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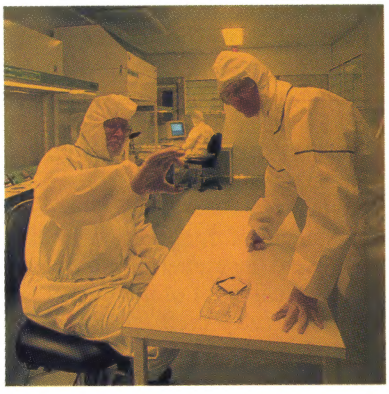
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# Electronics AUSTRALIA WITH ETI

Volume 55, No.9
September 1993

AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE — ESTABLISHED IN 1922


### Macquarie's new clean room



*The electronics and physics schools at Macquarie University in Sydney have set up a new Class 35 clean room, for research into compound semiconductor devices and circuits. Here Professors David Skellern and Trevor Tansley inspect an etching mask in the new room. See our story on page 106.*

### Hifi on wheels — the gear



*This month Barrie Smith continues his look at modern high-quality car sound systems, with a rundown on some of the more impressive system components. You'll find part 2 of his 'Search for the Ultimate in Car Sound' feature, starting on page 26.*

### On the cover

*Sony's new MZ-1 Portable Minidisc Recorder is impressively small, yet offers 'near-CD' quality — as Louis Challis found when he reviewed what was probably the first sample to be seen in Australia. You'll find Louis' review starting on page 10. (Photo by Phil Aynsley)*

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# LETTERS TO THE EDITOR




## Power factor meter?

The following is a suggestion for a technical project. I am sure your people could design it more quickly and simply than I could. The suggestion is: a power factor meter (digital) for finding the power factor of 240V AC appliances, e.g., meters, power supplies, etc.

As my house uses a stand-alone system (solar/generator) I feel being able to correct for power factor would be worthwhile. A possible approach I feel, would be to measure the time between a couple of zero crossing detectors (one for current and one for voltage).

D. Aberdeen (address unknown)

*Comment: We'll see what can be done, Mr Aberdeen.*

## Interest in vintage radio

I recently saw the January 1993 issue of *EA* and was dismayed to read of the fate of Colin MacKinnon's vintage radios.

While not an enthusiast, I do have a small museum of memorabilia, visited and appreciated by people of all age groups. I have included a few vintage domestic radios and would like a few more but the cost and availability of anything worthwhile in WA makes this difficult to achieve.

I hope that any future disposals of vintage radio 'lots' or collections from deceased estates, etc., can be advertised in *EA*, as I would, for instance, have been particularly interested in the 'rare gramaphone console', and prepared to pay its value. Of course, donations of vintage/historic items would be gratefully received, freight paid, and the donor acknowledged with the display.

I am sure someone, somewhere, would provide a home for these unwanted items, if it became known they were available.

R. Garcia,
Bayswater WA 6053

## Not dead after all

Many 'conclusions' reached in your magazine over the years imply that thermionic valves are obsolete, except in vintage equipment; and advancement in valve technology ended 30 years ago.

Speaking as a musician, I think I can safely say this:

Instrument amplification began with valve technology, and a great number of manufacturers today are pushing it still further. Many guitar amplifiers combine hybrid valve/solid state technology in their preamps, power amps, rectification, and signal processing.

Hundred of valve amps (instrument/PA), are on the market, and all for prices less than half that of exotic hi-fi amplification, as well as at least tripling their versatility and basic features.

Optimum quality valve production has been taking place in America for years, and many advancements in design have produced new models, such as the KT-99 and SP AX7.

Development of these technologies are biased toward instrument amplification, but they are real proof of how valve technology never really 'died'.

Trevor Marlow
Perth, WA.

## Cinema nostalgia

Having just read the March *EA* I must say that I particularly enjoyed the article by Rod Maclean telling of some of his experiences as a cinema serviceman in the mid 1950's.

I too became involved in the cinema scene around this time, first as a part time projectionist and later an unofficial serviceman. (In an emergency local theatres often found it quicker to contact me rather than wait for an 'authorised' serviceman to travel 50 miles from Sydney). Like Mr Maclean I well remember being amazed at the archaic nature of the equipment then in use. Nowadays I would see such gear as fascinating technical archaeology. Thirty seven years ago, I considered it obsolescent junk.

