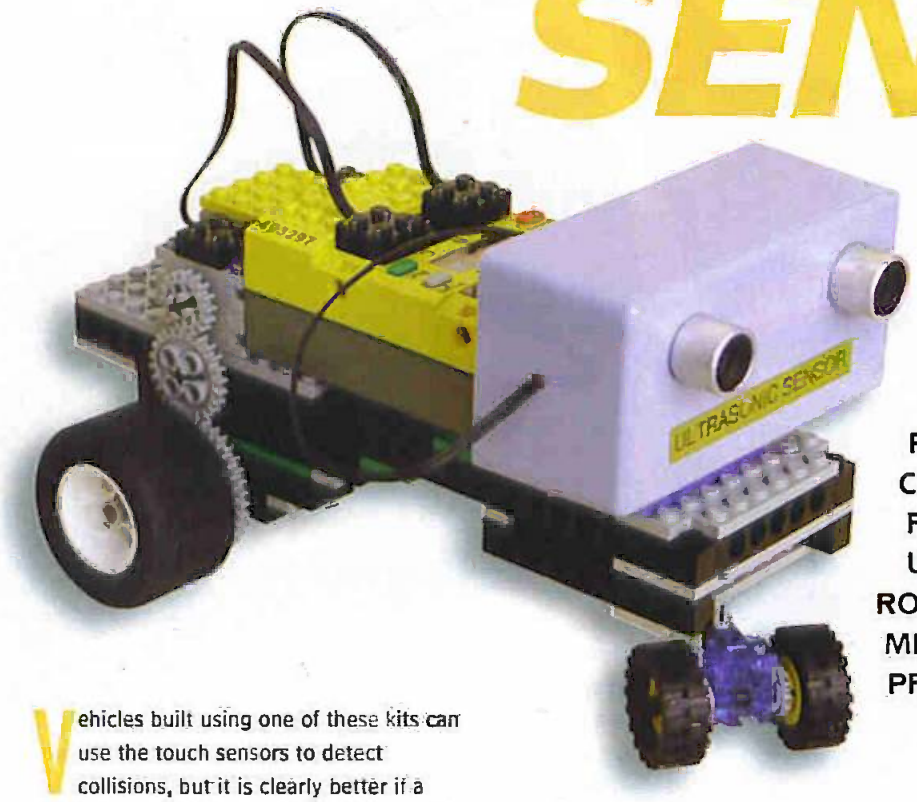
I have no idea where all this will end, but hey, I'm only 19 and there is always tomorrow!

David Jones
Chairman of Robots@War
www.robotsatwar.com

The winners were:

Antweights:	Combatant Peter Waller
Featherweights:	Beefcake Tommy Winkworth
Middleweight:	Zap Tommy Winkworth
Heavyweight:	Bigger Brother Jo Watts
Sportsmanship Award:	The Office Party Guy Radford

Lego Ultrasonic PROXIMITY SENSOR



by Robert Penfold

IN A PREVIOUS ARTICLE ROBERT PENFOLD DESCRIBED A SIMPLE ULTRASONIC REMOTE CONTROL UNIT FOR USE WITH ROBOTS CONSTRUCTED USING LEGO'S POPULAR MINDSTORMS CONSTRUCTION KITS. THE PROJECT FEATURED HERE IS ANOTHER ULTRASONIC DEVICE FOR USE WITH ROBOTS CONSTRUCTED USING A MINDSTORMS KIT, THIS UNIT IS A PROXIMITY SENSOR.

Vehicles built using one of these kits can use the touch sensors to detect collisions, but it is clearly better if a robot can avoid things in the first place rather than running into them and then taking remedial action. The standard Lego light sensor can be used as a proximity detector, and it can work quite well in this application. However, its effectiveness in this role inevitably depends on the reflectivity of the objects that come into its field of view.

An ultrasonic sensor is generally more reliable than a light type in this application. Some objects reflect sound waves better than others, but practically any solid object will reflect the sound well enough to give a good operating range. Ultrasonic sensors are not good at detecting objects that largely consist of empty space, such as a wire fence, or very small objects.

The same is also true of light sensors though, and something more than a very simple sensor is needed for awkward objects such as these. Both light and ultrasonic sensors are highly directional, and operate best when they are perpendicular to the surface being detected. The range of this sensor is therefore reduced when it is at a shallow angle to the target surface, but it should still detect it in time to avoid a collision.

Of course, this sensor is not restricted to operation in robot vehicles. It can also be used as a proximity detector in a stationary robot. In other words, the sensor is used to detect when someone comes close to the robot, and the robot then goes through a routine of some kind. It can also be used to provide the opposite action, with the robot being brought to a halt when someone is detected. Systems of this type are often used with 'real' robots as a safety measure. With a MindStorms kit a proximity detector is probably of most use with toys and novelty devices.

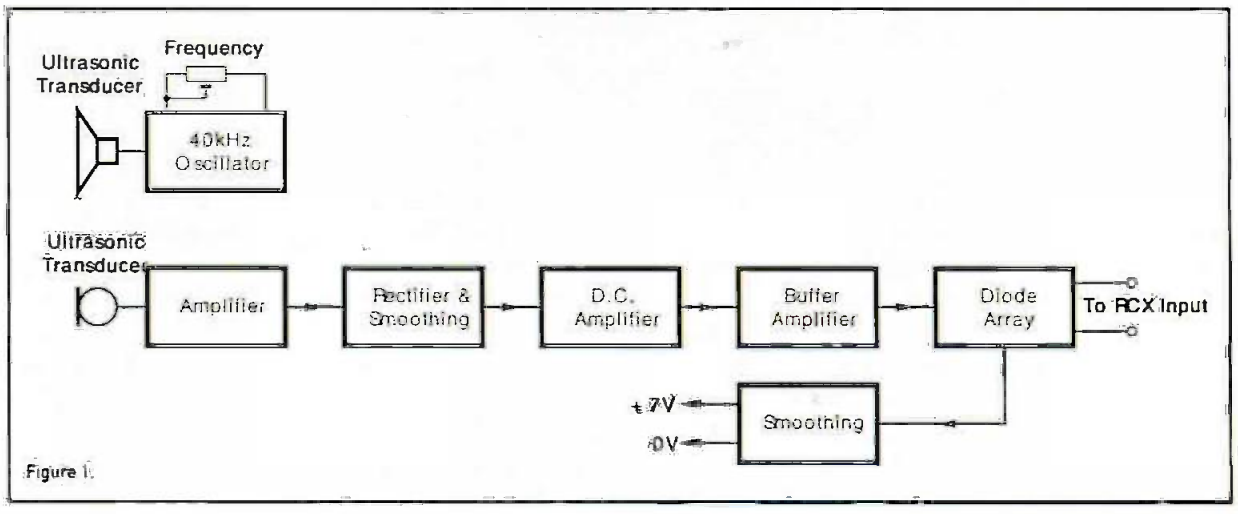


Figure 1.

Range

It is possible to obtain relatively long operating ranges using an ultrasonic sensor. In fact it is possible to obtain detection ranges that are too great for usable operation in average size rooms. With operation at high sensitivity the sensor nearly always detects something, giving unusable results. The range of this sensor has therefore been kept quite short so that it can be used successfully in rooms of normal dimensions. It will still detect large flat surfaces at ranges of around two metres or so when adjusted for optimum performance. If required, lower sensitivity can be obtained by slightly detuning the transmitter.

The circuit is powered from the RCX unit, and it connects to one of the RCX unit's input ports just like one of the standard Lego sensors. There is no specific support for an ultrasonic sensor in RCX code or any of the other programming languages normally used with the MindStorms kits, but this sensor 'looks' like a normal active sensor to the RCX unit. It can therefore be handled in the software in the same basic fashion as a standard active sensor such as the Lego light type. A sensor of this type is necessarily much larger than the 'proper' Lego sensors such as the light and touch varieties. This is due to the relatively large size of the ultrasonic transducers and the need to have the transmitting and receiving transducers a few centimetres apart. Normal vehicle robots still easily accommodate the unit.

System Operation

Figure 1 shows the block diagram for the ultrasonic sensor. The sensor relies on the fact that ultrasonic sound waves are highly directional. A continuous signal is emitted by the transmitting transducer, and with a suitable object a couple of metres or less in front of the unit, a reasonably strong signal will be reflected back to the receiving sensor. Although the transmitting and receiving transducers are only about 50 millimetres apart, the highly directional nature of ultrasonic sound waves ensures that direct pickup from the transmitter to the receiver is insignificant. Although one might expect a strong signal to be coupled from one transducer to the other through the case, in practice this does not give any problems either. The transducers are Piezo devices that are only efficient over a narrow frequency range. Only 40kHz types are readily available, and it 40kHz transducers that are used in this design.

Even with a suitable target object well within the range of the unit the output signal from the receiving transducer will be no more than a few millivolts. The receiving transducer therefore feeds into an amplifier stage that boosts the signal to a more useful level. A rectifier and smoothing circuit processes the output signal from the amplifier stage to produce a positive d.c. signal that is roughly proportional to the amplitude of the received signal. This signal receives a small amount of amplification and it is then fed to the input of the RCX unit via a buffer amplifier and a diode array. The input ports of the RCX unit feed into a 10-bit analogue-to-digital converter. On the face of it, the reading from the converter will give an indication of the target object's range. In practice the reading will vary substantially depending on the efficiency with which the target object reflects the ultrasonic sound from the transmitter. Also, objects less than about one metre from the sensor tend to give the maximum reading. The sensor merely indicates the presence of a target object and

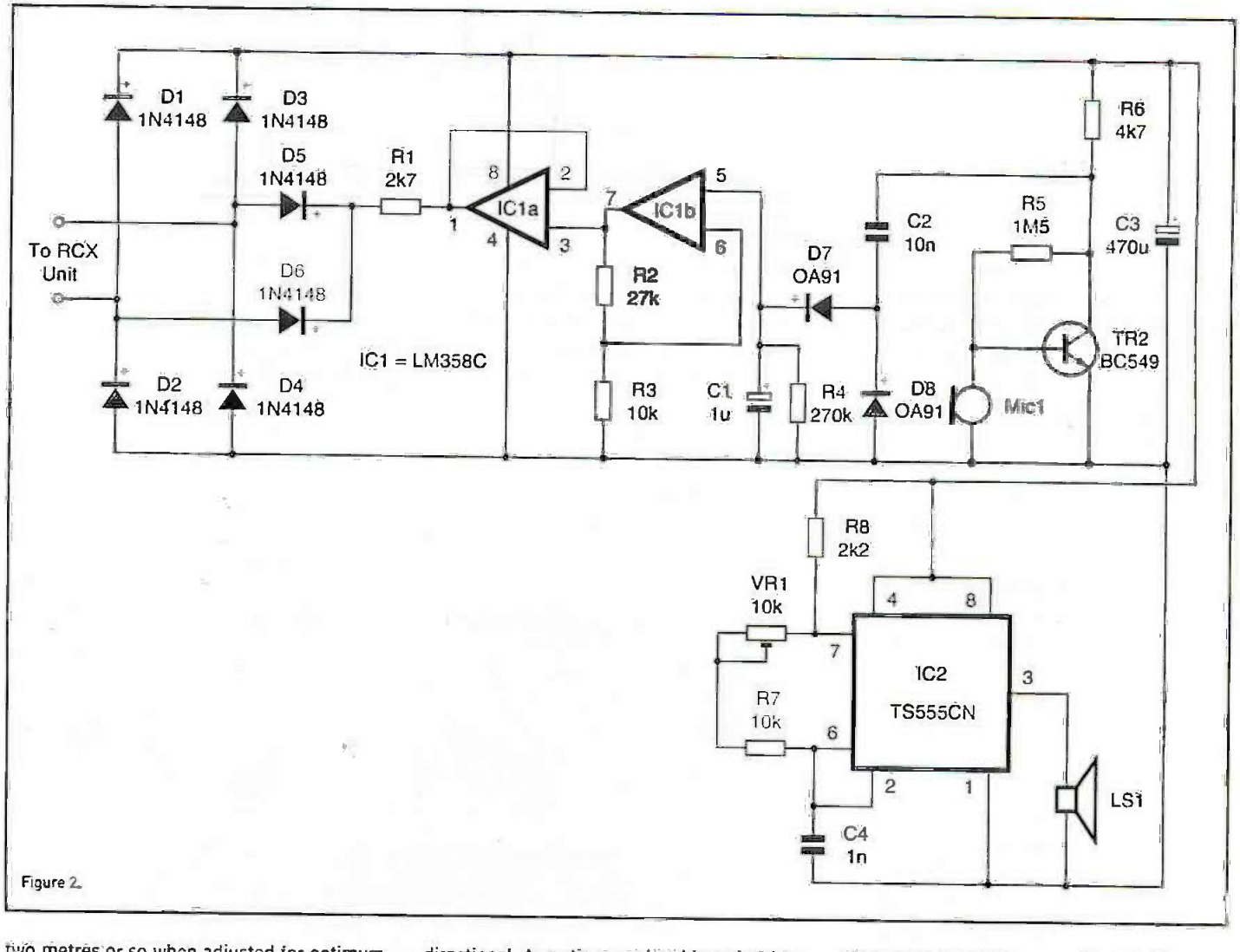


Figure 2.

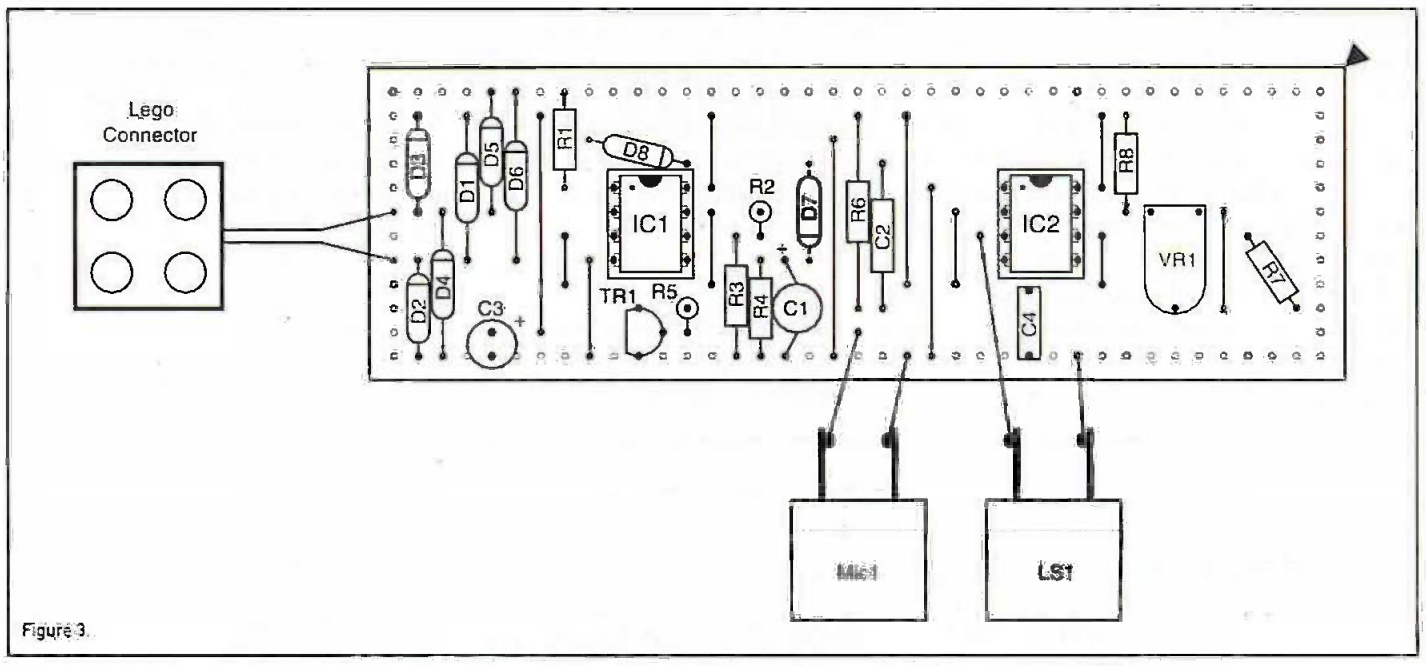


Figure 3.

does not provide a useful range data, but this is adequate for most purposes.

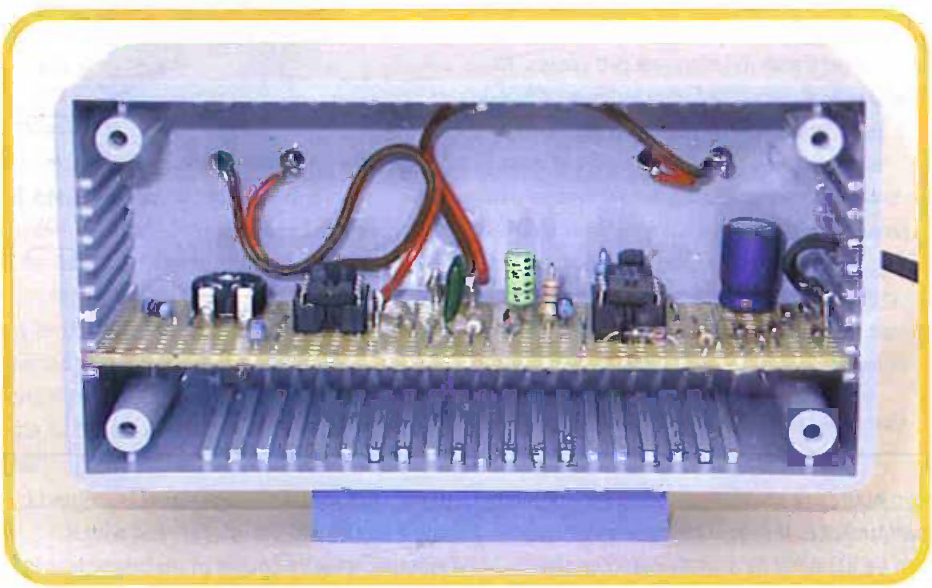
The diode array is needed because of the way in which the RCX unit uses the two input terminals to also act as a power source. The general scheme of things is to have the terminals act as supply outputs for the majority of the time. They are briefly switched to the input mode each time an input reading is taken. The connectors and circuits are designed so that it does not matter which way around the connectors on sensors are fitted to the ports of the RCX unit. There are four possible orientations, and a sensor will work properly whichever of the four orientations is used.

One role of the diode array is to make sure that the supply always connects to the main circuit with the correct polarity. Due to the brief gaps in the supply it is necessary to include a smoothing capacitor in the supply circuit. The exact supply voltage depends on the state of the batteries in the RCX unit and the level of loading, but it is usually around seven volts. Another function of the diode array is to ensure that the output of the buffer amplifier drives the input port correctly, whatever the orientation of the sensor's connector.

Circuit Operation

The full circuit diagram for the ultrasonic sensor appears in Figure 2. The diode array is comprised of D1 to D6, and a standard bridge rectifier circuit is formed by D1 to D4. This provides the seven-volt supply in conjunction with smoothing capacitor C3. A bridge rectifier provides full-wave rectification, so it does not matter which way around the circuit is connected to the RCX unit. The circuit will always be provided with a supply of the correct polarity.

An internal pull-up resistor in the RCX unit normally takes the input terminal to its full-scale potential. D5 and D6 enable the output of IC1a to pull the input terminal of the RCX port down towards the 0-volt supply rail. Again, it does not matter which way round the unit is connected to the RCX unit. The output of IC1a will connect to the 'hot' input terminal of the port via one or other of the



two diodes. During the periods when the input is providing the supply, one or other of the diodes will block the supply so that only an insignificant current flows through the two diodes. The output of IC1a is connected across the supply during these periods, but R1 prevents an excessive output current from flowing into IC1a's output stage.

IC1a is the buffer amplifier and it is a conventional voltage follower stage. IC1b is the d.c. amplifier. It operates in the non-inverting mode and its closed loop voltage gain is set at 3.7 times by feedback resistors R2 and R3. Note that the LM358N used in the IC1 position is a device that is intended for use in d.c. circuits that lack a negative supply. Most other dual operational amplifiers are not able to provide the very low output voltages called for here and will not work in this circuit. Few operational amplifiers work properly at the low supply voltage used here, and the use of substitutes is not recommended. TR1 amplifies the output from Mic1, which is the receiving transducer. TR1 is used as a simple common emitter amplifier that provides over 40dB of voltage gain. C2 couples its output to a simple half-wave rectifier circuit using D7 and D8. C1 and R4 form the smoothing circuit.

The transmitter circuit is just a basic 555 timer (IC2) used in the standard oscillator configuration. The maximum supply current that the RCX unit can provide from each input port is quite limited, and it is advisable

to use a low power version of the 555 for IC2. There is otherwise a risk that loading on the supply will be so great that an inadequate supply potential will be obtained. VR1 is the frequency control, and it is normally adjusted to produce optimum performance from the circuit. However, it can be deliberately offset from the optimum frequency if reduced sensitivity is needed.

Construction

The stripboard layout and wiring for the ultrasonic sensor are shown in Figure 3, and the cuts in the copper strips on the underside of the board shown separately in Figure 4. The board has 39 holes by 12 copper strips,

Neither of the integrated circuits are particularly vulnerable to damage from static charges, but it is still a good idea to fit both components on the board via a holder. The OA91 diodes used for D7 and D8 are germanium devices, which give better performance in this application than silicon diodes due to their lower forward voltage drop. The circuit will still work very well if OA91 diodes prove difficult to obtain and silicon diodes (1N4148, etc.) are used instead. Germanium diodes are more vulnerable to heat damage than the silicon variety, so take due care when fitting D7 and D8 to the board. It is not essential to use a heat-shunt when making the soldered

In most respects the general layout of the unit is not critical, but one exception is that the ultrasonic transducers (Mic1 and LS1) must be mounted a reasonable distance apart. Practical tests suggest that as little as 25-millimetres separating the transducers will give a suitable low level of direct coupling, but it is advisable to err on the side of caution and use a gap of 40 millimetres or more. The transducers are normally sold as a pair, and they are not usually identical. The transmitting unit is usually marked with a type number starting with a 'T', such as 'T16-40'. Similarly, the receiving transducer is normally labelled with a type number that starts with a letter 'R', such as 'R16-40'. The

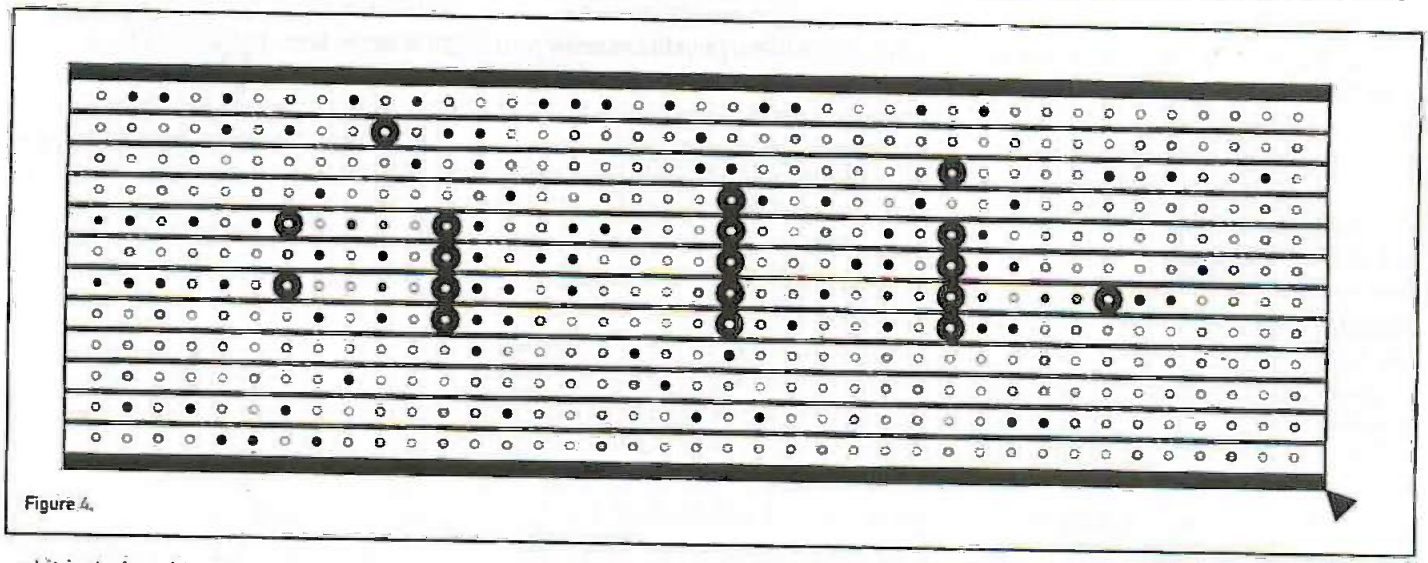


Figure 4.

and it is designed to fit into the guide slots of a suitable plastic case (Maplin Catalogue code YU52G). This is a neat solution to fitting the board in the case, but it does result in the use of a case that is somewhat chunkier than is really necessary. It is possible to use the board in practically any small plastic case that can accommodate the 100-millimetre length of the board. At least three extra strips are then needed at the top of the board to provide space for a couple of mounting holes so that the board can be bolted in place, and a board of 39 holes by at least 15 copper strips is then needed. Metric M2.5 mounting bolts are suitable.

Building the board is largely straightforward, but there are a few points that merit some amplification. The first point is that it is not a good idea for complete beginners to undertake a project of this type. The RCX unit is designed to take a certain amount of mistreatment, and there is probably little real risk of damaging the unit if a mistake is made in the construction of the sensor. However, bear in mind that the manufacturer's guarantee will not cover any damage caused in this way, and spare RCX units are expensive.

connections, but each joint should be completed reasonably quickly. After soldering the first lead in place allow the component to cool of slightly before connecting the other lead.

Make sure that all the diodes are connected with the correct polarity, but be particularly careful with D1 to D6. Internal circuits limit the maximum output current from the RCX unit, and mistakes are unlikely to cause any damage. However, it is best not to put this type of thing to 'the acid test'.

There is little space available for capacitors C1 and C3, which must be miniature radial (printed circuit mounting) types if they are to fit properly into this layout. C2 must be a type that has leads rather than pins in order to fit this layout, and a Mylar type is probably the best choice. A polyester or polycarbonate component having 7.5 millimetre (0.3-inch) is suitable for C4.

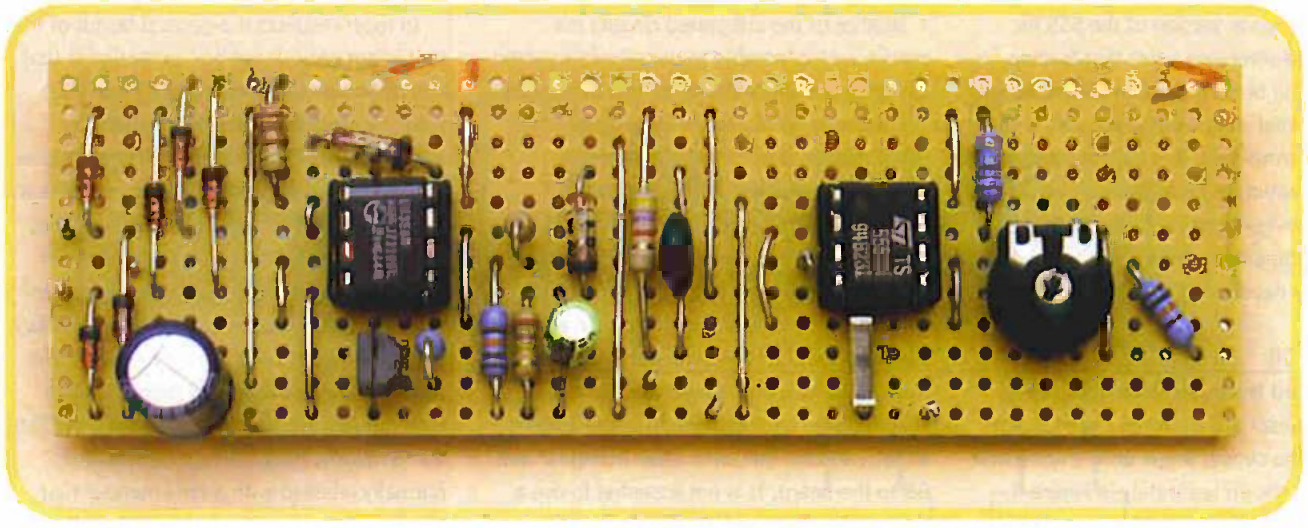
If the board is being used with the case mentioned previously and its built-in guide-rails, it will probably have to be filed down so that it tapers slightly towards the front. This is necessary to match the slight tapering of the case, which is noticeably narrower towards the front.

retailer's catalogue or other literature on the transducers should make it clear which device is which.

Ultrasonic transducers do not normally have any form of built-in mounting bracket. The easiest way of mounting them on the case is to drill holes about 2.5-millimetres in diameter to accommodate the two pins at the rear of each transducer, and then glue them in place. A good quality gap-filling adhesive is needed. An epoxy type is suitable, but a hot glue gun provides the quickest and easiest means of fixing them in place. Some ultrasonic transducers have one of the pins connected to the metal case. Where appropriate, this pin should be the one that connects to the 0-volt supply rail.

Making Connections

A small hole is drilled in one side of the case to take the lead for the Lego connector. This connector is based on a 2 by 2 Lego brick, and is obviously a non-standard type. There are various options available when connecting do-it-yourself projects to an RCX unit. It is possible to make your own connectors using standard 2 by 2 Lego bricks as the basis. A tour of web sites devoted to



Lego MindStorms should soon produce some details of home-made connectors. An easier method is to either buy some Lego connecting cables or sacrifice one of the long leads supplied in the MindStorms kit. The long leads are little used in practice, so many Lego project builders prefer to use one of these rather than buy an extra cable from a specialist Lego supplier. Cutting a connector plus about 200 millimetres of lead from each end of the cable provides two leads that can be used to connect your own devices to the RCX unit.

There is actually a third option available in the form of the connector plates that are available from specialist Lego suppliers. One of these can be mounted on the project and wired to the input of the circuit. The connector plate then connects to the RCX unit using a standard Lego lead, much like connecting the RCX unit to a touch sensor.

Some means of mounting the sensor on Lego robots is required, and gluing a Lego brick to the underside of the case is the best method. Due to the relatively large size of the sensor a fairly large brick such as a 6 by 2 or 8 by 2 type is best. Either the top of the brick must be filed flat or it must be glued in place using a good gap-filling adhesive.

Testing and Use

After a final check of the wiring the sensor is ready for testing. Start with VR1 at a roughly middle setting. The easiest way to test and set-up the sensor is to connect it to an input of the unit that is set for operation with an active sensor such as the Lego light type. The sensor will not work at all with an input set for use with a passive sensor such as a touch type, since it will not receive a significant supply voltage from the input port. Connect the sensor to the appropriate input port and switch on the RCX unit. Keep pressing the View button on the RCX unit until the arrow cursor indicates that the correct input port is being monitored by the display.

The sensor should work to some degree, with a high reading being obtained with the transducers aimed into a large empty space, and a much lower reading being produced if you place your hand in front of and close to the transducers. The maximum reading will probably be less than 100, and will usually be between about 80 and 90. The minimum reading will probably be zero, or something close to zero. If the sensor is clearly non-operational, switch off immediately and recheck the wiring, etc. If it works to some degree, the next step is to adjust VR1 for optimum performance.

Start by aiming the sensor at a wall, and then move the unit just far enough away from the wall to produce a high reading on the display. Then adjust VR1 for the lowest possible reading. It is likely that the reading will go right down to zero. If so, move the sensor further away from the wall to restore a higher reading and then readjust VR1 for the lowest possible reading. It might be necessary to repeat this process a few times in order to produce the largest possible operating range.

The maximum range of the unit will probably be around two metres, which is too great for use in small rooms. The sensitivity of the circuit is easily reduced, and it is just a matter of adjusting VR1 away from the optimum setting. Suppose that a maximum operating range of about 0.5 metres is required. Position the sensor about 0.5 metres away from a wall and aim it at the wall. Then adjust VR1 for a low reading, but a reading greater than zero. The sensor should then operate with approximately the required range.

The ultrasonic sensor is handled in the software in exactly the same way as any other active type. In RCX code it can be used as if it was a light sensor. When using the sensor in this way bear in mind that a high reading is obtained when empty space is detected, and a low reading is produced when an object is detected. Things operate the other way round if Raw mode is used when reading the sensor.

Parts List

Resistors	
R1	2k7
R2	27k
R3,R7	10k (2 off)
R4	270k
R5	1M5
R6	4k7
R8	2k2
All 0.25 watt 5% carbon film	
Potentiometer	
VR1	10k min horizontal preset
Capacitors	
C1	1u 63V radial electrolytic
C2	10n Mylar
C3	470u 10V radial electrolytic
C4	1n polyester
Semiconductors	
IC1	LM358N
IC2	TS555CN
D1 to D6	1N4148 (6 off)
D7,D8	OA91 (2 off)
TR1	BC549
Miscellaneous	
LS1	40kHz ultrasonic transducer (see text)
Mic)	40kHz ultrasonic transducer (see text)
Small plastic box.	
0.1-inch stripboard having 39 holes x 12 strips.	
8-pin DIL holder (2 off).	
Lego connector and lead (see text).	
Lego brick, wire, solder, etc.	

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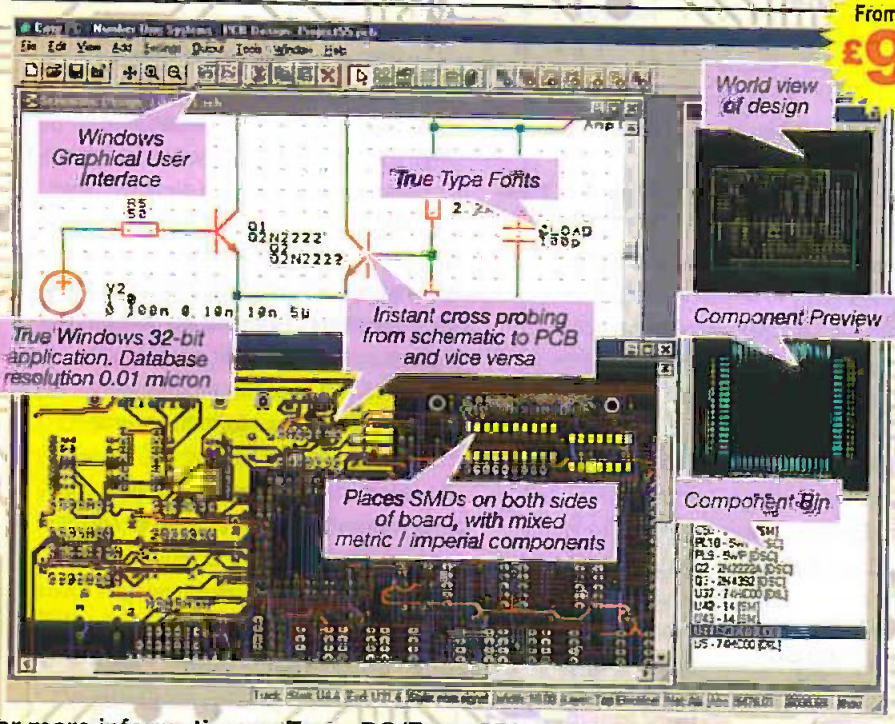

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The 'OPTO' in OPTOELECTRONICS

RAY MARSTON EXPLAINS THE BASIC NATURE AND BEHAVIOUR OF LIGHT AND MIRRORS IN PART 1 OF THIS OPTOELECTRONICS-RELATED 4-PART SERIES.

The word 'optoelectronics' first came into general use in the 1970s. The word roughly describes the branch of electronics that is concerned with the practical application of light-related optical (opto) phenomena and with traditional optical devices such as mirrors, prisms and lenses, and with modern optical devices such as fibre optic cables, LEDs, and lasers.

Most readers of this magazine will have few problems in understanding the purely electronic aspects of optoelectronics, but probably have very limited knowledge of its optical parts. This new 4-part series aims to help remedy the latter situation by giving fairly concise descriptions of vital optoelectronics-related 'opto' subjects. This opening episode deals with the basic nature and behaviour of light, and with mirrors. Part 2 will deal with prisms and lenses. The final two episodes will deal with fibre optic communication and with LED and laser operating principles.

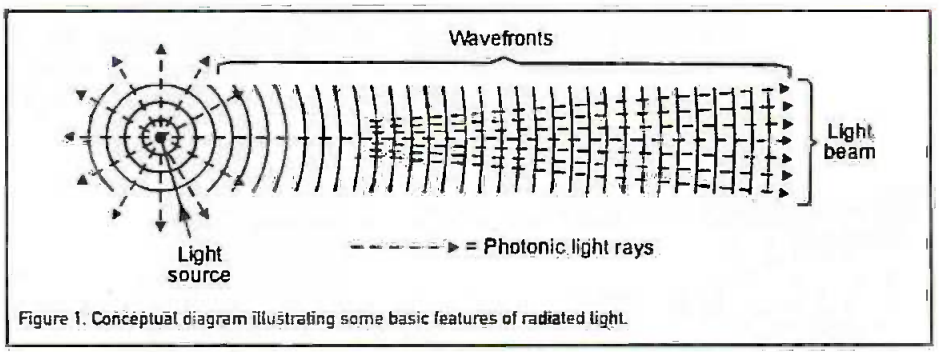

Figure 1. Conceptual diagram illustrating some basic features of radiated light.

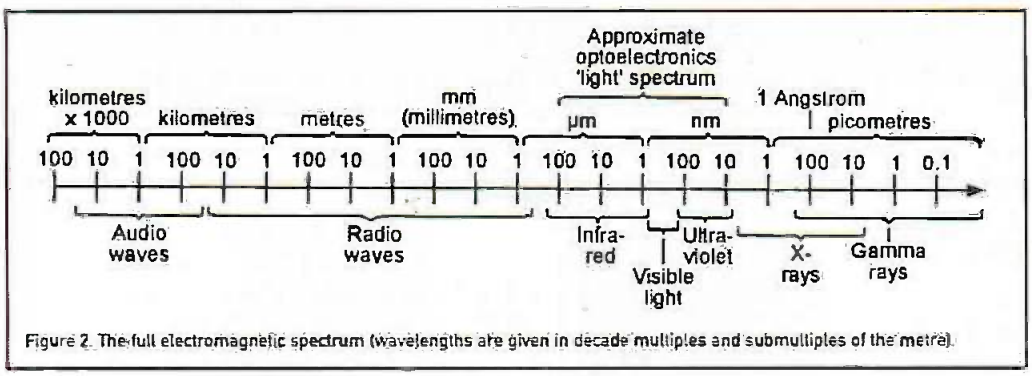

Figure 2. The full electromagnetic spectrum (wavelengths are given in decade multiples and submultiples of the metre).

Light

Light is a form of energy and is transported by electromagnetic radiation. It has an apparent dualistic nature that enables it to be regarded as both a wave phenomenon and as a flux-like flow of sub-atomic particles known as photons, which are released as a consequence of shifts in the energy levels of atoms, such as those caused by heating or various other disturbences.

All active (moving) photons are endowed with parameters such as frequency (f), velocity (v), free-space wavelength (l), and mass, and thus represent a finite unit of energy (e). In pure physics, the photon's energy, in joules per second, is usually defined by the formula,

$$e = h \times f$$

in which h is Planck's constant (= 6.626 x 10-34 J s).

In optoelectronics, it is more useful to define the energy in terms of electron-volt (eV) units, and to relate it to the photon's wavelength (l) in nanometers (nm) rather than its frequency. In this case the basic formula transforms into the easily remembered form,

$$eV = 1240/l$$

Thus, a LED that generates a red output at a wavelength of 645nm has a bandgap energy value of 1.92 eV. The energy value of an individual photon depends on its actual wavelength, but is very small; an ordinary green LED, for example, generates an output flux flow of about 2,500 million photons per microsecond at a mean light output power level of a mere 1mW.

Figure 1 shows a simple conceptual diagram that illustrates some basic features of light when radiated from a small point source. The light flux (which contains vast numbers of photons) is effectively radiated in the form of a continuous series of spherical photonic waves that become progressively more planar (less sharply curved) as they move further from the source. The photons move outwards, perpendicular to the wave fronts; a photonic light ray traces the mean path of a photon; a photonic light beam depicts the paths of a collection of rays. A light beam is angular when close to the light source, but becomes progressively more parallel as the distance from the source increases.

In optoelectronics, the term 'light' relates to the entire visible light (400nm to 700nm)

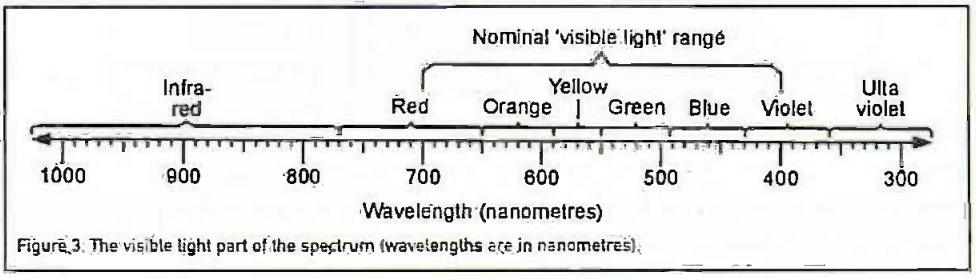

Figure 3. The visible light part of the spectrum (wavelengths are in nanometres).