I was pleased to note that Mr Maclean, in his reference of the 3D era, mentioned the use of polarised (colourless) viewing devices. So many authors, when discussing this system refer to 'those horrible red and green glasses'. I suspect these writers have never seen a feature film in 3D. Discounting a couple of examples from the silent age, there has never been a full length 3D 35mm film that used the vastly inferior red/green anaglyphic system.

Speaking of misinformation, Mr Maclean's mention of MGM's 'Perspecta' pseudo stereophonic system jogged my conscience regarding a minor error that crept into my own dissertation on the sub-

ject. In the April 1990 issue of *Electronics Australia*, I stated that the 30, 35 and 40 Hertz control tones decrease the level of their respective channels as they increase in amplitude. A friend of mine who owns what is possibly the only working 'Perspecta Integrator' left in the world, has since informed me that I got it wrong. An increase in the level of a tone increased the audio gain of its respective channel. A minor point perhaps, but I would not like to have it on my conscience that I'd led some future technical historian astray in the fashion of the red/green 3D chroniclers.

Charles Slater,
Fairy Meadow, NSW 2519

## Airborne PA

The story on aerial PA ('When I Think Back' *EA* February 1993), brings to mind my most unusual PA job. In 1946 I was employed by a Toowoomba Radio & Electrical firm also specialising in PA.

A group of barnstormers arrived at the local aerodrome with the intention of performing daring aerial acts the next Sunday. They asked for a PA system to be installed in a Tiger Moth, so aerial PA could advertise this air show.

Now there is not a lot of room in a Tiger Moth cockpit — so our existing PA system was removed from its rack — the amplifier chassis was put in a wooden fruit case and the power supply (a DC to DC rotary converter) was put in another wooden fruit case. A horn about 6' long was tied on the wing walk (on top of one of the lower wings), with the large end of the horn facing backwards and almost touching the ground.

I was seated in the front cockpit with a large six volt wet battery between my feet, the box with the genemotor across my feet and the box containing the amplifier on my knees. When airborne, my cue to start my speech was when the pilot closed the throttle. This was done at about 300', and the throttle had to be fully opened again at power pole height — so I had to get the message out quick smart.

It's almost 50 years ago, but I remember it well.

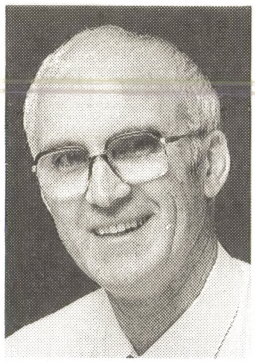
Darcy Walters,
Hervey Bay, Qld.

*Comment: It sounds like the kind of job you would remember, Darcy!* ❖

## DROP US A LINE!

Feel free to send us a letter to the Editor. If it's clearly expressed and on a topic of interest, chances are we'll publish it — but we reserve the right to edit those that are over long or potentially libellous.

# EDITORIAL VIEWPOINT



## *Audio reproduction entering an exciting new era*

After months of eager anticipation, some weeks ago we finally received an advance sample of Sony's new MZ-1 Minidisc Recorder — the very unit you see on this month's front cover, complete with some of its control legends in Japanese. It was probably the first to come to Australia, and thanks to Sony Australia we were able to rush it to our audio reviewer Louis Challis, so he could give it a thorough workout on your behalf.

(The only catch was that he had to carry out the tests in even greater secrecy than usual, and then *we* had to delay publication of his review until September 1, to meet Sony's embargo. That's why this issue was published later than usual, if you wondered. It was either delay the issue by a few days, or hold the review over until the October issue — and we didn't think you'd want to wait *that* long...)

Coincidentally, Louis himself discovered that Sanyo Australia also had an advance sample of *its* Portable MD Player, the MDG-P1, and were quite happy to let him test this out as well. So after a quick conference, we decided to bring *both* reviews to you in this issue — as our way of marking the Australian release of Minidisc technology.

Why am I drawing this to your attention here? Simply because the two digital recording technologies now becoming available in Australia — Minidisc and DCC — undoubtedly represent an important milestone in the development of audio recording. Each is the result of an enormous amount of R&D effort by the companies concerned (led by Sony and Philips respectively), and in our opinion the technical developments they embody are almost certain to form the foundation for most further developments in audio recording, for the next decade or two.