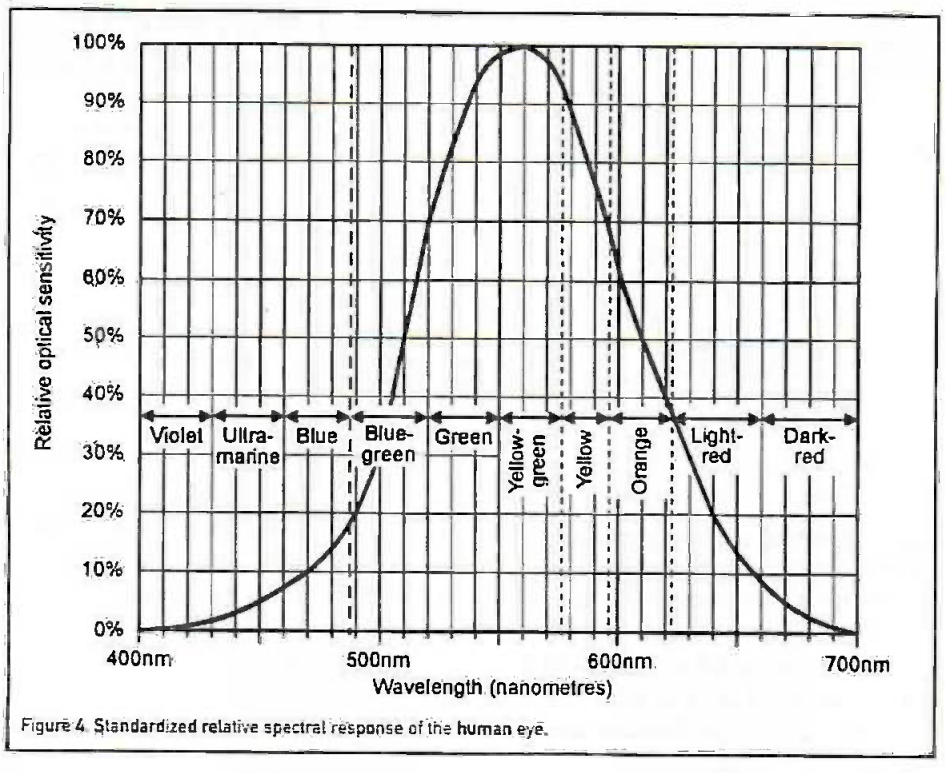

Figure 4. Standardized relative spectral response of the human eye.

part of the electromagnetic spectrum, plus most of its invisible infra-red (IR) and ultra-violet (UV) ranges, i.e., to the spectrum's 10nm to 100mm section. Figure 2 shows details of the full electromagnetic spectrum, and Figure 3 shows the so-called 'visible' part of the spectrum; all wavelengths are marked in decade multiples and submultiples of the metre.

The Sun is the most powerful light generator in our solar system. It generates and radiates light energy as a byproduct of its continuously-active nuclear fusion process; 60% of its radiant energy lays in the IR range. Only 0.0005% of the Sun's radiated energy is (after travelling a mean distance of 93 million miles through space in 8 minutes 20 seconds) received by planet Earth, and one third of this reflects directly back into space. The energy contained in the remaining flux delivers a mean power of 4kW per square metre per day to the Earth's surface and act as the engine for our planet's weather systems and (as a consequence of the results of photosynthesis, etc.) sustains all life on our planet.

Light travels through empty space at a velocity of 186,282 miles (299,792 kilometres) per second. Light's velocity was first estimated with reasonable precision by the Danish astronomer Ole Roemer in about 1690, after he observed unexpected variations in the actual and predicted times of the eclipse of Saturn's moons. The velocity of light through the Earth's atmosphere (which is 0.03 percent slower than through empty space) was first measured with reasonable precision (within 5 percent) by the French amateur scientist Armand Fizeau in Paris in 1849. Fizeau used an opto-mechanical stroboscopic technique to measure the time (about 57mS) that a beam of light took to cover a two-way 17km journey, and from the results estimated the speed of light at 313,300 kilometres per second.

of sight below Earth's horizon; the areas of space through which the sunlight is travelling appear completely dark.

If you go out into the open air on a bright summer's day, you will be bombarded by a stream of solar-generated IR, UV and visible light rays that will produce three distinct types of physiological effects on you. The IR rays will produce a sense of warmth wherever they strike exposed areas of your skin, and the UV rays will slowly start to change your skin's pigmentation in those exposed areas, eventually giving them a deep tan. The visible light rays from the Sun span the full colour spectrum. When they strike an object that you can see, the object's visual colouring is dictated by the object's spectral characteristics.

If the object that is exposed to the Sun's light absorbs all of the spectrum's light energy, the object appears black. If it absorbs only part of the available energy and reflects the rest, it will appear white if it reflects light equally across the entire spectrum, or red if it reflects mainly the red part of the spectrum, or green if it reflects mainly the green part of the spectrum, and so on. The apparent colours have degrees of purity that depend on the width of the reflected part of the spectrum.

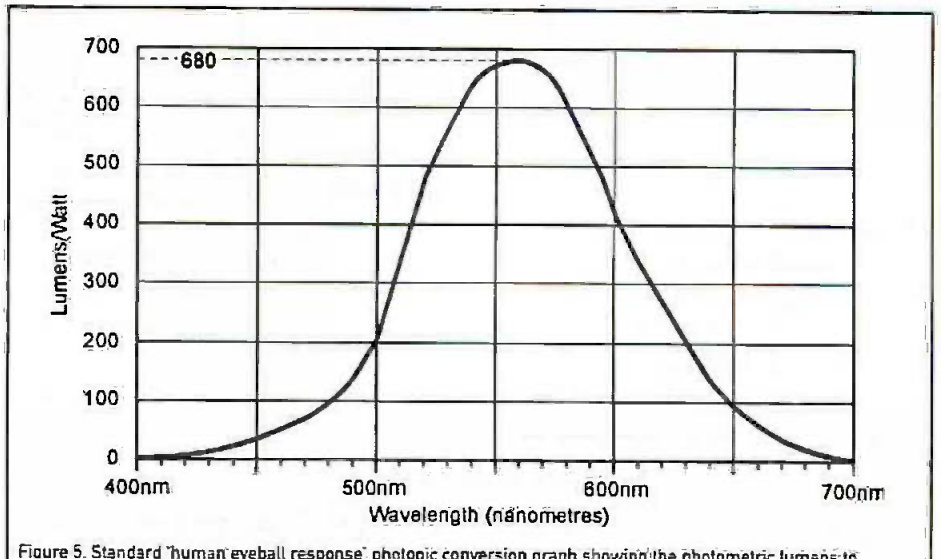

Figure 5. Standard 'human eyeball response' photopic conversion graph showing the photometric lumens to radiometric Watts relationship.

The Visability of Light

A stream of light (photons) racing through empty space can be regarded as a stream of latent energy, and is quite invisible; it only becomes visible when its flux strikes an absorptive material and releases some or all of its latent energy. These effects can be observed by looking up at the moon on a clear night; parts of its surface are illuminated because they are absorbing energy from the rays of the Sun, which is out

Note that human eyes do not have a linear spectral response (just as our ears do not have a linear aural response), and the response varies between individuals. The graph of Figure 4 shows the spectral response of typical human eyes, which are ten-times more sensitive to yellow-green (560nm wavelength) than they are to mid-blue (470nm) or mid-red (660nm). You can observe these effects by looking at a stained glass window (from within a building) when

the window is brightly illuminated by the Sun; the window's glass segments all have roughly similar values of translucence, but the green segments seem far brighter than the mid-red or blue ones. The next section of this article gives more details on this subject.

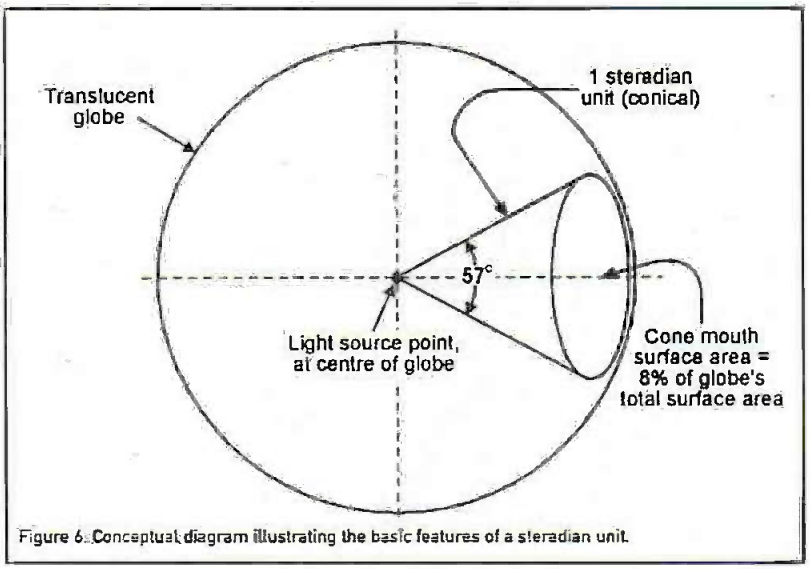

Figure 6. Conceptual diagram illustrating the basic features of a steradian unit.

Light Units

When dealing with light and optoelectronic components such as LEDs and lasers, etc., the units most often used in data sheets are those relating to the light's wavelength and spectral bandwidth, and to the intensity and power levels of its flux. Light wavelength is a measure of the light's colour; visible-light wavelengths fall within the range 400nm to 700nm; UV-light has a wavelength below 400nm; IR-light has a wavelength above 700nm.

The colour purity of a light is defined by its spectral bandwidth, which is measured between the points where the radiated power falls to half of its peak value. True white light contains all the colours of the 400nm to 700nm spectrum; it thus has a bandwidth of at least 300nm and is known as chromatic (multi-toned) light. Red LEDs (operating at about 650nm) have typical spectral bandwidths in the range 15nm to 50nm and are thus also chromatic, since their light outputs span various shades of red. Laser-generated light usually has an exceptionally narrow bandwidth (often less than 0.01nm), and is known as mono-chromatic (one-toned or pure-toned) or (if all of its emitted photons are in phase) coherent light.

Dealing next with the light units concerned with values of light intensity and power, it is important to note that - since human sight does not have a linear spectral response - these values may be expressed in two different types of unit. Conventionally, photometric units are used if they relate to the physiological (apparent) values of visible light sensed by humans, and radiometric units are used if they relate to genuine (true) values of visible or IR or UV light. The following four basic types of unit (each of which has both photometric and radiometric notations) are widely used in optoelectronics.

Total Radiated Flux Power

Light is radiated energy; the total power of the flux flowing from a light source is measured in Watts in radiometric notation, or in lumens in photometric notation. The photometric quantities are related to the corresponding radiometric ones by the internationally-recognised standard 'human eyeball response' photopic conversion graph shown in Figure 5, which shows that 1 Watt of light power is equal to 680 photometric lumens at a wavelength of 555nm (yellow-green), or roughly 82 lumens at 475nm (mid-blue) or 65 lumens at 660nm (mid-red), and so on.

Flux Density

In most practical optoelectronic applications, only a small fraction of a light source's total radiated power falls on a targeted light receptor such as a photocell or an eye's retina, and in such cases the most relevant parameter is the light's flux density (brightness) at the actual target point. In radiometric notation, this parameter is known as the light's irradiance value and is measured in Watts per square metre (W/m2). In photometric notation the parameter is known as illuminance and is measured in lumens per square metre (lm/m2) or 'lux'. The lumen/watt relationship is the same as that shown Figure 5.

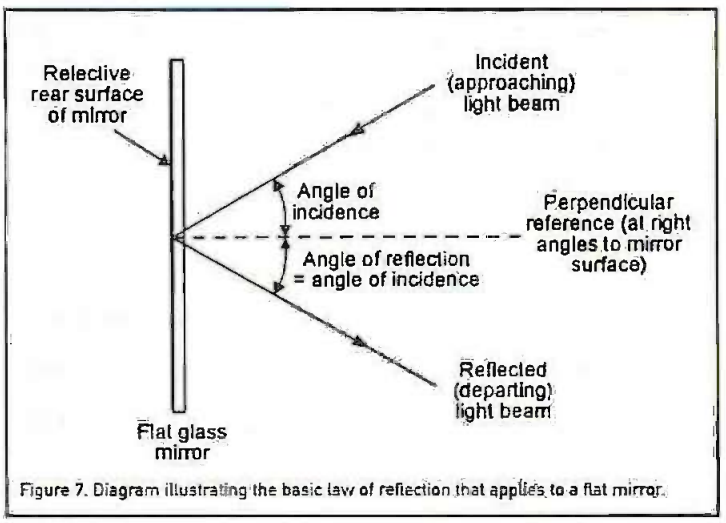

Figure 7. Diagram illustrating the basic law of reflection that applies to a flat mirror.

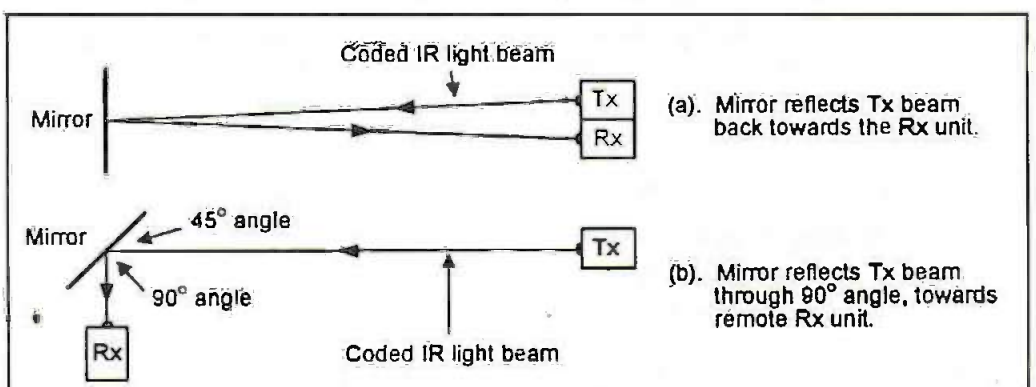

Figure 8. Two simple ways of using mirrors in optoelectronic security applications.

Angular Flux Intensity

Man-made light generators such as LEDs and filament lamps act like crude 'point' light sources but produce directional outputs, i.e. most of their available flux is concentrated into a cone of radiation. To specify flux intensity in such cases, a standard three-dimensional angular unit known as a steradian (symbol sr) is used; in radiometric measurements, angular flux intensity is known as radiant intensity and is specified in units of Watts per steradian (W/sr); in photometric measurements, angular flux intensity is known as luminous intensity and

is specified in units of candela, in which one candela equals one lumen per steradian (lm/sr).

Figure 6 shows a conceptual diagram that illustrates the basic features of a steradian unit. Imagine here that a point source of light is set at the centre of a translucent globe. From the point source, form a 570 cone that reaches out to the surface of the globe. This cone is a three-dimensional angular unit known as a steradian; the surface area of its mouth encompasses approximately 8% of the globe's total surface area.

Radiated Flux Brightness

The brightness of a light source is proportional to both the radiated flux density and the radiating surface area of the light source. In radiometric notation, this parameter is known as the light source's radiance value and is measured in Watts per steradian per square metre (W/sr x m2) of radiating surface area. In photometric notation the parameter is known as luminance and is measured in lumens per steradian per square metre (lm/sr x m2) or candela per square metre (cd/m2).

Light-Beam Manipulators

Visible and IR light beams can readily be reflected, bent, or manipulated in various other geometric ways with the aid of simple optical devices such as mirrors, retroreflectors, prisms or lenses. This section and the whole of next month's episide describe the basic operating principles and optoelectronic applications of such devices.

Mirrors

The simplest mirror is the ordinary flat totally-reflective silvered-back glass type. If a narrow beam of light is aimed through the glass and onto the reflective (rear) surface of such a mirror, the reflected beam always obeys the basic law of reflection, which is illustrated in Figure 7 and states that the angle of incidence (the angle between the arriving ray and an imaginary line drawn perpendicular to the mirror's surface) and the angle of reflection (the angle between the reflected ray and the imaginary perpendicular line) are exactly equal.

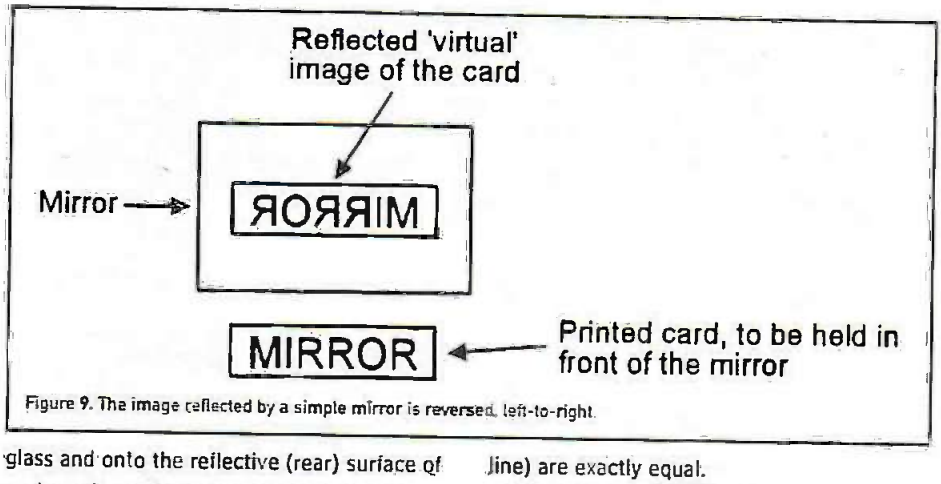

Figure 9. The image reflected by a simple mirror is reversed, left-to-right.

Figure 8 shows two simple ways of using a mirror in optoelectronic security applications. In Figure 8(a) the mirror is used in a corridor protection system, to link a coded Tx IR light beam into an adjacent Rx unit, which activates an alarm if the beam is interrupted. In Figure 8(b), the mirror is angled at 450 and projects the Tx beam around a 900 corner and on to a remotely placed Rx unit; this system can be used to protect an L-shaped corridor or two adjoining outside walls of a building, and is aligned by aiming the Tx beam directly at the mirror's Rx image.

Note that the image reflected by a simple mirror is reversed, left-to-right, as shown in Figure 9. If you take Figure 9 and hold it in front of a mirror, you will see that all of its text is reversed in the reflected image, which is thus known as a 'virtual' (rather than real) image. While you are standing in front of the mirror, scratch your right ear; you will see that your virtual image is scratching its left ear.

If a mirror's reflection is viewed in a second mirror, the image that appears in the second mirror becomes real, rather than virtual. Try standing sideways in front of a large mirror, with a small mirror in your left hand; use the small hand mirror to view your image in the large mirror, and scratch your right ear; note that your image also scratches its right ear, but that if you look at your virtual images directly in either mirror it is the left ear that is being scratched.

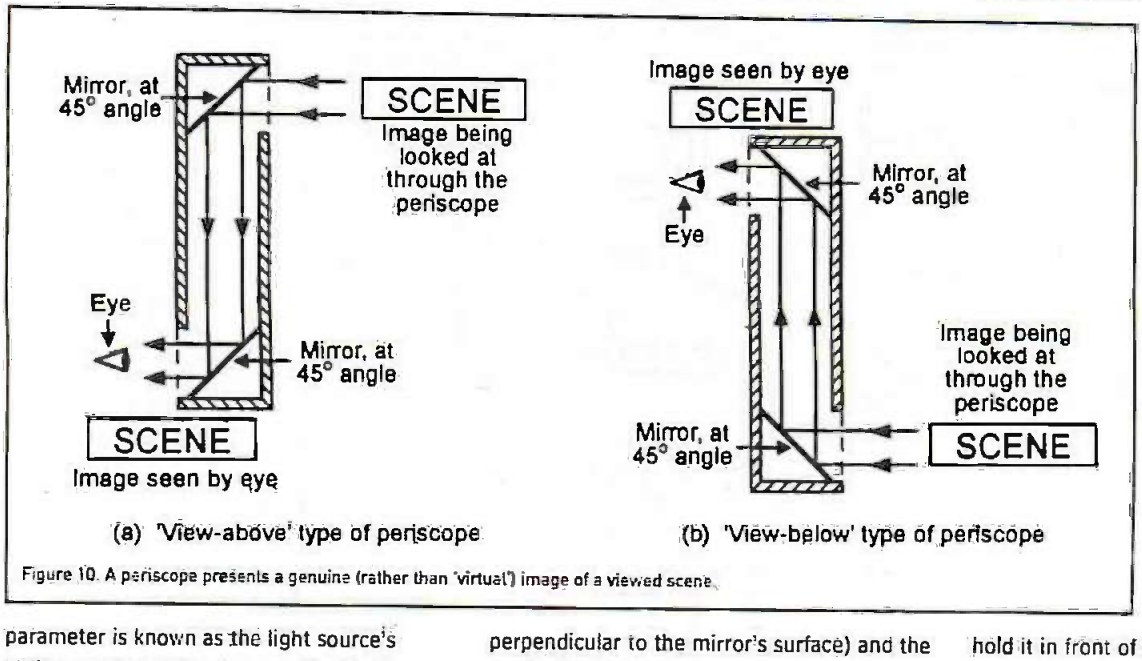

Figure 10. A periscope presents a genuine (rather than 'virtual') image of a viewed scene.