Sure, we've had digital audio recording and reproduction for over 10 years now, in the form of media like the compact disc. But these have been relatively simple, unsophisticated *linear* digital recording, with a high degree of inefficiency when it comes to recording storage density. Minidisc and DCC are the first 'mass market' examples of the *next* generation of more sophisticated digital recording media, which can achieve significantly higher recording densities by using digital compression and related techniques. They also take advantage of new knowledge about the way human ears work, allowing some information to be simply discarded, rather than recording it at all — because it isn't going to be heard on replay anyway. (It's a bit like the way movies and TV rely on persistence of vision, to 'recreate' visual motion...)

So don't make the mistake of assuming that MDs are simply CDs made a bit smaller, or that DCC is just a 'tarted up' digital form of compact cassettes. There's a lot more to both of them than that; they really do represent the start of a new era in audio recording.

Of course with the two new systems being set up in an adversarial situation by their proponent 'camps', it remains to be seen whether both will survive. But this outcome is likely to be decided on the basis of physical media convenience (i.e., disc vs. tape), rather than the actual recording technologies — which are rather similar, as I understand it.

**Jim Rowe**

## *Video & Audio: The Challis Report (1)*

# SANYO'S MDG-P1 MINIDISC PLAYER

By sheer good fortune, this month Louis Challis was also able to try out and test a *second* advance sample of a new Minidisc product: the very compact MDG-P1 Portable MD Player, from Sanyo. We decided to bring his review to you in the same issue as that for the Sony recorder, because of the likely significance of Minidisc technology for the future of domestic audio recording and reproduction.

A funny thing happened to me on the way to the forum — or more accurately, on my way to the Olympics 2000 Stadium in Sydney. As it happens, the new Stadium and Aquatic Centre are literally across the road from Sanyo Australia's headquarters at Homebush, so I decided to drop in and see Sanyo's technical manager Colin Doyle to discuss one of their products.

Whilst there, I discovered that Sanyo had recently received an overseas production sample of their model MDX-P1 Portable Minidisc Player, which they had displayed in Chicago at the Summer CES in 1992. With some trepidation I suggested that the magazine would be delighted to review the new MDG-P1, and I was pleased at their positive response. So the deal was immediately clinched, and this review was made possible.

As most *EA* readers will be aware, Sanyo has developed a reputation for producing innovative consumer products, the majority of which are aimed at satisfying the 'mid-price market' requirements. A cursory examination of the MDG-P1 convinced me that its potential market niche had been carefully researched, to cater for the 'under 30' age group in the global market.

The MDG-P1 is the smallest and neatest Minidisc player that I have yet seen, and quite apart from performance, one of its real attributes is that it is less than half the weight — as well as being less than half the volume — of the Sony MZ-1 Minidisc Recorder reviewed elsewhere in this issue.

The instant affinity that the MDG-P1 can create in the younger generation was typified by the response of one of my sons, who was asked to pick up the MDG-P1 from Colin Doyle that evening, as I was otherwise occupied. By the time I reached my son's house somewhat later that evening, I experienced difficulty in convincing him that my need was greater than his, and that he should part with the MDG-P1.

As I subsequently discovered, he had already completed his own subjective assessment — during which he had flattened the rechargeable batteries in playing the Michael Jackson Minidisc supplied with it. He was not backward in coming forward, and pointedly asked when he could have one!

If recording is not required, a Minidisc player has many advantages over a Minidisc recorder, as it is able to save considerable weight and bulk by deleting a significant number of components and related circuitry, associated with the recording process. Thus for example, there is no need to incorporate the high-powered recording laser circuitry, or the associated magnetic recording circuits, which are a vital part of the Minidisc recording process. Further bulk and cost can be eliminated by opting for a simpler disc loading system, which in the case of the Sanyo MDG-P1 is a simple manual loading drawer as opposed to the motor-powered system used in the Sony Minidisc recorder.

Although Sanyo is a Minidisc licensee, its licence does not involve the use of Sony designs or chips, and consequently the Sanyo Minidisc player features Sanyo hardware design.

In fact as I subsequently discovered by opening up the back of the MDG-P1, the full sized printed circuit board has one jumbo sized LSI chip with 132 pins, one relatively small 64-pin LSI, and three other somewhat smaller LSI's plus




***In this close up view of the Sanyo MDG-P1 with its 'mouth' open, the objective lens of its laser pickup is just visible to the right of the disc drive spindle boss. The player is shown here larger than life — it's really only 87mm wide...***




numerous transistors. The active and critical components were primarily Sanyo manufactured chips, rather than being from Sony as I might have expected at this early stage.