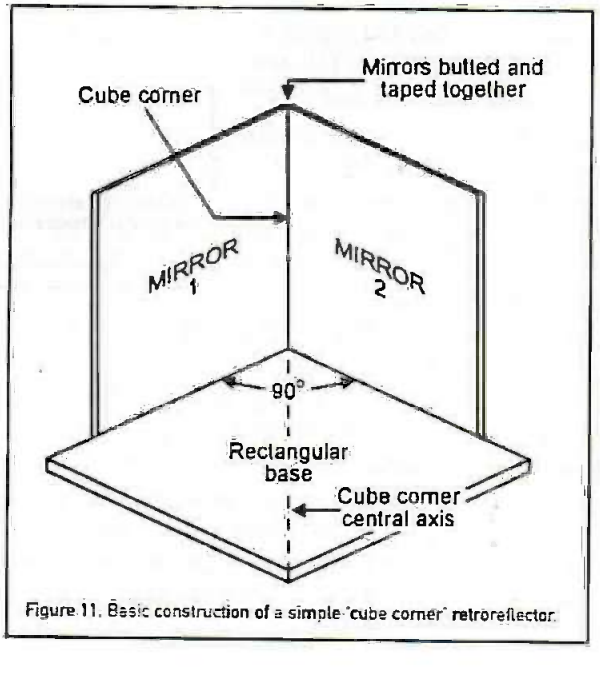

Figure 11. Basic construction of a simple 'cube corner' retroreflector.

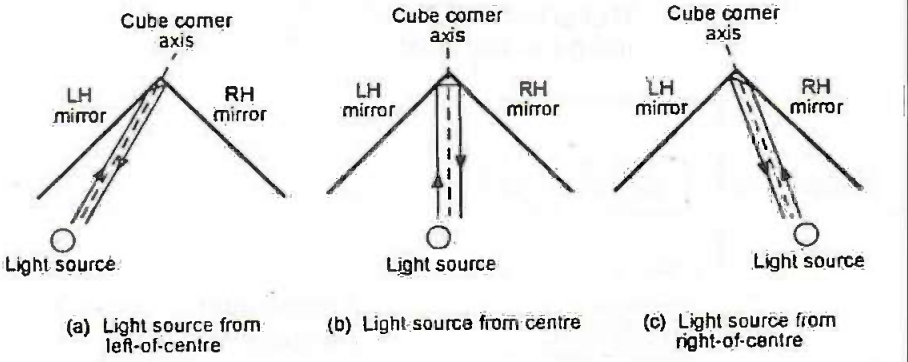

Figure 12. Diagram illustrating the functional operation of the cube corner retroreflector.

One of the most common applications of the above 2-mirror technique is in simple periscopes, as illustrated in Figure 10. Figure 10(a) shows the basic construction of a conventional 'view-above' type of periscope. Here, the light from the scene that is being viewed strikes the upper mirror, is reflected downwards at an angle of 900 and strikes the face of the lower mirror, which bends the light through another 900, where it can be viewed by the eye of the observer; the resulting image is real, rather than virtual, and is seen from a perspective above the viewer's eye level.

The 'view-above' periscope of Figure 10(a) can be used as a 'view-below' type by turning it upside-down, as in Figure 10(b). View-below periscopes are often used in the movie and TV industries to obtain ground-level shots of small animals or of miniature (model) towns or battle scenes, etc., for use in various films/videos.

Retroreflectors

A retroreflector is a passive device that automatically reflects a light's radiation back towards its source, irrespective of the light's precise angle of incidence. Devices of this type are widely used in reflective optoelectronic light-beam security alarms and barrier control systems and do not have to be precisely aligned with the light-beam source.

Figure 11 shows a way of using two small mirrors (or mirror tiles) to make a device known as a cube corner retroreflector. The two mirrors are simply butted and taped together and set at an angle of 900 degrees by pressing them against the edges of a rectangular base (such as a soft-cover book). If a light beam (or image) is aimed into the cube corner of this device from any point that is at right angles to the cube's vertical plane and anywhere within ±350 of its central corner axis on the horizontal plane, the device automatically reflect the light (or image) back towards its source point. Figure 12 illustrates the unit's operating principle.

In Figure 12(a), the light beam is projected from a left-of-centre source towards the retroreflector's corner, hits the LH mirror at an incident angle of (say) 750, is reflected off again at 750, hits the RH mirror at an incident angle of 150, and is reflected off again at an angle of 150, and heads back towards the source on a parallel path. The light beam's total angular change is equal to the sum of the two incident and two reflection angles, and inevitably equals 1800. This same basic action is obtained in Figures 12(b) and (c), except that different incident and reflection angles are involved and that the Figure 12(c) illustration shows the beam bouncing from the RH mirror on to the LH one.

Note in Figure 12 that an imaginary line drawn centrally between the transmitted and returning parallel beams always hits the cube corner, and that the two beams thus lay symmetrically about this line. This action enables the cube corner retroreflector to produce some unusual visual effects when viewed in frontal elevation, as illustrated in Figure 13.

In Figure 13, a three-dimensional solid L-shaped model is turned around so that it is facing the retroreflector and is placed in front of its cube corner. Note that the LH mirror reflects the RH mirror, and vice versa, producing a 'mirror cube' reflection. The retroreflector produces virtual images of the object in both the LH and RH mirrors, and produces a true image of the object in the mirror cube.

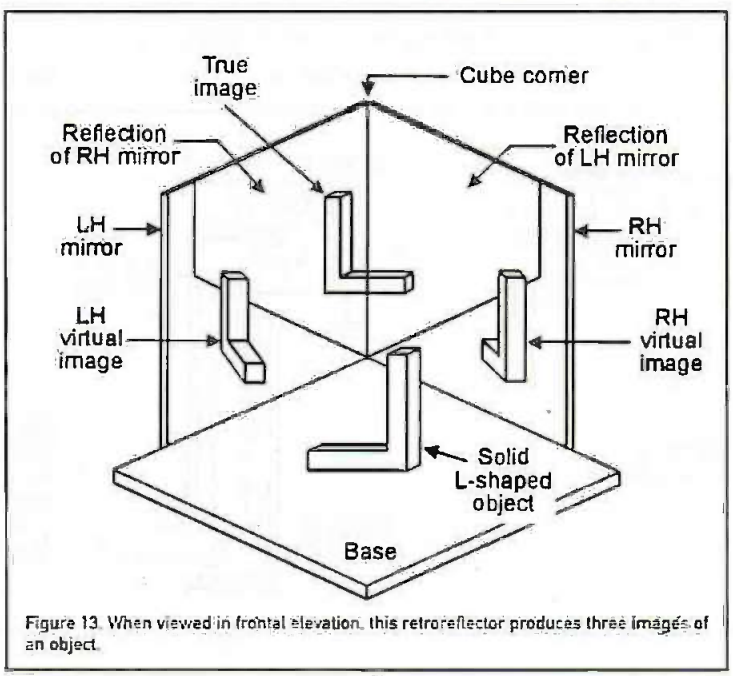

Figure 13. When viewed in frontal elevation, this retroreflector produces three images of an object.

The cube corner unit gives only one-dimensional (horizontal plane) retroreflection. An alternative design is the trihedral unit, which gives two-dimensional (vertical and horizontal planes) retroreflection of light beams. Figure 14 shows the basic construction of this unit, which uses three diamond-shaped mirrors set at 1200 to each other; the unit's action is such that a light beam entering its front is reflected through 1800 in two dimensions by the mirror surfaces and then returns towards the source point on a parallel path. Often, hundreds of miniature retroreflectors of this basic type are used in road-side signs, making them glow brilliantly in the headlights of passing vehicles.

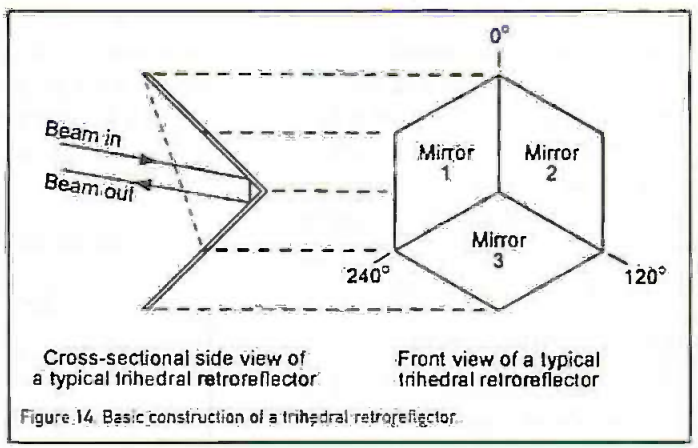

Figure 14. Basic construction of a trihedral retroreflector.

Next month's in Part 2 of this series Ray Marston will describe the action and applications of prisms and lenses.

ELECTRONICS and BEYOND

Reader Profile Survey

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All entries will be entered for a free prize draw to win the book **Programming and Customizing the AVR Micro Controller** by **Dhananjay V Gadre**
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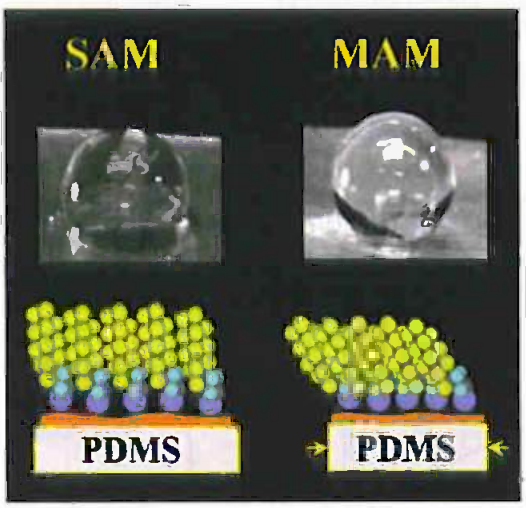
Squeezed MOLECULES

by Reg Miles

Chemical engineers at North Carolina State University have discovered a way to make flexible coating materials more durable and water resistant, without the use of environmentally harmful solvents, and using a simple process. The research, supported by the US National Science Foundation (NSF), groups molecules so tightly that they form a slick surface that would be potentially useful for many medical, technical and industrial applications. The University emphasises water resistance while the NSF opts for non-stick in their respective press releases.

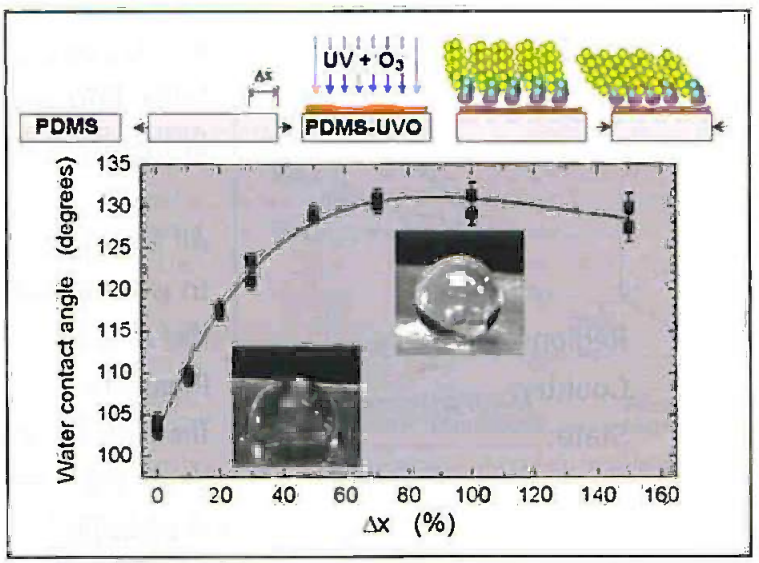


From the University: 'Coatings enhanced through the process would be a boon for use in wet environments where a nonpermeable barrier must function without fail for prolonged periods, such as on ship hulls and buried or submerged cables. Because the coatings are biocompatible, they also could be used to extend the useful life of surgical implants, or in cosmetics.'

From NSF: 'The molecules are jammed into a tight-knit, non-stick layer that could one day coat everything from frying pans to disk drives, medical implants to airplanes. Such surfaces would be highly water-repellent and nearly frictionless, and might reduce the need for many lubricants.'

What the researchers, Jan Genzer and Kirill Efimenko, did was to force molecules to create an almost impenetrable layer by bonding them chemically to a polymer material that had been stretched by 70 percent, then released again to regain its original shape. According to Andrew Lovinger, NSF's Program Manager for Polymers, 'This was a very clever way to pack molecules more closely than nature intended. While much research has gone into synthesising new non-stick materials, Genzer's technique is the only one that can improve the surface of any of these materials by squeezing their molecules tightly together.'

According to the abstract of the Genzer and Efimenko paper that appeared in 'Science': 'We show that elastomeric surfaces can be tailored using 'mechanically assembled monolayers' (MAMs), structures that are fabricated by combining self-assembly of surface grafting molecules with mechanical manipulation of the grafting points in the underlying elastic surface. The versatility of this surface modification method is demonstrated by fabricating MAMs with semi-fluorinated (SF) molecules. These SF-MAMs have superior nonwetting and barrier properties in that they are 'superhydrophobic' and nonpermeable.



We also establish that these material characteristics do not deteriorate even after prolonged exposure to water, which usually causes surface reconstruction in conventionally prepared SF self-assembled monolayers.'

(Fluorinated materials are the common ingredient in the polymer surface of products such as non-stick cookware, water repellent fabrics, and self-lubricating engine parts.)

As Genzer modestly puts it, 'We discovered, quite by accident, that you can tailor control a flexible material's physical and chemical surface properties, such as water resistance and durability, by increasing its surface area before you chemically attach the layer of molecules that form its final coating. Stretching the substrate material allows you to fit more of the desired coating molecules - up to a critical point - onto its surface. Then, when you release the tension and the material resumes its original size, the chemically grafted molecules are squeezed and locked together in a much greater density and with much greater chemical stability than would occur naturally.'

Genzer adds, 'The relative simplicity of it is stunning. For years, scientists have relied on oxygen plasma treatments, which are quite harsh on the substrate, to attach the molecules without being able to control the density of the anchored molecules. Here's a mechanical way that's cheaper, easier, less harsh and more controllable.' Figure 1 illustrates that a coating created using the new MAMs method (right) repels water more effectively than a coating made the conventional way (left).

Genzer's method is also better for the environment because it doesn't require the use of solvents that produce harmful fumes or by products.

He and Efimenko used polydimethyl siloxane (PDMS) networks - an elastic polymer film widely used in industry and research - as a substrate material in their experiments. Because PDMS is a model material for other polymer films made of crosslinked molecules, Genzer believes the

process will work on other elastic materials as well.

In their experiments the researchers fabricated their material's surface using an array of rigid, semifluorinated units composed mainly of CF2, and one CF3 group. 'Aligning molecules perpendicular, or close to perpendicular, to the substrate rather than keeping them laying in the surface plane gave us the tool to control the density of such molecules on the surfaces, and thus achieve such superior surface impermeability,' Genzer explained. See Figure 2.

To test the durability and impermeability of the experimental coating, Genzer and Efimenko submerged strips of the MAM material in water for controlled periods of time and subsequently stored them in normal ambient laboratory conditions, and then studied their stability. 'To our surprise, the surfaces of MAMs stayed virtually unchanged, even after six months in a dusty and humid atmosphere. The MAMs chemical properties, such as orientation and molecular density, remained the same, and there was very little physical deterioration,' Genzer said. In contrast, strips of coating materials made the conventional way usually begin to decay and deteriorate after sitting in water a relatively short time. Their molecules become disorganised. 'In some cases, we have observed that surface properties are degraded after barely more than a day,' he added.

Despite the initial results, Genzer stresses that more research is needed before the mechanically assembled monolayer process can be put into commercial use. Next, the researchers have to explore the coating's stability and resistance to acids and other extreme environments.

So far, the researchers have worked with a nano-sized layer of fluorinated molecules, bonded to an elastic polymer. Next, the team will experiment with lower cost hydrocarbons.

'By manipulating materials at the nanoscale, we can vastly improve on what Mother Nature offers, for the benefit of both manufacturers and consumers,' said Genzer.

Pictures: North Carolina State University and National Science Foundation.

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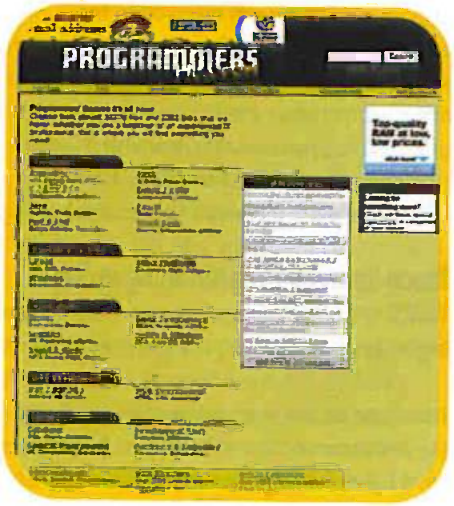
National Science Foundation
Amber Jones at (703) 292-8070 or ajones@nsf.gov.

web electronics

THIS MONTH SEES THE START OF OUR NEW FEATURE – SEVEN SITES. SEVEN READERS' WEB SITES HAVE BEEN PICKED OUT AT RANDOM FROM OUR SEVEN SITES MAILBOX. READ ABOUT THEM, TYPE IN THE URLS PROVIDED AND SEE WHAT OTHER READERS OF THE MAGAZINE ARE INTERESTED IN AND HAVE TO SAY. BUT BEFORE THAT, WE TAKE A LOOK AT SOME OF THE WEB SITES OUT THERE FOR PROGRAMMERS. WHETHER YOU ARE AN EXPERIENCED PROGRAMMER OR A BEGINNER, THERE SHOULD BE A SITE ON THESE PAGES THAT WILL BE OF INTEREST TO YOU. IF YOU ARE NOT SURE IF THE SITE IS APPROPRIATE TO YOUR ABILITY, LOOK UNDER THE TITLE FOR A GENERAL INDICATION.



Programmers Heaven

Beginner ✗, Student ✓, Professional ✓

www.programmersheaven.com is one of the best places to go on the Internet if you are after sourcecode examples, tutorials, patches, library files, links to other programming websites, programming utilities and tools. The number of files (over 10,000) and links (over 2,300) is huge, as is the article collection, which has a massive 1,552 articles on everything from Access to Z80.

This is all shareware, and the site is developed and maintained by Synchron Data, a Vendor Member of the Association of Shareware Professionals (ASP). If you want to keep up to date with new additions to the site, there is also a page where you can sign up to receive a bi-monthly newsletter containing the latest about what is new on the site and elsewhere.

The Datasheet Locator

Beginner ✗, Student ✗, Professional ✓

This is a free electronic engineering tool that enables you, from one location, to locate product datasheets from hundreds of electronic component manufacturers worldwide. Datasheet Locator uses every component manufacturer's own website to ensure that the accuracy of its service is always maintained.

Some component manufacturers enable you to locate a datasheet by entering a specific part number, while other component manufacturers provide an environment where you must select a product 'type' or 'series'. After you select a component manufacturer, Datasheet Locator determines whether the datasheet is searchable by part number or if further user navigation is required. Datasheet Locator will allow you to enter a part number if the site is searchable, or will link you directly to the primary datasheet source page

of the component manufacturer's website if the site is not searchable. When entering a part number, search results will only be reliable when a complete and exact part number is entered. Each manufacturer has different search methods and entering partial numbers will yield unpredictable results.

There are presently 622 manufacturers listed and the site is available in ten languages including Japanese, French and Portuguese. You can access it at www.datasheetlocator.com.

Learning To Program by Alan Gauld

Beginner ✔, Student ✔, Professional ✗

This is a good site to go to if you want to learn about the basic theory and mechanics of computer programming. Unfortunately, the course is mainly conducted through a little-known language called Python, and that's not likely to be much use to you once you move out of this course to program in the real world (although we'll probably get letters after saying that...). You can access the site at www.crosswinds.net/~agauld.