I was impressed by the well-constructed unit, with careful grafting of ribbon cables and multi-pin plugs and sockets, designed to simplify servicing should it need to be carried out. I have no doubt that such servicing will be required for some of these units, which will inevitably end up being dropped on roadways, footpaths and hard floors.

Even the neat little nickel-cadmium battery, and its power supply (100V in the case of the review sample), together with its battery charging circuit, are all manufactured by Sanyo, who are a vertically integrated company.

By adopting a space and weight efficient NiCad battery power supply, and a case which is strong and light, Sanyo has perfected the jogger's dream — although it would of course be equally at home on your bedside table, desk or plugged into your hifi system.

Whilst the thrust of the design is primarily directed to satisfy the jogger's need, with the main output and emphasis being directed to the use of miniature headphones, the design sensibly provides a miniature stereo line output socket so that the player can be connected to your hifi system — through which its full performance capabilities may be accessed.

With no record functions to worry about, the small number of controls provided are as simple and as sweet as you could ever hope for. The player will therefore be equally happy serving a teenager, as it would an octogenarian.

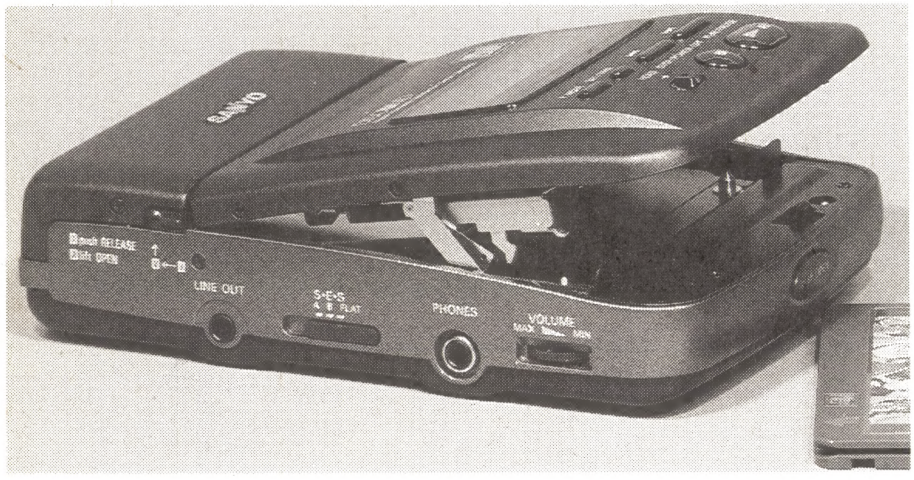
At the lower edge of the front panel is a large 'Push OPEN' button, which releases the lid catch. The lid then opens up to provide direct access to the Minidisc drawer slot — into which, or from which, the Minidisc may be inserted or removed.

With the disc inserted and the lid pushed down, there are seven primary function buttons on the front panel through which the Minidisc's operation may be controlled. The largest button is the PLAY/PAUSE button, adjacent to which is a STOP/POWER OFF button and to its left a HOLD slide switch, which locks the controls so that whilst jogging, moving or inadvertently bumping the player, the other switches will not be disturbed.

Immediately above those main controls are the two buttons for FORWARD and REVERSE music search, which provide access to the start of the next, or previous pre-recorded track on the disc. To the left of these are two additional buttons which allow you to determine the track time or total time on the disc, and an additional button for PLAY MODE, so that you can read the table of contents — or with no disc loaded, and by using the STOP/POWER OFF button, evaluate the residual battery charge in the NiCad battery.

On the left hand side of the player is the headphone volume control, adjacent to which is a miniature 3.5mm stereo headphone socket. Centrally located on the side of the case is a three position slide switch, which provides optional bass boost or high frequency cut, together with a third position which offers a flat frequency response.

Towards the rear of the case is the miniature 3.5mm diameter stereo line output socket, so that you may take the output and record it, or feed it to your hifi system to achieve optimum playback performance.




***This side view of the player, again taken with its mouth open, gives a good idea of both its compact construction and the small number of easy to use controls. Just visible at the right is part of a Minidisc, in its protective sleeve.***

On the rear of the MDG-P1 is a miniature polarised DC supply socket for a 6V DC input, and the Australian MDG-P1's will come with a 240V to 6V regulated DC plug pack.

This plug pack will power the player and simultaneously recharge the battery if flattened. One nice feature of this external supply, is that when connected, it illuminates the LCD display so that it is visible in the dark. Even when the ambient is not dark, the display is far easier to read when illuminated from the rear.