Programming in C. UNIX System Calls and Subroutines using C

Beginner ✔, Student ✔, Professional ✗

This very informative site is part of the web site belonging to Cardiff University's Department of Computer Science (www.cs.cf.ac.uk). Written by Dave Marshall, who is a lecturer there, this forms part of his course documentation. There are diagrams, sample code listings and exercises to help you practise. University source material text is very good if you can find it, and short of buying a book on the subject it is probably the best introductory and self-teaching material you can find. As well as the texts on C, there is course documentation on Artificial Intelligence and image processing, all available from links found on www.cs.cf.ac.uk/Dave.

Catalogue of Free Compilers and Interpreters

Beginner ✗, Student ✔, Professional ✔

www.idiom.com/free-compilers is a site sponsored by a USA Internet services company, which gives instant access to free compilers, interpreters and source code. You might think such a site would be useful for beginners – because beginners need compilers – but as this site can be a bit bewildering for the beginner, we are not recommending it as such.

compilers.net

Beginner ✔, Student ✔, Professional ✔

From the point of view of the beginner, this site is much better. You can download a huge range of free compiler software for C/C++, Java, Cobol, Fortran, Logo, Modula-2 and Pascal. If you are a newcomer to computer language programming, you will definitely need a compiler before you get started. This site (www.compilers.net) has good information which will help you decide which compiler is best for you before you choose. Clicking on a name will take you to the external web site where the compiler is available for download, and if you need any more information – the host web pages will be bound to provide it. There is also a list of commercially available compilers, for if you need those extra features and support.

Teach Yourself Programming in Ten Years

Beginner ✔, Student ✔, Professional ✔

There can be few people who, upon scanning the computer section of their local bookshop, have failed to notice the vast array of 'Teach yourself [various programming languages] in 24 hours' books. This web page takes a wry look at the genre of '24 hours' and '7 days' books and offers advice on how you should work at your own pace. Peter Norvig is the Director of Machine Learning at the search engine company Google, and there is a lot of other, more technical stuff accessible through his site. Out of this other material, we would pick Java IAQ: Infrequently Answered Questions as being most of interest. You can access both of the above mentioned information pages from www.norvig.com.

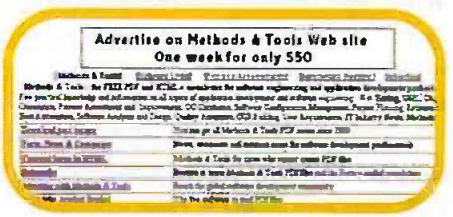
The comp.compilers Newsgroup

Beginner ✗, Student ✔, Professional ✔

comp.compilers is a usenet news group which addresses the topics of compilers in particular and programming language design and implementation in general. Recent topics have included optimisation techniques, language design issues, announcements of new compiler tools, and book reviews. Messages come from a wide variety of people ranging from undergraduate students to well-known experts in industry and academia, and authors live all over the globe. The estimated total readership is over 100,000, which makes it by far the most widely read medium on the topic in the world.

The web pages for this newsgroup are available on http://compilers.iecc.com, where you can find a huge archive of articles and postings, dating right the way back to its foundation in 1986.

Let's Build a Compiler, by Jack Crenshaw is a fifteen-part series, written from 1988 to 1995, which is available from the comp.compliers site. It claims to be a non-technical introduction to compiler construction, and you can read the fifteen parts on-line or download them in the form of a ZIP file.



Methods & Tools (Free PDF / HTML e-newsletter)

Beginner ✗, Student ✔, Professional ✔

Designed for software engineering and application development professionals, this free e-newsletter has practical knowledge and information on all topics of application development and software engineering.

You can subscribe to this tri-monthly newsletter via the homepage at www.martinig.ch/mt. You will not have your name passed on to third parties and will also have the option of requesting an email that instead of having the newsletter in PDF (Adobe Acrobat) format, merely informs you that the new issue is up and running on the web site and offers you the chance to go straight to it in a link. Because the newsletter is available via the web site, you do not need to subscribe in order to read it. Back issues are also available for download and are available all the way back to Spring 1999.

And finally...

Really Terrible Programming Humour

Beginner ✗, Student ✗, Professional ✗

Rather than pick out any one of these sites, we will instead just point you in the direction

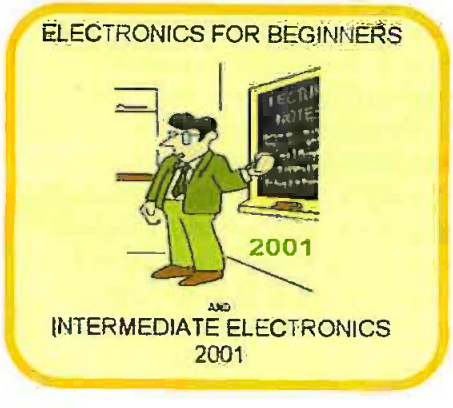
of a competent search engine and the keywords 'Programming' and 'Humour'. Doing this will, no doubt, result in some of the most poorly thought out humour pages on the Internet. Most of these people probably genuinely do think their material is funny, but jokes about programming are notoriously terrible and rarely travel well, even between programmers themselves. Such a collection of sites is probably a good destination for psychology students looking out for a dissertation subject. Try out www.ioccc.org and try to figure out for yourself just why anyone would find pages and pages of deliberately bad C code amusing.

Seven Sites

Site 1
Electronics, Computers and Model Railways by Ian King

www.kingim.btinternet.co.uk
(Personal)

This site is intended to reflect my interests in electronics, computing and model railways. The site includes useful projects and information, relating to the electronic control of model railways, and how to interface and control them using microprocessors or the PC. Current projects and ideas relate to Digital Control, Point Control, the PC Parallel Port and Track Mimick Panels.



Site 2
Electronics For Beginners and Intermediate Electronics 2001 by Graham Knott

http://homepage.dtn.ntl.com/g.knott
(Educational)

My name is Graham Knott and I teach Electronics and Microcomputing at Cambridge Regional College, situated in the University City of Cambridge, England. I hope that you find this website useful.

Site 3
Electronics Projects by Dr Mike Roberts

www.customelectronics.co.uk
(Personal/Commercial)

A collection of electronic projects, mostly featured in Electronics and Beyond. Particularly worth a visit if you are interested in microcontroller programming (PIC development board with code to download) or building projects such as the popular digital soldering iron from E&B issue 116. Also has selection of projects devoted to Radio Control.

Site 4
Radio Electronics by Ian Poole

www.radio-electronics.com
(Personal/ Commercial)

The site contains a variety of information about different aspects of radio and electronics. Amateur radio, radio signal propagation, history of radio and electronics, electronics components and several other aspects associated with radio and electronics. The site also includes information about radio and electronics books that it is possible to buy through the site in association with Amazon. For the future more topics are planned to be covered and it will be fully hosted under the radio-electronics domain name rather than just being a forwarding address as it is at the moment. So watch our for new developments. The site is run by Ian Poole, contributor to Electronics and Beyond as well as many other radio and electronics titles. Ian Poole has also written over fifteen books, published by variety of publishers including Babani, The Radio Society of Great Britain and Butterworth Heinemann (Newnes).

Site 5
Software & Systeme Efurt GmbH

www.sse-erfurt.de
(Commercial)

An employee at Software & Systeme Efurt suggested to someone at our parent company that he take a look at this site, and he passed it on to us. Though commercial, it has a set of 4 interactive robots, which are controllable over the web and accessible to everyone (although some or all of them may be inactive or on charge at various times in the day).

Site 6
Meccanoman by Dave Taylor

www.meccanoman.co.uk
(Personal/Commercial)

Meccano mail order service, information, history and links. Part of the Meccano web ring community.

Site 7
Central Arkansas Transit Authority

www.cat.org
(Community)

Some readers might have typed in www.cat.org as seen in the What's On section of E&B February 2001. Instead of getting the site belonging to the Centre for Alternative Technology, however, type in this address and you will get the page belonging to the Central Arkansas Transit Authority. Thanks to reader Linton Rapid for pointing this out and sending us the web link for inclusion in Seven Sites. Whether or not any readers will actually find anything there to interest them or not is another matter. The real web address for Mid Wales' CAT is www.cat.org.uk, so remember to include the .uk at the end, because otherwise you could be in for quite a detour.

Have you got a web site you would like other readers of Electronics and Beyond to see? If so, send it via email to jaldred@electronicsandbeyond.com, with the number 7 in the subject line (this will divert it to a special mailbox). Remember to give your name, the name and address of your web site, its classification (Personal, Community, Educational, or Commercial) and, in your own words, an explanation of what the site is about and what other readers can expect to find there.

Miniature ROBOT 'Willi'

by Jens Altenburg

AGAIN AND AGAIN THEY APPEAR IN MAGAZINES, JOURNALS AND SOMETIMES EVEN IN THE DAILY PRESS: THE ROBOTS. HERE THE SPEECH IS NOT ABOUT THE BIG ROBOTS OR THE INDUSTRIAL AUTOMATONS WHICH LET A SHIVER RUN DOWN SOME PEOPLE'S SPINES, BUT ABOUT THE MOSTLY SMALL MOBILE ARTIFICIAL OBJECTS WHICH ARE MORE OR LESS INTELLIGENT. HERE ACADEMICALLY TRAINED ENGINEER JENS ALTENBURG INTRODUCES US TO WILLI AND GIVES US SOME SCHEMATICS AND PROGRAMS FOR HIM, AS WELL AS SOME WRY INSIGHTS ON ROBOTS IN GENERAL.

Why Robots?

The interest in robots has increased since 'Pathfinder' and his envoy 'Sojourner' radioed their photos to Earth. The small mobile Sojourner conquered the hearts of all space enthusiasts easily. NASA reported a record access rate to their Internet web site. More than 200 million interested people have looked at the information and photos on the homepage of the Mars experiment since then.

Finally, robotics seems to come out of its shadowy existence. The success that can be reached by this technique is amazing. The costs which scientists and engineers charge for seem to be pocket money in comparison with the usual amounts in space travel. Where does this small miracle worker come from, that was able to oust all the news about catastrophes and the arguments of the politicians to minor themes in the daily newsflash?

The subject matter has been researched intensively at technical colleges and universities for a long time. System algorithms, control programs and simulation software have already managed to come into industrial practice. Films of nearly deserted factory buildings are no longer sensational. Nevertheless, inside these fully automated production lines every working industrial robot has its particular place. At most, the service mechanics are mobile; almost all robots are fixed.

Why are they used that way? A lot of things must be moved or transported in daily life. How often do we need anything, mostly a biro and some sheets of paper to note something on the phone? The search for things is so usual, so we hardly become conscious of it. Only if the caller is not patient and there is no biro or paper in the house. At least, at this point the busy rummaging should change into a useful search strategy – what ballpoint (colour, size, reservoir: full?) and pad of self-stick notes (to stick the note to the others on the fridge, where all the other undone jobs are) last seen in the child's room in the box with the glove puppets. Standing up, going to fetch the missed thing – this process is described almost longer than done.

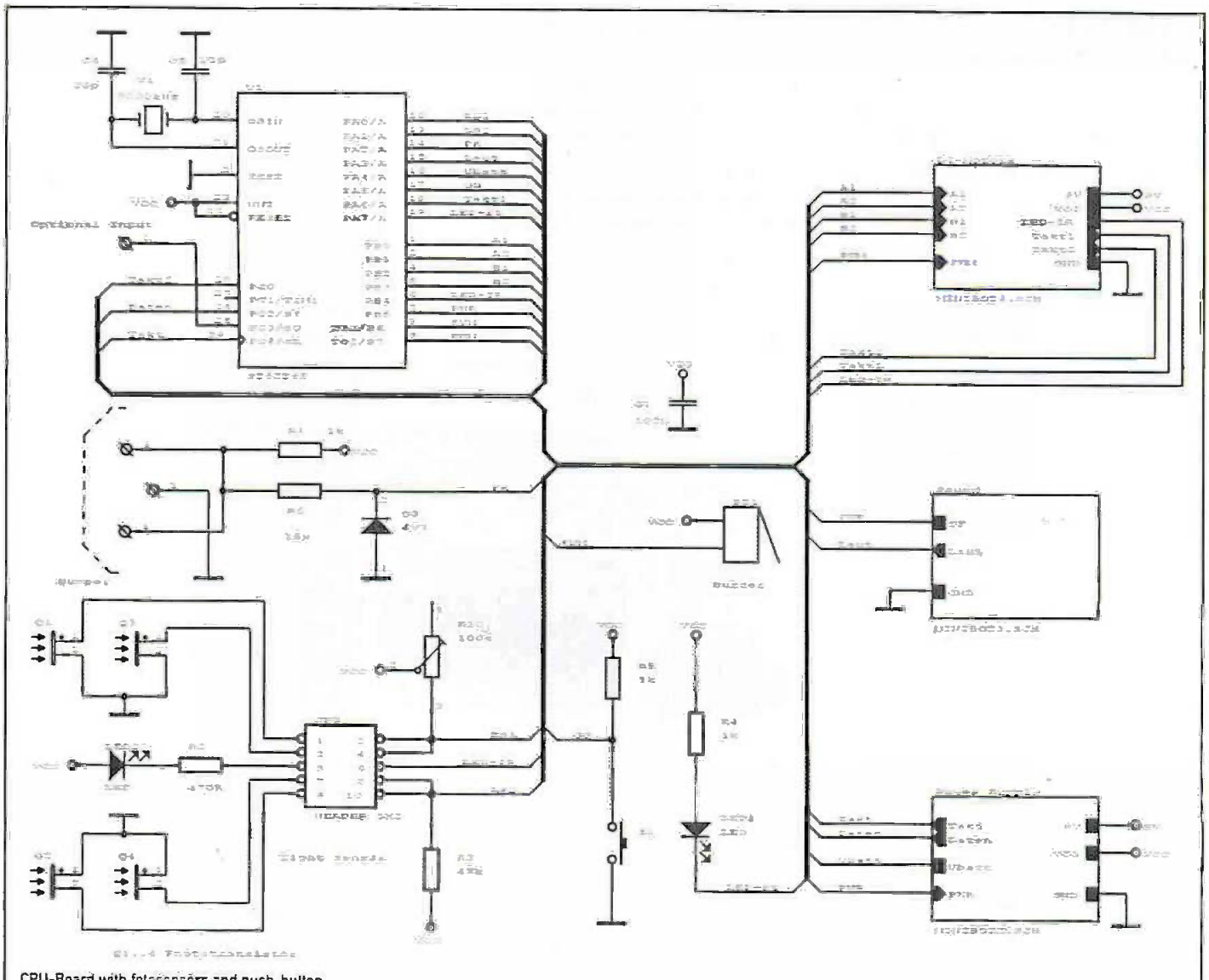
However, what seems to be very easy, is (still) an absurdity for a robot. The available technology simply cannot manage it. Of course, there are encouraging attempts (see: Further Reading, J. Jones, A. Flynn), but they almost exclusively take place in a laboratory. The layperson reads the articles with great interest, gapes at the photos and is left out. The playground of the academics can only be entered by insiders. That is really a pity.

From time to time in addition to the photos experiments are published. In spite of the applied high tech (or exactly because of that) some of those texts encourage to emulate.

A lot of people have a computer at home. Writing letters, filling out the tax declaration, playing flight simulator – but there must be more you should be able to do with such a thing. Do not fear, there is no super intelligent simulation program with a wire grid model of a self-designed piece of furniture, called robot, appearing in yellow light and staggering through the blue and green glimmering rendering world of the room planner after hours of endless puzzling. On the contrary, this article is about the practical connection of software and hardware. What is right and expensive for universities and technical colleges, shall be possible for schools, too: experiments with 'mobile robots'.

Where does the robot come from?

The robot is called 'Willi'. It is a representative of 'mobile robots'. As a small moderate intelligent miniature robot it can be provided with certain behaviour patterns and afterwards it can be left to go and discover



CPU-Board with fotosensors and push-button

the world.

At first the simple vehicle cannot set anybody in astonishment. However, some software inside the robot and some human intelligence in the form of a program let the robot be alive. The result is amazing. Even though this product of an engineer's mind actually does not have any intelligence, it behaves like an animal, strangely enough. Its behaviour is often reminiscent of certain characteristics of insects. Programmed like a 'cybernetic moth' Willi is looking for light as soon its electricity is switched on. If he finds the source of light, he goes there the shortest way. At this process a tactile switch makes out if there are some hindrances on the way and starts an evasive action. After that the robot looks for light again. Nevertheless, it is not our aim to replace primitive insectoid movement with even more simple electronic controlled behaviour pattern. The important realization is based on the connection of certain definite courses.

In this behaviour based controlling there is an important attempt at solution of control theory of robotics. Without explaining this theory at this point the robot shall be introduced. Its photo gives a first outward impression.

Willi – a classical representative of mobile robots – consists of a circuit board with some electronic equipment, two motors, some sensors and a few mechanical parts. So it is not such a sensational monstrous product of human creativity.

Maybe there are its inner worths, one hopes now. Fiddlesticks, even here is not so much to expect. Only a 8 MHz clock pulsed CPU, 4 Kbyte ROM and 128 Byte EEPROM storage capacity; Pentium, turn green with envy. In times of mega and gigabytes it is really no witchery. Only the current taking is impressive (if that is a sign of capacity). The robot needs 50 mA maximum (less than a porch) when the motors are working. So nobody needs Li-ionic-accumulator technology to move Willi two hours long (that is the usual working time of a not very new set of accumulators of a notebook).

However, if the robot stands in front of you, it must be tested at once. There are the usual things on the circuit board: colourful blocks, small rollers with blobs of paint, black boxes with ports – it is not an edifying sight for persons without technical interest. There is a switch to switch it on, why not? A bleeper signals the waking up of the robot. So we let it start. Another button, push again. It works as usual as PC software: 'Do you want to purge all files [YES],[NO],[CANCEL]' - yes - 'Do you really want to purge all files [YES] ...' - yes, really ...

Now we want to see the robot moving. Let us go. And really, it moves. It drives around the table, collides with the keyboard of the PC. It is its own fault. Why does it drive so fast? But stop. Immediately, if the robot touches the keyboard its feelers close a contact. Willi stops, drives back, turns around and goes on. What a triumph. We lean back proudly. Switched on by us the robot still moves around and if he finds a hindrance he gets out of the way. How does he do that? Now we should finally be curious.

The inner works

The AI (artificial intelligence) has investigated questions to the topic 'behaviour of human beings or animals' for years. What induced us to make decisions? How do animals scout unknown surroundings? Why are little children able to do a lot of silly things in a short time? And how are all these questions connected with robots? Till now, the only aid to make it possible for a computer to make decisions is a program.

Lots of us use programs (and computers) every day. Some do this in a professional way, when they write complicated programs for users in industry or offices. Other do it on the side, while designing a macro for their word processor. Surely, everybody has been angry about more or less meaningful system messages, if the expected result did not want to appear at once.

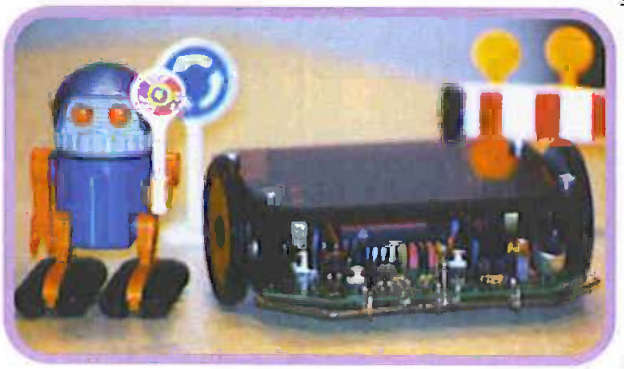
It is a little bit harder when you want to program a robot. A message on the screen can be ignored, or the computer can be started again after pushing the closing button (after a short system crash). Anyway, you will see a wrong Willi-control command and you should take hold of it quickly before Willli is going to leave the table at the opposite side.

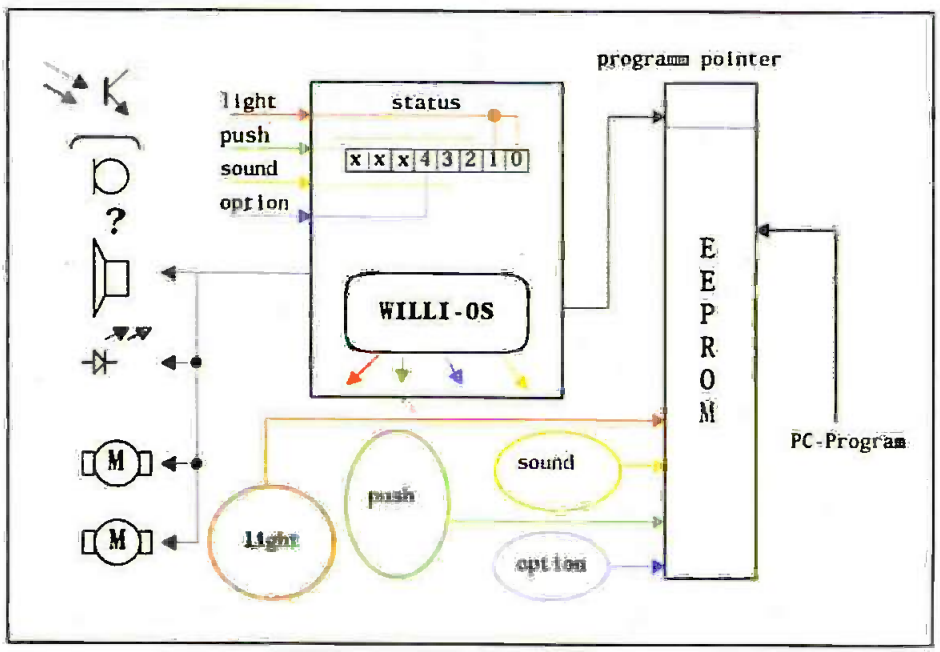
However, this is not a disadvantage. Learning by doing promises quick success. Even computer grousers are sitting up and taking notice. To write a very short program you must handle a PC, read a manual, familiarize with a program language, look inside a micro controller. Are you very frightened now?

The controlling of the robot is done by a micro controller. Basically, this is a processor with additional assemblies directly on the circuit, analogue-digital converter, memory or timer. A program will be compiled with a few special instructions and sent to the robot via a cable. Afterwards the program is in the EEPROM of the controller and will not be lost even after switching off the operating voltage.

There is a special program tool to program the robot efficiently. It works with Windows 3.x and Windows 95 and makes it possible to read in and edit programs. An assembler run translates the instructions into Willi-microcode. Then the program will be loaded in the memory of the robot via serial interface.

The assembler runs are very fast, therefore the programs can be written in trial and error-method. Syntactic errors are found during the assembly. An on-line help gives information about the instructions. Approx. 80...100 instructions can be put in the 128 Byte EEPROM storage. That seems to be not much, but the compact command set produces very short and effective programs.





The functions of the robot are easy to explain if one looks at some examples. Let us start with a simple type of problem. Willi shall go straight on and beep at the end of its way. At first, three commands are needed therefore: step, port and speed. For program input please open microbotassembler as usual by double click at the icon. Then you can start writing (The lazy writer can load the data 'example1.st6'.):

```
start:
   speed 1   ; speed 1 is enough -
the robot shall not race
   speed 47  ; You can also choose
other numbers
   port%1110 ; now Willi is beeping
```

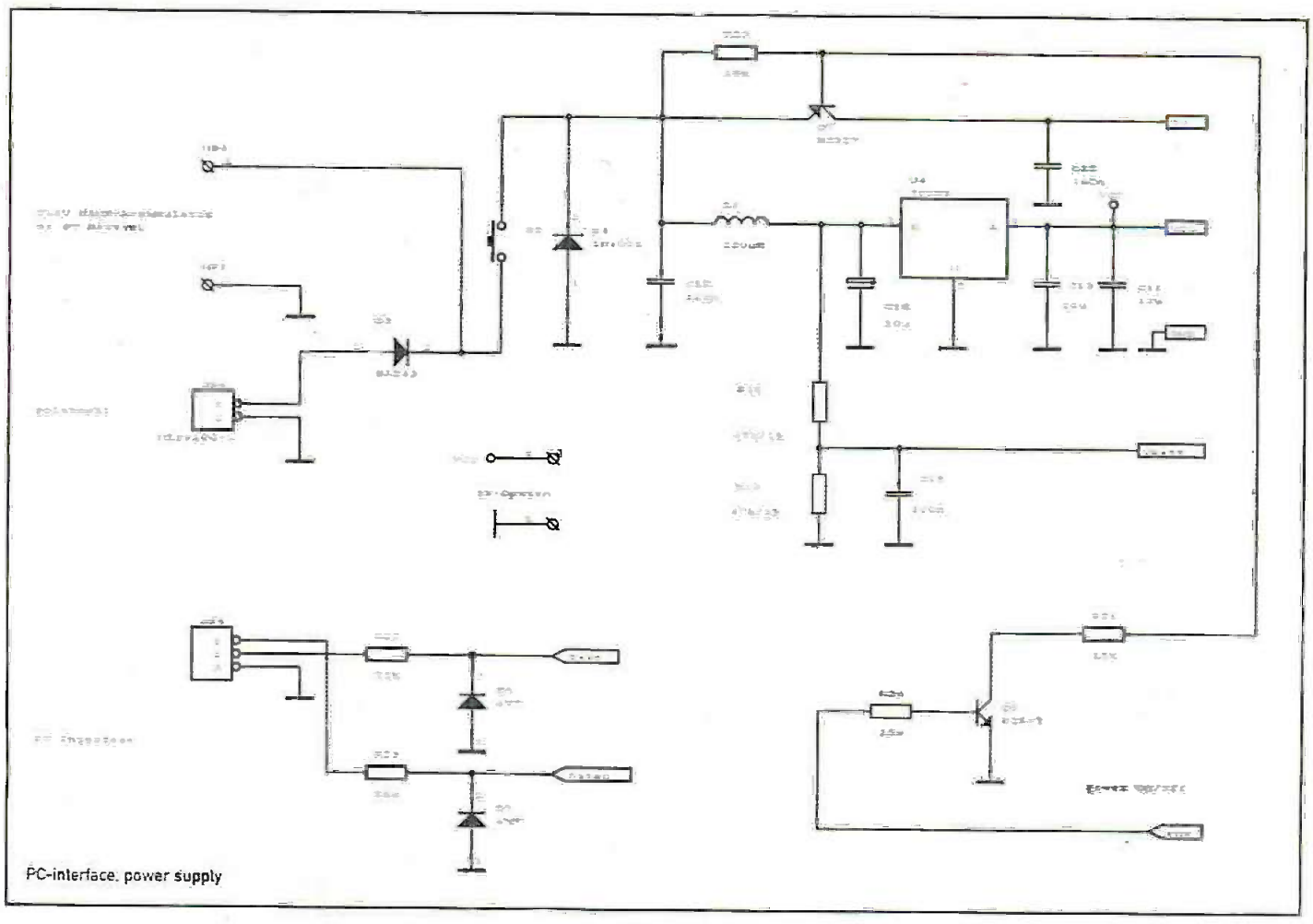
The written program will be assembled. The easiest way to do this is to click the relevant short symbol. Now you receive a message about the procedure and in case of error a suitable description of the error.

Try this machinery (i.e. nonsensical speed like 10,000 or other). To make Willi work with the program, it must be loaded. To do this Willi and the PC must be connected by cable. Willi is switched off during this procedure. Click the relevant icon to start the load. It is also possible to use the menu bars of Program or the control keys F9 or F10. If there is a connection between the PC and Willi you can start the data transfer. Please switch on Willi only when the program asks you to do it. The data transfer is not carried out via RS232-listing although the relevant port at the PC is used. The synchronous interface (SPI) of the ST6 is used.

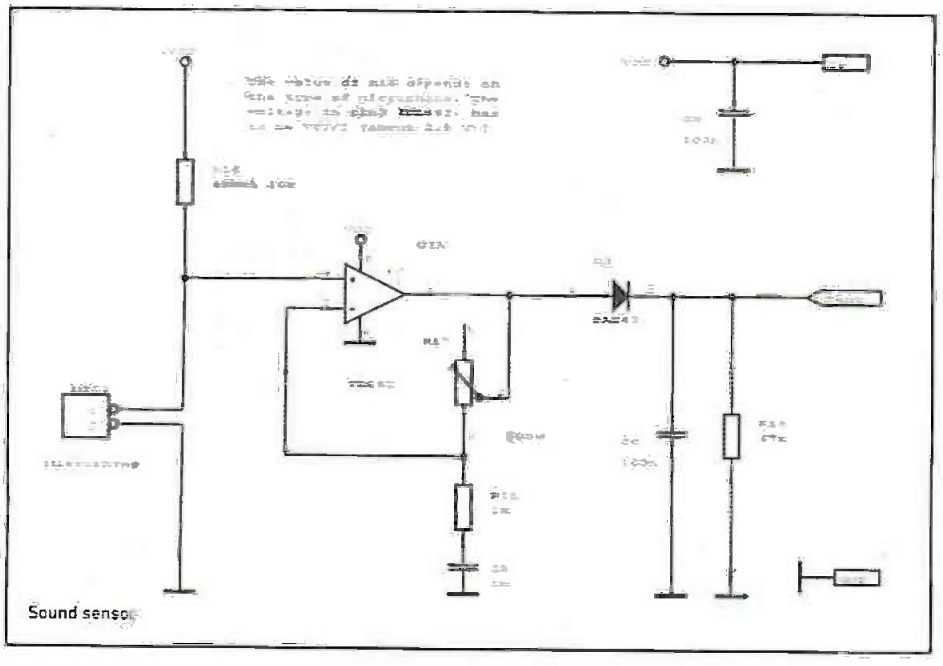
After the request to switch on Willi the robot beeps twice. At the same time the LED lights up. If that does not happen, please, switch the robot off and on. If it does not work even though, check the cable splicing.

During the transfer the LED flickers (actually, it flashes at every received signal). Willi beeps again after a successful program loading. Then you remove the ratch gland and press the start button. Obediently, Willy begins to move, goes its 47 steps (or how much you have wanted), beeps and does nonsense. Why does it do that? You have nothing ordered after the port-command, but Willi cannot know that. It fetches the next instruction out of its memory and simply does it. And there is always something in the storage. A little changing of the program will help:

```
start:
   step 1    ; speed 1 is enough, the
robot shall not race
   step 47   ; you can also choose
other numbers
   port %1110 ; now Willi is
bleeping
   jp  start ; do it again
```



PC-interface, power supply



Sound sensor

Now the program goes round: Go, bleep, go, bleep .... If that is nothing:-)! In addition to the control commands like step, turn or port there are limited commands like jpand or jpor.

Willi has got a status register similar to a normal computer which mostly executes its operations in a special register, the accumulator. The results in the status register represent certain sensor data. The firmware, virtually the operating system, updates these results in short intervals. So there is a possibility to program actions of the robot in an easy way or to react to surrounding lures.

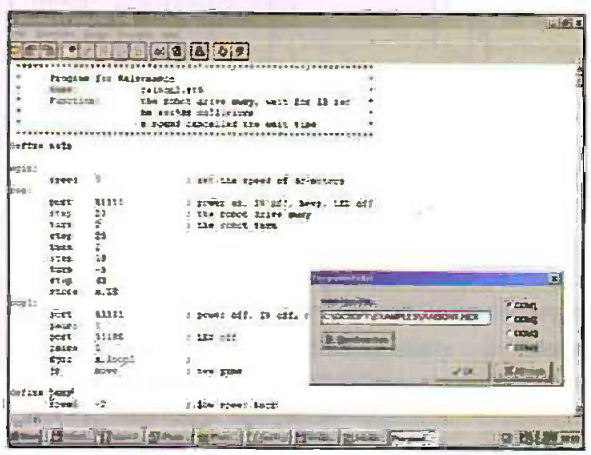
A graphic shows Willi´s construction. The sensor-delivered signals will be edited and memorized as a status bit in the status register. Four variable surrounding lures are registered. Light, push, sound and an optional sensor can start a process each. Willi can react to those variable signals thrgugh the process control.

Our example shall be the already mentioned 'cybernetic moth'. This artificial creature shall move around while looking for a source of light. As soon a ray of light is noted, the robot goes straight there. It works perfectly, as long there is no hindrance on the way to the light. If there is something on there, the robot pushes against it until its battery is empty. Therefore the program must connect the stimulus light with the stimulus push. A variant that suggests itself is firstly the additional query where the optical sensors are tested. That means the permanent test of bit 2 of the status register. Depending on the complexity of the total program the expenditure of branch and return structure is not insignificant. So it is better to give higher preferred stimuli an own process, that will be activated if the event happens. Afterwards the program can be continued on the interrupted point.

However, the Willi's application profile is not limited to the programming of an 'animal-like' behaviour. Even an interaction between several robots is thinkable. A robo-race would be interesting, as well. Such a race would not mean that the Willis race as fast as they can, but they should find their way through a labyrinth with stopping the time. The person who has programmed the best search algorithm will win.

```
;*****************************************************************
;*                  example program 4                            *
;*    name:         example4.st6                                 *
;*    function:     the robot is looking for a (black) line on light ground *
;*                  hindrances are got out                       *
;*                  'frightening' in case of sound signal        *
;*****************************************************************
#define main                        ; define main process
search:
      port  %1100                   ; LED off
      speed 3
      store a, 5                    ; search course 5 times
s1:
      step  2
      mturn 1                       ; torsion
      jpor  %00011, follow                ; test on black line
      djnz  a, s1
;
follow:
      port  %1101                   ; LED on
      speed 7
f1:
      jpand %00000, straight_on     ; no light on sensors F go on
      jpand %00001, ri              ; correction on the right necessary
      jpand %00010, le              ; correction on the left necessary
      jpand %00011, search                ; line lost F search
le:
      mturn 1                       ; correction on the left
      jp    f1                      ; test if enough
ri:
      mturn -1                      ; correction on the right
      jp    f1                      ; test if enough

straight_on:
      step  1
      jp    f1

#define bump
      speed -3                      ; speed 1, backwards
      step  7                       ; 5 steps back
      speed 3                       ; forward
      turn  2                       ; torsion through 90 degrees
      port  %1110                   ; bleep
      end                           ; evasive action is over

#define talk
      store b, 2
t1:
      port  %0001
      pause 1
      port  %0000
      pause 1
      djnz  b, t1
      port  %1100
      end

; END
```

Another program is the search for and following a line. The line is a black stripe on light ground. The light-emitting diode that is fixed at the robot sends a light signal that will be registered and analysed by photo receivers. Therefore the 'moth-program' shall be modified. Our moth searches for a line on the ground. That is why it has its own light. The walking 'glow-worm-moth' will be a line-leaded miniature robot.



Two processes are defined in this example, too. The robot can react on hindrances and is 'frightened' for acoustic signals.

Now, the question about the sense of such mobile robots should be easier to answer. Whoever took the trouble to put the robot together, to install the software, to write some programs for Willi and to deal with all the problems existing meanwhile has made a lot of basic experiences.

Conclusion

This short essay about robotics is an attempt to work up the complex topic of mobile robots easily. Beyond the explanation and description of theoretical correlations the interested reader can carry out own experiments with a miniature robot called 'Willi'. Especially in the sphere of education and training there should exist a lot of possibilities to use such mobile robots. For example, the programming of an already described robo-race needs much more brain matter than the most complicated role-action-arcade-jump-and-run-game has ever needed. Furthermore, it is much more fun.

Unfortunately, some cryptic phrasings are unavoidable with the description of the types of problems. But all program instructions must be input via text editor as usual. That is not easy for absolute programming beginners, and even pros often have problems with 'counting the bits'. It is simple to make full programs for the robot with the ST6. Several symbols and prefabricated program parts are available.

The picture shows the 'electronic moth' as a ST6-Realizer™ program. This software will be burned in the ROM of the microcontroller. Therefore one needs a special programming device and realizer-software. The tight connection of mechanical, electronic and program technical topics supports an inter-disciplinary solution of problems especially in the sphere of education and training. The monster computer will be comprehensible.

Another kind of programming is the use of more powerful programming languages. A high level programming language is 'C'. More and more good tools for programming in C are available. For the ST6 a very good tool, the RIDE (Raisonance integrated development environment) software package is available at www.raisonance.com. This tool allows an easy use of C for micros. The following picture shows a small robot complete programmed in C.

More information about Willi can be found at www.elektronikladen.de or www.sse-erfurt.de.

A kit with the needed mechanical and electronic parts and the software is available at 'Elektronikladen Detmold', Germany (phone: 0049-5232-8171). Questions or hints

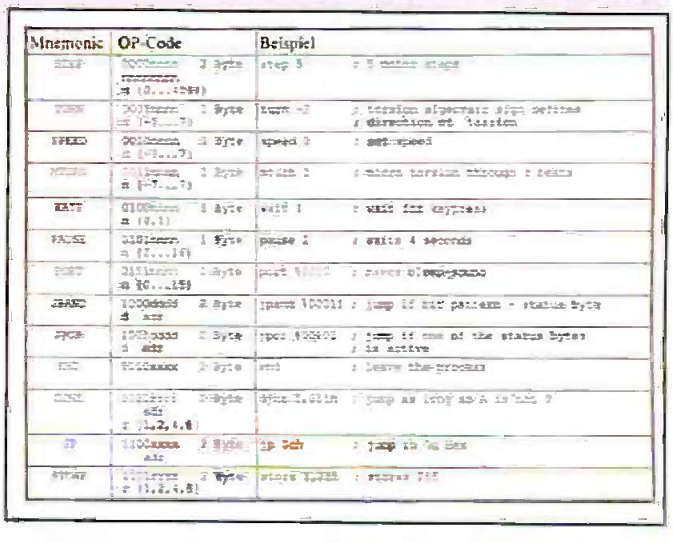
can be sent to the author via Email: jens.altenburg@t-online.de or jens.altenburg@sse-erfurt.de.

List of instructions

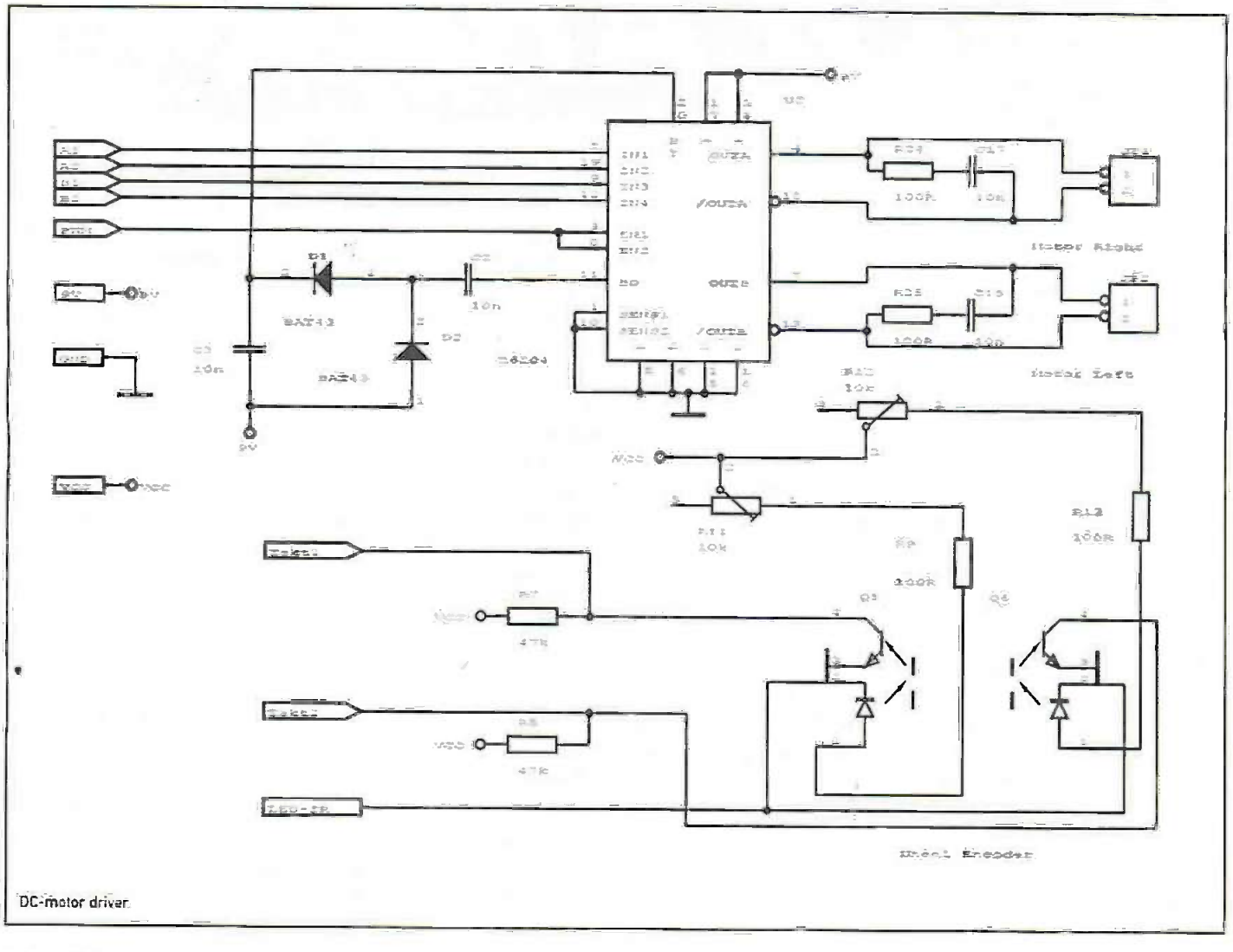
The instructions consist of a key word and a data input each (excluding: end). The range of the data depends on the instruction. The data can be read in as decimal or as binary number. Before binary numbers there is a **%**. To improve the readability it is possible to address the registers symbolically with the letters A, B, C, D. That is meant for both commands that have an effect of registers (store, djnz). Branch marks are randomised in absolute addresses by assembler.

```
adr          address in memory area
d            bit pattern register for status byte
n            operand, range as given
r            register, symbolic names A,B,C,D
5.2.         List of possible processes
#DEFINE main basic process, after start always active
#DEFINE bump started by bump contact
#DEFINE talk started by acoustic sensor
#DEFINE field started by optional sensor, the threshold value of this sensor is regulated separately
Statusbyte   This byte is permanently updated by the firmware of the ST6.
             The content serves the program branch in case of JP-commands.
             Only bit0..4 are compared bit for bit.
             bit0 - LS1
             bit1 - LS2
             bit2 - bump contact
             bit3 - acoustic sensor
             bit4 - optional sensor
```

J. und U. Altenburg – Mobile Roboter (Carl Hanser Verlag München, 2./8/00)



Mnemonic	OP-Code	Beispiel
STEP	5000xxxx 1 Byte n (0...15)	step 5 ; 5 motor steps
TURN	2001xxxx 1 Byte n (-8...7)	turn -2 ; rotation algebraic sign settled ; direction of rotation
SPEED	2011xxxx 1 Byte n (-8...7)	speed 3 ; set speed
MTURN	2101xxxx 1 Byte n (-7...7)	mturn 1 ; motor rotation through 1 rotor
WAIT	0100xxxx 1 Byte n (0..1)	wait 1 ; wait for keypress
PAUSE	0101xxxx 1 Byte n (1...15)	pause 2 ; waits 4 seconds
JUMP	0111xxxx 1 Byte n (0...15)	jump 10000 ; jump direction
JBAND	1000dddd 2 Byte d adr	jband 100011 ; jump if bit pattern - status byte
JNOR	1001dddd 2 Byte d adr	jnor 100101 ; jump if one of the status bytes ; is active
END	0000xxxx 1 Byte	end ; leave the process
CASE	0010xxxx 2 Byte adr r (1,2,4,8)	djnz A,label ; jump as long as A is not 0
JP	1100xxxx 2 Byte adr	jp 5ch ; jump to the box
STORE	1101xxxx 2 Byte r (1,2,4,8)	store 1,255 ; stores 255



DC-motor driver

POLARIC and

From his earthen home in the woods, Polaric of Fane trudged through the mountain gap into the mystical wooded tundra of Ender Fir. The journey should have taken at the most two and a half days on foot, but Polaric was never a man who walked light.