The 3.6V NiCad battery chosen for the MDG-P1 is small, light and efficient and provides a genuine 1 hour 20 minutes of playing time after appropriate discharging and recharging. It is not normally removed, but it can be very simply removed for replacement, and Sanyo provides an alternative screw-on 'piggy-back' battery pack.

This innovative extra provides an extremely simple way of making use of three AA cells to power the unit when the NiCad rechargeable battery is flattened, and there is no mains supply available.

## Objective testing

The objective testing of the Sanyo MDG-P1 was fraught with similar difficulties to those which I faced when testing the Sony MZ-1 Minidisc Recorder. Fortunately I still had the test disc which I made during the MZ-1's record to replay characteristics.

Using that disc, (with all its attendant problems), I was able to evaluate most, but not all of the MDG-P1's characteristics. As I soon discovered, the MDG-P1 has a fairly flat replay response which is certainly equal to or better than flat within +0/-1dB from 10Hz to 20kHz.

I suspect that the real frequency response is marginally better than the graphed results, which of course incorporate some compression and non-linearity associated with the Sony MZ-1 recorder. A frequency response as smooth as that shown is substantially better than most cassette recorders, and is certainly as good as the second generation of CD players which I was reviewing six to eight years ago.

To evaluate the dynamic transfer and replay linearity characteristics of the MDG-P1, and specifically its digital to analog converter and ATRAC software, I used the pre-recorded dynamic stepped sawtooth signal, which I had already recorded on the Sony MZ-1 recorder.

For the starting point in that evaluation I used the point corresponding to -12dB relative to the original signal starting point, and plotted the results with my level recorder (which has a 50dB dynamic range). By joining the two separate graphs together, and ignoring the slight non-linearity displayed at the top of the graph (which is a function of the MZ-1 Minidisc recorder's compression circuitry), what you see is a very smooth digital to analog conversion linearity — extending from 0dB to at least -86dB.

What *is* interesting is that there are minimal signs of curvature, even at the bottom of the graph where the superimposed noise starts to raise the threshold of the signal, but does not really blur the picture.

What is clear is that the Sanyo MDG-P1 signal to noise figures are not quite as good as those of the Sony MZ-1 Minidisc Recorder.

I experienced some difficulty measuring the distortion figures of the MDG-P1, but was able to measure the distortion figures for the 100Hz signal — which were 0.06% THD at -20dB, 0.14% THD at -40dB, and 1.4% THD at -60dB. My distortion figures at 1kHz and 6.3kHz were suspect, so I set them aside pending the production of a new test Minidisc. This I carefully produced with a new reference Minidisc Recorder, which I managed to borrow for just that purpose — but alas, by that time the MDG-P1 had been whisked off for photography, and I never got a second bite of the cherry.

## Listening tests

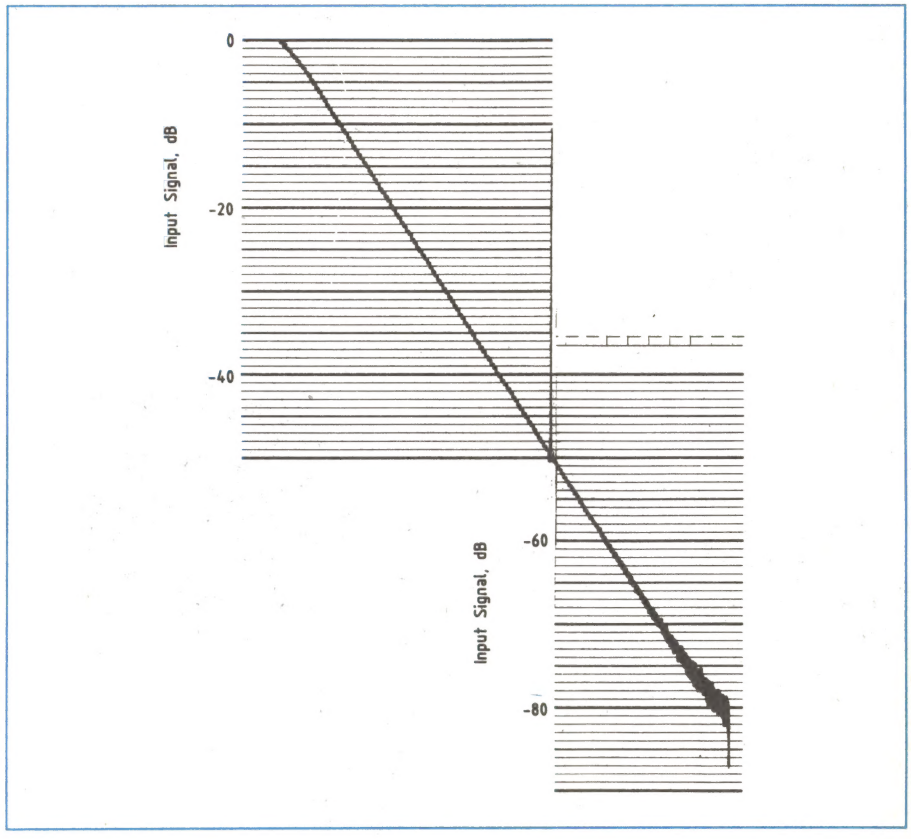
For the subjective evaluation of the MDG-P1, I was fortunate enough to have *seven* Minidiscs to play — three of which had matching CDs so that I could perform true A-B comparisons with my test panel.