'So, you've made the trek at last,' came a wizened old voice from the Spheres. The Spheres accompanied every traveller in Ender Fir, as indeed they did every inhabitant, and Polaric had thus far let them join and follow him along without comment. 'Visitors from Fane have worried of you'.

Polaric sighed. It was easy to ignore the Spheres when they were not conversational. If he did not at least say something though, they would pester him for the rest of his stay. 'I haven't slept for nine days,' he stated, as if that should be an end to the matter.

'We'd heard it was more like thirteen'.

'Not including the days coming here,' he added, as if for the last seven words his ears had been elsewhere.

'You should have been wise and come after two'.

'Hah!'

The three Spheres drew closer, each one revolving slowly around the other two. 'You have brought half of your house with you'. Polaric trudged on without feeling the need to respond. 'What is the purpose of bringing those skins along? You do realise that trading in skins and furs without a permit is illegal here?'

'Yes'.

'And you still intend to do it?'

Polaric grunted to himself. 'If I could afford to pay the fine, I might well just stop to consider it. But as it happens, no – these skins are my tent for the night. There's been no law passed against tents since last I came, has there?'

'No, but we're debating one'.

'Hah!' Polaric took some bread from his knapsack and without looking tossed it into the bushes.

The blue pulsating Spheres sighed and started to orbit the traveller methodically. 'Alas, good Ender have peace on the man. He knows full well of the charge for his action yet wastes a not inconsiderable ten Kromahs on a pointless show of defiance to demonstrate what he thinks of our laws. The foolish will live by their statements and who but they themselves are truly able to stop them from doing so. Do you have no money, good candle-smith, to spend on a room here? Or is your tent of skins a statement against us as well?'

'I would have brought a spade,' said Polaric stubbornly, 'and dug a hole, as should be my right. But now, of course, you have rules against that too'.

'The last time someone dug a hole, he did Tralzaic the Merciful's roof in. We had to pass a law just to save people from repeating the experience. The things that man is capable of doing to someone with a shovel, you would not even want to dream about. Why do you not stay with your niece? You and her get on all right'.

'I am a principled man who pays his way. Persephone would not dream of taking anything in return for her hospitality and thus I prefer not to ask her'.

'Have peace on you, candle-smith. You really are as stubborn as a plains mule, aren't you'.

'Just leave me alone'.

'And unsociable too. Lack of rest does not alter your temperament either way, does it Polaric'.

A rumble began at the back of the traveller's throat but it stopped just as quick as it had come. 'I have not heard an official crediting yet, as I am entitled to,' he said tersely. 'I would wish for you to read it out to me and let me continue my journey alone'.

'Very well'. The three blue Spheres floated round to the front of him. Polaric stopped in his tracks to receive. 'Polaric of Fane, you are hereby summoned to make peace with yourself. For a deliberate act against the province of disposal of bread, you are fined the sum of ten Kromahs and will be blessed by Ender 'till dawn. I hope that was worth it'.

'Blessed by Ender,' said Polaric sarcastically, starting to walk on again. 'Of course, I only did it to be blessed by Ender the all-seeing and wise'.

The Spheres floated back to the side of him. 'You'd have been doubly blessed if you hadn't,' they said.

Polaric continued his journey into the province of Ender Fir without further interruption. All Spheres, it is said, are one so presumably, though physically still with him, they had gone to bother some other poor souls. Whoever they were, Polaric's sympathetic thoughts went out to them. After an hour, he reached the town and decided to sit on a sitting stump and take in the air. The aroma of baking bread was all around in this part of the woods and was a gently seductive one. He did not think that well of the baker, though, so a purchase was out of the question. A girl walked up.

'Polaric,' her voice was full of concern, 'the Spheres told me you were here, yet when they said how long you had taken to come, with the problem that you have, I could hardly believe it was true. How could you possibly have taken so long?'

The traveller sighed. 'You know what I think of shamans. I had hoped it would wear off from me after a while. Anyhow, it is good to see you again, my niece. It has been a long time'.

'It must be four months or more. It's a pity my deliveries are only so local, else I could have visited. I know delivering bread door to door isn't exactly a calling, but I do enjoy it, uncle, and wouldn't want to place it at risk by taking such a large amount of time off, not really for anything'.

'The man has no heart. I have said it one time over a thousand if any. I do not like you working for him'.

'Perhaps, but he pays well and has never been anything other than kind'.

'Maybe so, but he has not a bone in his body that could tell me the meaning of right. If he were half a man, he'd honour his debt to me'.

Persephone tilted her head at him. 'If he cut off his arm, like you'd wish of him, his whole trade would be ruined. Have you ever tried kneading dough using only one hand?'

'No, but I'm quite sure I could if I tried it. And even if not, I would just have to manage. The man made a bet with me and a man who

will not pay his dues is in my mind no real man at all'.

'But uncle, his arm,' said Persephone reproachfully.

'Arm or a hair from his beard, it should make no difference once hands have been shaken. When I make a bet, I stick to it and there's not a soul who can tell me I don't. It is, you must understand, my niece, the principle of the thing. Where would we be if no-one had standards?'

'Principle again,' said Polaric's Spheres.

'Your uncle is a fool,' said Persephone's. 'Good Ender have peace on the man'.

After talking some more, the two of them headed off through the wooded town to the hut where the shaman lived. Over joining paths and bridges they walked, passing doors in the ground and hollowed out tree-stump chimneys every step of their way. When they arrived, it was at a large stone and straw building with a sign on the roof that read 'SOATL – WAH'.

'What in the name of...'

'It stands for Will Accept Heads,' said his niece. 'He always gets paid in internal organs or Kromahs, but I believe he still lives in hope'.

'Not that! Shaman of a thousand lights? The damned man's regressed – he used to have a million!'

'What? Uncle, don't you know? The old shaman died five years ago. You really haven't been keeping up with your check ups, have you'.

Persephone watched as her uncle set his tent up on the ground above her house. 'How's your forehead?' she asked.

Polaric touched his forehead and winced. 'It stings like a death bee!' Covered in sores, it was unlikely to heal for some time. 'But I don't mind telling you this, though – between that potion he gave me and that poultice of fuming manure, I really do think I'm going to get my head down tonight'.

'I'm glad,' said Persephone.

'Well don't be – I meant that by morning I'll probably be dead'.

His niece tilted her head again and smiled. 'You really are such a distrusting person, uncle. You really should learn to have a little more belief in people'.

'He's a pitiful creature who will always be alone,' said her Spheres. 'Ender have mercy on his bones'.

'Belief?' The candle maker raised his palms to the sky. 'In a mere thousand light shaman who can't even put his deer on right? His hut was full of snow globes, Persephone! Snow globes with people's internal organs floating around inside. How can you have trust in a man who tries to sell you bits of his own townspeople pickled in a snow globe, for Vendric's sake!?'

'Whoops,' said his Spheres. 'Now you've gone and done the big one, haven't you. Polaric of Fane, you are hereby summoned to make peace with yourself. For a deliberate act against Ender of invoking the name of a lesser local god, you are fined the sum of two hundred Kromahs

THE SHAMAN

A short story by Jonathan Bethell Aldred.

'Died? What did he die of?'

'Officially, tooth decay. Though rumour has it he died of bad hygiene'.

'Unhealthy lifestyle, I'd take a guess at. It's not right living permanently above the ground. The whole thing's unnatural'.

'Shall I knock?'

Polaric took a pause to feel gloomy. 'Go on then. Might as well do'.

The door was a curtain of dangling straw. Persephone knocked on the timber frame and stood back. A semi-naked man jumped out and wailed at them. Polaric almost went white. 'Greetings, Polaric of Fane,' said the man, removing the dead deer from his head. 'I am Herbararlalis, son of Herbexieyde – shaman of a thousand lights and licensed trader of trinkets and talismans the sight of which will blow your mind. All internal organs and body parts accepted – they don't have to be your own, just as long as they're human and fresh they're all right by me'.

'I'll pay cash,' Polaric said bluntly.

'Accepted. Now, to your trouble. The spirits have told me you're unable to sleep'.

'No, they haven't – it's those blasted blue globes of yours'.

'No it wasn't,' said the Spheres. 'Bless the unbeliever for he has indeed been bewitched'.

'Shall we go in?' asked the shaman. 'I've prepared a flask of green blood and a poultice of oxen manure and lime that's been rotting up a treat'.

and will be blessed by Ender for five minutes reluctantly. If he's feeling generous'.

'Fine!' He threw his arms up in the air. 'Take two hundred Kromahs off me! The candle trade's been good this year, so you can have another two hundred if you want and I'll say it again! By Vendric, I hate this town! Why, if there was any justice in this world-'. And with that, Polaric collapsed face first onto the ground, creating an imprint that would stay in the soil for weeks.

Persephone looked down at her uncle. She stood there for a while wondering what to do and then pulled him, feet first, backwards into the tent. After thirteen days of grumbling, Polaric of Fane had finally got his head down.

THE END.

NEXT MONTH: We announce and publish the first of our nine winning entries in our Robot Wars short story competition.

SOLUTION

SALES & MARKETING

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SOLUTION TECHNICAL RECRUITMENT, The Tower House
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Tel. 01296 336036. Fax. 01296 336037

Please use the template of Sales Marketing & Applications, with the contact details of Aaron Keep, e-mail -- Solution is a specialist recruitment consultancy that has consultants focusing on set sectors of the technical market. Due to substantial growth and demand within the electronics division we are looking to hear from candidates that have a strong commercial background within sales and marketing, cupped with an electronics qualification and are ready to make the next move in their career.

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For more information and an initial discussion contact **Aaron Keep** or **Andy Raymond** or visit our web site **www.soljobs.com**

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SOLUTION

Solution are currently working with a number of organisations recruiting for the electronics industry in sectors such as aerospace, automotive and telecommunications.
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Typically, you will be one of the following:

SOFTWARE ENGINEER • SENIOR SOFTWARE ENGINEER PROTOCOL ENGINEER • PROJECT MANAGER PRINCIPAL ENGINEER • ASIC DESIGNERS • FPGA DESIGNERS RF DESIGNERS • TEAM LEADER HEAD OF SOFTWARE DEVELOPMENT • ANALOGUE DESIGNERS MIXED SIGNAL DESIGNERS

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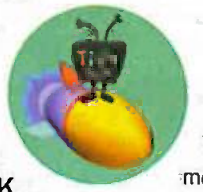
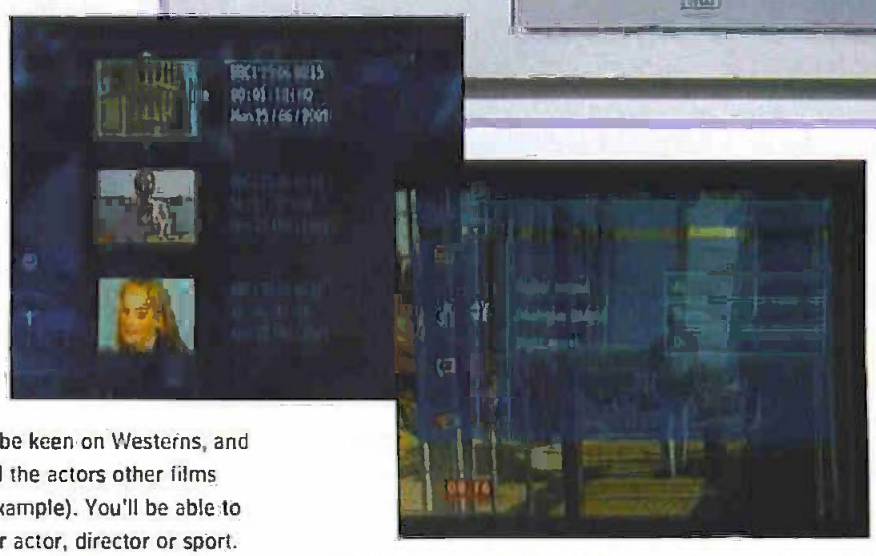
Technology Watch

with Martin Pipe

IN THE LAST TECHNOLOGY WATCH WE EXAMINED THE TIVO PERSONAL VIDEO RECORDER IN SOME DEPTH. THIS LINUX-BASED PRODUCT RECORDS TV PROGRAMMES ON A 40GB HARD DISK, AFTER DIGITISING THEM AND COMPRESSING THEM ON THE FLY WITH AN MPEG-2 ENCODER.



To pick the programmes you want to record - or indeed watch on your TV - TiVo employs a comprehensive user interface that will even pick programmes based on your personal tastes (if you like The Simpsons, why not try Futurama?), or record all shows of a specified name (the so-called 'season pass'). The programme schedules, which are paid for with a modest monthly subscription, are transmitted to the TiVo recorder by modem. In the autumn, TiVo subscribers will receive a software update that allows them to 'add time' to a recording - so that programme endings aren't missed (TiVo, being of American origin, lacks the PDC feature of basic UK-spec VCRs). The software update will let also you narrow your programme preferences still further. You might like Clint Eastwood but not be keen on Westerns, and so TiVo will record the actors other films (Dirty Harry, for example). You'll be able to specify a particular actor, director or sport.



One of TiVo's principal limitations is the fixed storage. The same will apply to Sky's forthcoming personal video recorder - which scores over TiVo insofar that it writes the wanted programme's original MPEG-2 stream directly to the hard disk, thanks to the integrated two-tuner (watch one show while recording another) satellite receiver. As the hard disk begins to fill up, the system will automatically delete programmes that are past their 'view-by' date, unless you tell the system to keep them. If you keep doing this, though, you'll run out of space and TiVo won't be able to record any more shows unless you manually delete old ones (after transferring them, if required, to videotape - TiVo sports a VCR Scart socket for this very reason). VHS inventor JVC realises this problem. It has just introduced the £1000 HDS1, a product that combines a 40GB hard disk MPEG-2 video recorder with a S-VHS ET analogue VCR (ET, by the way, means standard-play S-VHS recordings on VHS tapes).

The HDS1 has a 16-event timer that can be spread across the VCR and hard disk ('HDD'), but it's nothing like the TiVo system. You do, however, get an innovative navigation system that stores 'index' pictures from each tape on the hard disk. Look for a show, and the machine will invite you to insert the appropriate tape. There are four recording modes which are christened - in order of decreasing quality - SP (6.4Mbps), LP (4.5Mbps), EP (3.2Mbps) and Super-EP (2.2Mbps). Maximum recording times are 40 hours, 28 hours, 20 hours and 14 hours respectively. In Japan, incidentally, JVC sell a TV with a built-in hard disk video recorder. This product was introduced at around the same time the HD-S1 made its first appearance - and no doubt has much in common with the HDS1's hard disk recorder electronically. Nevertheless, the HDS1 still requires you to dump prized programmes onto analogue tape so that they can be cleared off the hard disk. It's just that JVC has integrated the two products in a neat way.

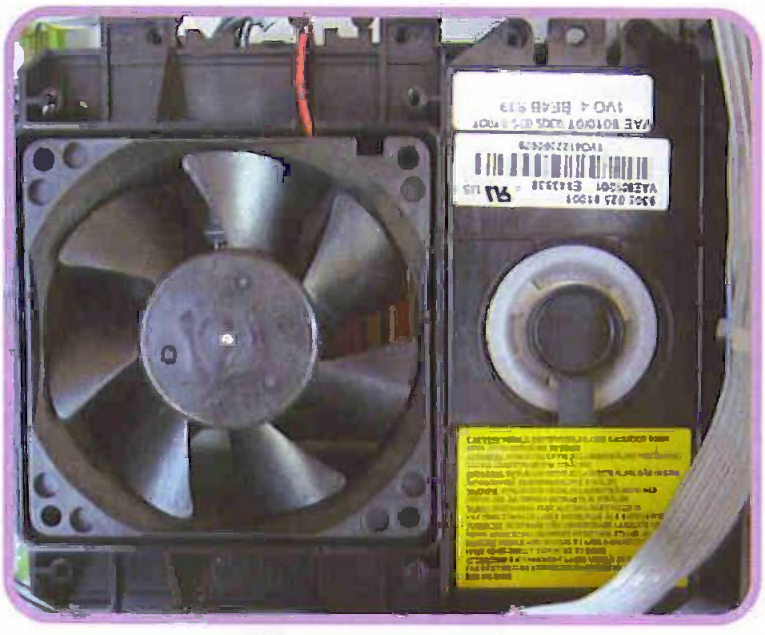
Wouldn't it be great if you could keep those digital recordings in the digital domain all along. That means a removable digital medium - when the disk fills up, you have an alternative to deletion. Just like a VCR, you can eject the full medium and replace it with a blank one. Why not make this recording medium DVD-compatible, so that recordings can play on a conventional DVD player? Well, folks, you'll soon be able to. Philips' innovative £1400 DVD recorder, the DVDR1000, will be with us by the time you read this. Panasonic will introduce a similar machine, the £1300 DMR-E20, some time in the autumn. They employ different recording medium, however. The DVDR1000 sticks to DVD+RW, while Panasonic has allied itself with the rival DVD-RAM. There's a third format - Pioneer's DVD-RW - which means we could be for a format war to rival the 80s VHS vs. Betamax vs. V200 debacle. All of these contactless phase-change formats have their relative advantages and disadvantages, which are outlined in Box 1. Advantages common to all are random (i.e. fast!) access to a particular programme, no physical wear and tear, DVD playback and smooth noise-free slow motion, stills and variable-speed searches. You'll also get basic editing facilities, that will allow you to split up tracks

and delete unwanted material.

We had our chance to get our hands on a pre-production DVDR1000, and try it out. The machine works only with DVD+RW media and won't, unlike the rival Panasonic, record onto DVD player-compatible 'write-once' DVD-R discs. But then again, Panasonic had to make such a concession because its choice of rewritable media (i.e.DVD-RAM) is incompatible with DVD players. Reflecting its prestige status, the DVDR1000 is a gargantuan piece of kit of impressive style and build quality. Front panel controls are minimal - record, stop, play, tray open/close and standby. Press another front-panel button, and a 'drawbridge' lowers to reveal other operating controls. These include chapter/track access, search, record level adjustment and channel up/down buttons. Hit the record level adjusters and a pair of bar-graph audio meters appear on the comprehensive fluorescent display. Also on offer are an IEEE-1394 input for dubbing from DV camcorders - the DVDR100 incorporates a decoder board that converts DV into uncompressed digital YUV, which is passed directly to the MPEG-2 encoder.