I had earlier telephoned my nephew in New York, who sent me two discs by courier. These surprisingly arrived 48 hours after I rang him, which I suspect may be a new record.

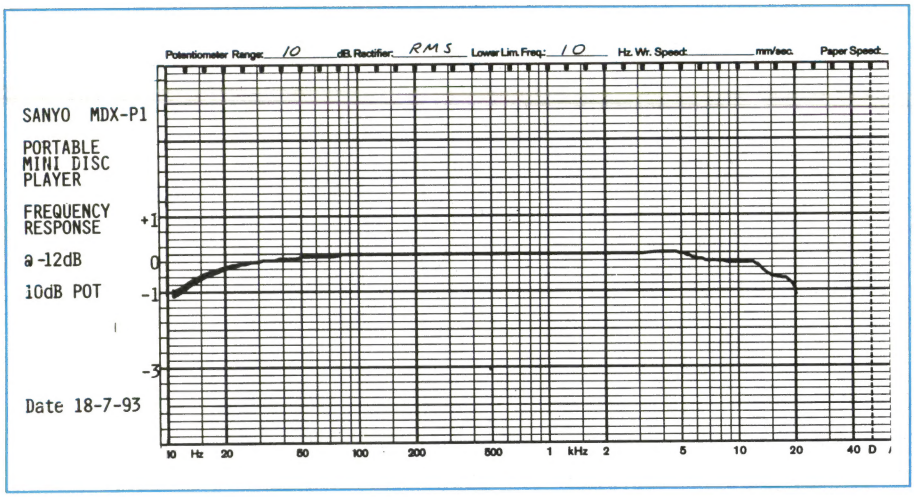
One of those discs, Harry Connick Junior in '25' (Columbia CM53172) was excellent. However the other, featuring the Drottningholm Baroque Ensemble in Vivaldi's *The Four Seasons* (BIS-MD-275), was far too strident and clearly either poorly recorded or poorly converted into the Minidisc format.

The music which I liked best was Yo-Yo Ma and Bobby McFerrin in 'Hush' (Sony Master Works SM48177 and CD version SK48177). The audible differences between the Minidisc and the CD were detectable, but primarily by way of a slightly higher noise threshold on the Minidisc, and a gentle change in the spectral balance.

With Sade in 'Love deluxe' (Epic




***Again, this plot shows the record-replay dynamic transfer characteristics of the Sanyo MDG-P1, over an 85dB input signal range. As you can see, it is remarkably linear, with only a slight curve at each extreme.***




***Here is the replay frequency response for the Sanyo MDG-P1 (not MDX-P1 as shown), taken at a level of -12dB. This plot was made using an MD test disc recorded by Louis Challis using the Sony MZ-1 recorder.***

472626 2), I could still just detect the difference in the background sound level, but the generally higher recording level most certainly masked any sonic differences that my test panel or I could identify.

The MDG-P1 had come with just one disc, Michael Jackson's 'Dangerous' (Epic No ESYA 1014), for which I had the matching CD (Epic 465802 2). Whilst Michael Jackson's music is not my normal fare, I must acknowledge I was impressed by the Minidisc, and the extent of the trouble to which I had to go to detect differences between the Minidisc and the CD.