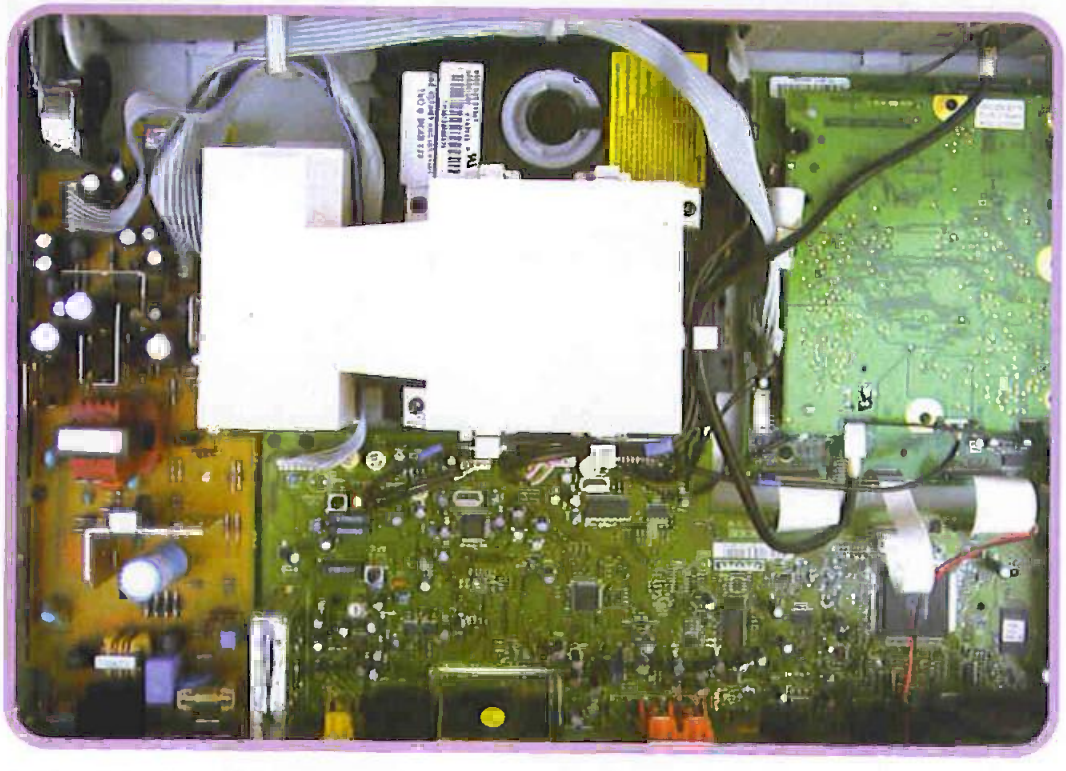
For analogue camcorder enthusiasts, there are front-panel composite/S-video and stereo audio analogue inputs - the same complement that you'll find on today's D-VHS VCRs. No current D-VHS machine can hope to compete with the DVDR1000 in terms of rear-panel connectivity. For a start, you get both optical and coaxial digital outputs.These will output a DTS or Dolby Digital signal for your AV amp when playing commercial DVDs. Sky Digital plans to move to 5.1-soundtrack broadcasting, and the feature will be supported by its forthcoming SkyPlus personal video recorder. Unfortunately, the DVDR1000 doesn't have a digital input. If Philips had been more forward-thinking, such an input would have allowed the 5.1 bitstream to be transferred from the satellite receiver to the recorder - while a Scart cable carried the video. Instead, purchasers of the DVDR1000 will be stuck with stereo recordings (which are 16-bit 48kHz Dolby Digital, in case you were wondering). Next up on the connectivity front are composite and S-video inputs and outputs, which are complemented by stereo audio phonos.

As an alternative, there are two Scart sockets. The first is intended for your TV, and will deliver a RGB output for the best quality results. The second would normally be hooked up to a set-top box. We're pleased to report that it will recognise a RGB input, allowing the most to be made from digital set-top boxes (or TiVo!). Talking of TiVo, the DVDR1000 also gives you a choice of four recording modes given. Here, the MPEG-2 compression ratio is varied. The heavier the compression, the lower the data transfer rate and the longer the recording time per 4.7GB disc. Higher compression rates do, of course, have an effect on picture quality. As with TiVo, MPEG 'artifacts' - most noticeably 'blocking' on fast movement - become more noticeable as the data rate is reduced. The DVDR1000's four recording modes - all of which are compatible with DVD players - are HQ (1 hour per disc, 9.72Mbps), SP (2 hours, 5.07Mbps), LP (3 hours, 3.38Mbps) and EP (4 hours, 2.54Mbps). HQ does, of course, offer the best picture quality. Artifacts are barely visible, although the 1 hour recording time is a limitation. It's ideal for dubs from DV camcorder tapes, though. Film fans would be better off using the SP mode, which should provide enough recording time for the average movie. The other two modes are surprisingly good, and are less artifact-ridden than their TiVo equivalents. This is surprising, seeing that the bitrates involved are very similar.



LP and EP are ideal for lengthy concerts and sporting events - in recognition of the latter, the two modes benefit from a switchable 'tweak' that optimises the MPEG-2 compression algorithms for fast movement. The recording mode is selectable from an on-screen menu, or via the 6-event VideoPlus timer. The latter, by the way, scores over TiVo insofar that PDC is fitted as standard. But then again, you don't get TiVo's ability to pause live TV as you can with TiVo. If this facility appeals, then you'll have to wait for the Panasonic DVD-RAM machine. Although you can play MPEG-1 VideoCDs, you can't record them. This is a pity, because just about every DVD player is compatible with this VHS-quality system, which would allow over 7 hours of video to be crammed onto a single-sided 4.7GB disc. You can record from NTSC and PAL sources, although you cannot convert from one standard to another. In other words, you can't make PAL DVDs from NTSC sources (or vice versa). Nevertheless, NTSC recording may appeal to those who want to commit rare imported laserdiscs to DVD. You can't NTSC and PAL material on the same disc either - such an act would, apparently, breach the DVD standard.

The DVDR1000's editing features are similar to those of the DVD-RAM and DVD-RW hardware now available in Japan. When you record a programme, it ends up as a 'track' - which is analogous to a DVD movie. For convenience movies are, of course, split into chapters - which can be seen as strategically-placed index points. The DVDR1000 makes provisions for these during recording. There's an 'auto-chapter' mode that adds these every few minutes. In addition, a new chapter is created if a manual recording session is momentarily stopped using the pause button. Additional chapter 'breaks' can be added by using the editing mode's 'add chapter mark' feature - pause the video where you want the new chapter to begin. These chapters are, of course, recognised by standard DVD players.



Another editing feature is the 'Minidisc-like' ability to split a track into two parts. This is rather time-consuming, because the MPEG data stream has to be altered. Why would you want to do it, though? It's intended primarily for the deletion of unwanted material. Split the programme into wanted and unwanted parts - the pause button allows for great accuracy here - and the unwanted sections can be deleted.

We tried playing DVD+RW recordings on Hitachi and Samsung DVD players, and had no problems. Automatically written onto the disc alongside your MPEG2-encoded video footage is a basic track/chapter-selection user interface identical to what you see when you're using the DVDR1000 itself. Each DVD+RW disc can be rewritten to around 1000 times, and recorded discs have an estimated archival life of over 100 years. In all, the Philips DVDR1000 points in the right general direction. Within five years, the price of DVD player/recorders should hopefully come down to a more affordable £500 or so. Bearing in mind that you also get a DVD player, a sum of this magnitude would not be unreasonable. Custom chipsets should bring down the manufacturing costs - as should the elimination of features not required by 'everyday' home users (like the DV input). Over the next five years, the price of the media should drop too. Currently, DVD+RW discs sell for around £20. Assuming that the Philips system is still around by then (and Philips hasn't, with the obvious exception of the CD standard that it co-developed with Sony, got a good track record in these matters), blank DVD+RWs might be selling for £5 or so.

Martin Pipe welcomes comments and ideas. E-mail him at:
martin@webshop.demon.co.uk
Or look out for him onlinel His ICQ ID is: 15482544

Comparison between formats

	Advantages	Disadvantages
DVD+RW	Computer drives on their way Recorded discs compatible with majority of DVD players Random-access medium means you get to a particular recording quickly Basic 'Minidisc'-style editing a possibility Edited discs should play on all compatible hardware Hardware will also play DVDs No caddy required	Double-sided media not yet available Philips' current machine won't record onto 'write-once' DVD-R media Simultaneous read/write (and thus 'pausing' live TV) not yet possible Not officially recognised by the DVD Forum cross-industry body.
DVD-RAM	Computer drives available now 9.4GB double-sided DVD-RAM available (up to 12 hours of video per disc) Random-access medium Basic 'Minidisc'-style editing a possibility Potential for simultaneous record and playback Hardware will also play DVDs Recognised as a standard by the DVD Forum	Protective caddy required DVD-RAM video recordings incompatible with current DVD players
DVD-RW	DVD-RW computer drives available now Random-access medium 'Video mode' for creating DVD-RW discs that can be read by DVD players 'VR' mode provides Minidisc-like editing Potential for simultaneous record and playback Will also play DVDs Ratified DVD standard No caddy required	VR-edited DVD-RWs incompatible with with DVD players Home recorders not yet available in UK

Email 'Chinese Horoscope' spreads like virus across the Internet

There's a very strange email going around, and it spreads like one of those pyramid schemes such as the recent 'Women Empowering Women', only much more rampant because there is no risk of losing any money by participating. This is what happens – you receive the email and read it. It looks fun and so you take some time and fill it out. Here at Kanda Systems we can testify that most of the people who tried it did indeed believe it to be uncannily accurate. Far from being written in the stars though, this 'horoscope' was obviously written by someone who has a very good understanding of psychology and the subconscious mind – not just in the way the test works, but also in how it encourages people to pass the message on.

Before we continue, here is the email so you can play the game for yourself. We have put some of it in upside down text to make it easier for anyone who wants to do the 'horoscope' properly.

[Email subject heading:] CHINESE HOROSCOPE: THIS IS AMAZINGLY ACCURATE

THE YEAR OF THE IRON DRAGON, WISHING YOU PROSPERITY AND GOOD FORTUNE. FOLLOW THE INSTRUCTIONS – DO NOT CHEAT OR IT WON'T WORK AND YOU WILL WISH YOU HADN'T. TAKE 3 MINUTES AND TRY THIS. IT WILL FREAK YOU OUT.

THE PERSON WHO SENT THIS SAID HER WISH CAME TRUE 10 MINUTES AFTER THEY READ THE MAIL. BUT NO CHEATING !!!!

THIS GAME HAS A FUNNY / CREEPY OUTCOME. DON'T READ AHEAD - JUST DO IT. IT TAKES ABOUT 3 MINUTES – WORTH A TRY.

FIRST GET PEN AND PAPER

WHEN YOU FINALLY CHOOSE NAMES, MAKE SURE IT'S PEOPLE YOU ACTUALLY KNOW, AND GO WITH YOUR FIRST INSTINCTS !!!!

SCROLL DOWN ONE LINE AT THE TIME – DON'T READ AHEAD OR YOU'LL RUIN THE FUN!

1. FIRST, WRITE NUMBERS 1 THROUGH 11 IN A COLUMN
2. THEN, BESIDE NUMBERS 1 AND 2, WRITE DOWN ANY 2 NUMBERS YOU WANT
3. BESIDES THE 3 AND 7, WRITE DOWN THE NAMES OF MEMBERS OF THE OPPOSITE SEX

DON'T LOOK AHEAD OR IT WON'T TURN OUT RIGHT

4. WRITE ANYONE'S NAME (LIKE FRIENDS OR FAMILY ..... IN THE 4TH, 6TH, AND 8TH SPOT

DON'T CHEAT OR YOU'LL BE UPSET THAT YOU DID

5. WRITE DOWN FOUR SONG TITLES IN 8, 9, 10, AND 11
6. FINALLY MAKE A WISH

AND THERE IS THE KEY OF THE GAME

11 YOU MUST TELL ONE NUMBER IN SPACE 2) PEOPLE ABOUT THIS GAME
2. THE PERSON IN SPACE 3 IS THE ONE YOU LOVE
3. THE PERSON IN 7 IS ONE YOU LIKE BUT CAN'T WORK OUT
4. YOU CARE MOST ABOUT THE PERSON YOU PUT IN 4
5. THE PERSON YOU NAME IN NUMBER 6 IS THE ONE WHO KNOWS YOU VERY WELL
6. THE PERSON YOU NAMED IN 6 IS THE YOUR LUCKY STAR
7. THE SONG IN 8 IS THE SONG THAT DESCRIBES HOW THE PERSON IN NUMBER 3 FEELS ABOUT YOU
8. THE TITLE IN 9 IS THE SONG FOR THE PERSON IN 7
9. THE 10TH SPACE IS THE SONG THAT TELLS YOU MOST ABOUT YOUR MIND
10. AND 11 IS THE SONG TELLING HOW YOU FEEL ABOUT LIFE

SEND THIS TO 10 PEOPLE WITHIN THE HOUR YOU READ THIS.

IF YOU DO, YOUR WISH WILL COME TRUE.

IF YOU DON'T IT WILL BECOME THE OPPOSITE

So, did it work for you? It actually seems to work better with women than it does with men, but the point is that it works well enough to encourage those who would never have forwarded it to 10 other people had it told them to at the beginning, to send it out in the hope that good fortune might come their way (or in the fear that in not sending it, bad luck will in some way befall them).

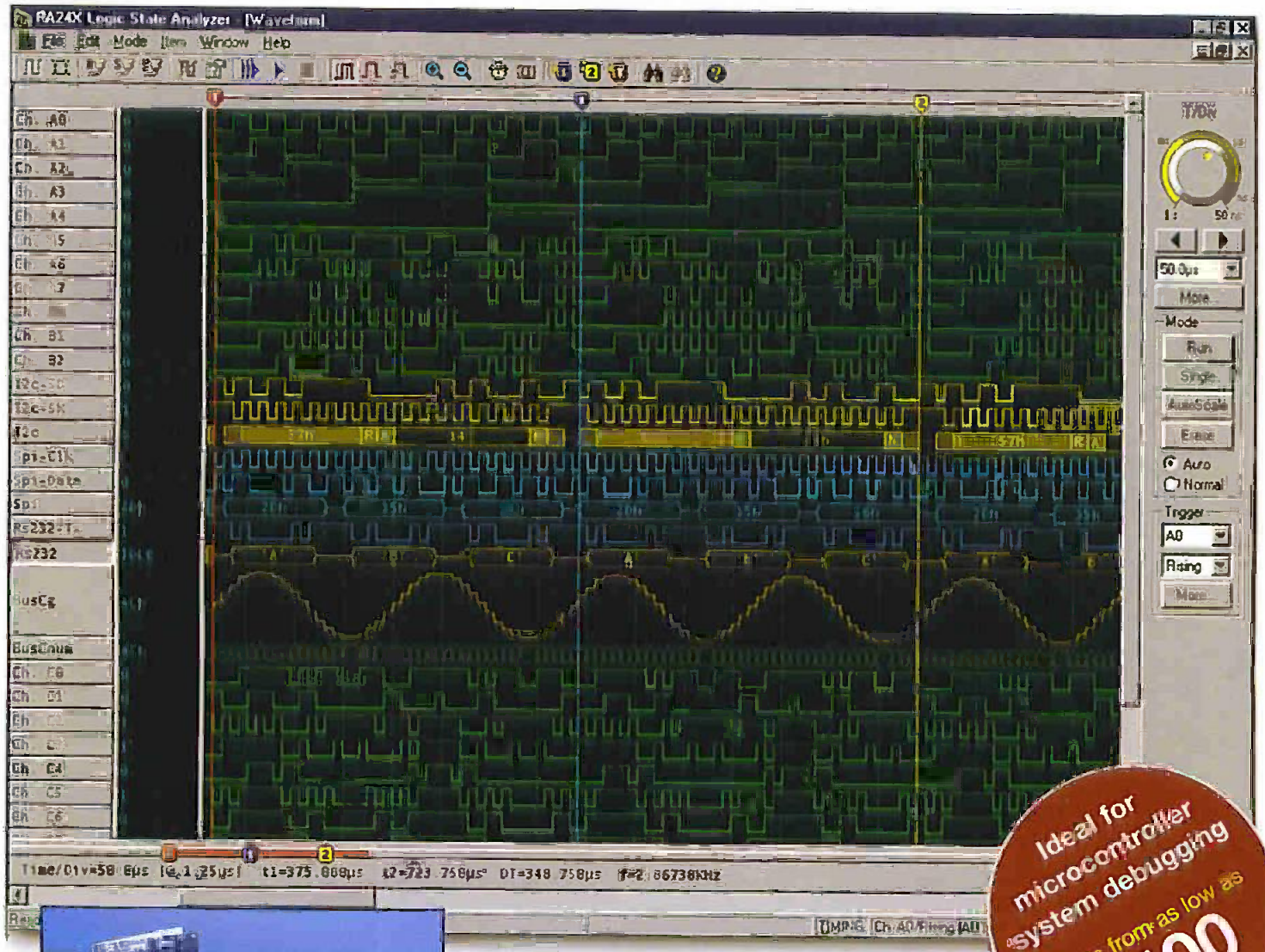
Psychology aside, what is the catch here? If it isn't selling something and it does not have a virus attached (please note that just because our version was harmless, that does not mean you should be complacent upon receiving any similar emails), what is the point in creating it? What was the email created to achieve? Well, the truth is, we don't know. It might have been copied out of a magazine for all we know and passed on initially within a small group of friends. Or it could have had a virus or request for money attached, but somewhere along the line this was taken out of the email before the receiver of the email passed it on.

Whatever its origin, this email and others like them can be extremely disruptive – there is a chance that you might receive the same email several times, or that someone will add something nasty to it, such as a virus, a demand for money, or even something slanderous or with the implication of blackmail. Aside from anything, it can spread around an office like wildfire and cause serious disruption as several members of staff put their duties aside for a few minutes to write their answers down and then automatically email 10 other members of staff who work in the building.

So if you do get a message like this one come into your in-box and you feel tempted to investigate instead of simply dragging it onto the bin icon, just print it out and do it at a later date or, even better, sit down with this issue's copy of Electronics And Beyond.

Wishing you lots of luck for you and yours for the future,

Jonathan and the rest of the E&B team.



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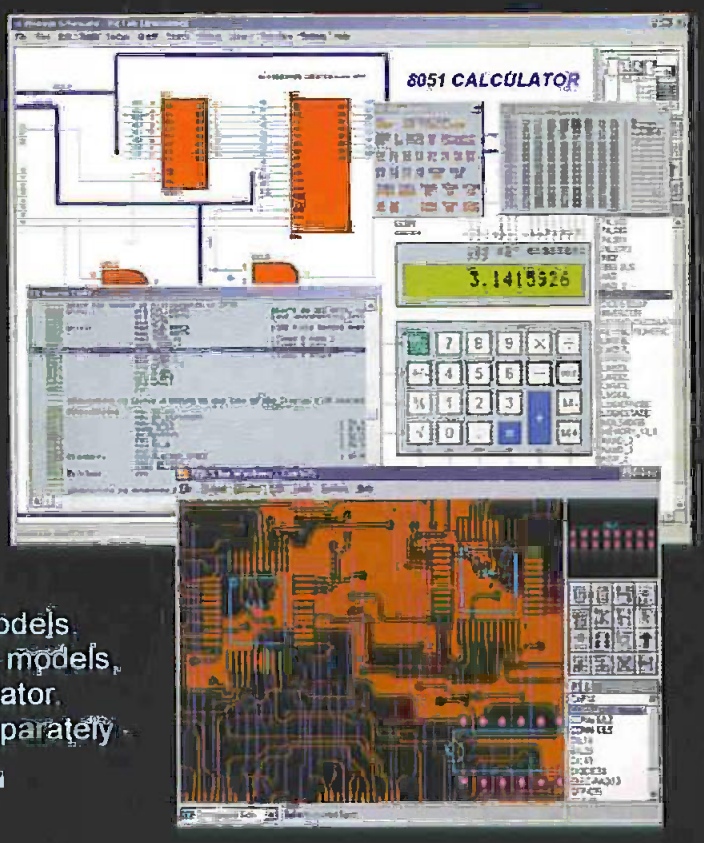
- CPU and interactive device models are sold separately - build up your VSM system in affordable stages.
- ARES Lite PCB Layout also available.



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E.g. PROTEUS VSM can simulate an 8051 clocked at 12MHz on a 300MHz Pentium II

Write, phone or fax for your free demo CD - or email Info@labcenter.co.uk.
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