***A close up view of the remote control unit for the MDG-P1. It provides all basic control functions.***

Track 1 on this disc, entitled 'JAM' (which I initially interpreted as a failure of the Minidisc player, and scratched my head as to how I was going to explain my problems to Sanyo Australia), proved to be an exciting obstacle course whose staccato passages, bangs and thunderous bass content clearly attracted my son — but also provided a wonderful demonstration of virtuosity of Minidisc's ATRAC technology. Music like this played with the delightful panache of the MDG-P1 will mesmerise countless teenagers and others into purchasing this Minidisc player.

What I noted in my A-B comparison of Michael Jackson's 'Dangerous', was how *clean* the Minidisc output was. This was especially so when monitored with the miniature headphones, which masked (or obliterated) any signs of the residual noise threshold, as well as masking any subtle differences in the quality of the sound.

With the signal fed to my amplifier and monitor speakers, the audible differences between the CD and Minidisc were just detectable — but frankly they were just not of sufficient magnitude to warrant any criticism or condemnation. Put simply, they were no more than I would otherwise expect to hear when playing the sound through a second and different set of speakers.

I charged up the NiCad battery, strapped the MDG-P1 onto my belt and went for a jog. I wanted to listen to some good music, so I put in 'Take Up The Trail' (Inak 922-2 MD) from PC Audio in Brisbane, and the Labeque Sisters 'Love of Colours' (Sony Master Works SM 47227). Then I jogged to Bondi Beach and back without the MDG-P1 missing a single beat.

Now I thought to myself "this is no good — it must be able to be disturbed by taking it off my belt and shaking it as hard as I possibly can!" Well, shake it I did, long and hard, but as hard as I shook it, I could not upset the MDG-P1 one little bit, and the music just kept on coming.

So if jogging is your scene, and modern pop, rock or classical music is your desire, then the Sanyo MDG-P1 is an almost perfect way of satisfying your need.

More importantly, Colin Doyle has assured me that they will be available before Christmas. They are also just the right size, and weight, for you to pop into that Christmas stocking — if you can afford it. For the record, the Sanyo MDG-P1 Portable MD Player measures 132 x 87 x 35.2mm, and weighs in at 265 grams. The target retail price in Australia is quoted as 'in excess of $1000'.

Further information is available from Sanyo Australia, 7 Figtree Drive, Homebush 2140; phone (02) 763 3822. ❖

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# SONY'S NEW MZ-1 PORTABLE MD RECORDER

By special arrangement with Sony, Louis Challis received the first sample to reach Australia of their long-awaited MZ-1 portable Minidisc recorder — to review for *EA* readers. In order to bring his review to you in this issue, we had to delay publication by a few days in order to meet Sony's embargo. But we trust you'll agree that the short delay was well worthwhile, in order to get this first in-depth review at the earliest possible time...

At the last Consumer Electronic Show (CES) in Las Vegas, Sony, Sharp and Aiwa displayed early production Minidisc players and recorders. The interest that those Minidiscs created was truly astounding. Sadly the conditions under which they were displayed were far from optimum, and as a result my ability to assess their subjective performance was greatly impaired by the noisy environment. What was needed were well designed listening rooms, instead of what we got: a set of 'open air' headphones. Like all the others, I had no opportunity to inter-compare their outputs against CDs or other similar high quality formats.

During my short stay in Las Vegas, I was privy to many discussions around the coffee bar in the Press room, and various luminaries of the hifi press openly voiced their concern at the need (or justification) for yet another hardware format at a time when there are already 'too many formats'!

There were numerous comments that the market was already suffering from a product oversupply, and poor market responses. One of the comments that I repeatedly heard was 'if the Minidisc proves to be a success, then some of the other formats must surely fall by the wayside!'

With those thoughts still in mind, I guess it's appropriate to briefly examine the basic design philosophy of the Sony MZ-1 Portable Minidisc Recorder, which is the first of the progeny of a whole new generation of hifi hardware. I believe that Minidisc players will set the market on its ear, and notwithstanding the comments of my friends in the USA, will — in a relatively short time — come to dominate a section of the mobile music market.

## How MD developed

Now the Minidisc is a diminutive first cousin of the CD, whose performance was originally specified by what is now known as *The CD Red Book*, which was originally

prepared by Philips and Sony (and subsequently ratified by the International Electro-technical Commission, in IEC Documents Nos.958 and 908). There have of course been two subsequent CD standards, which are endearingly known as *The Yellow Book* (in which the CD ROM Standards have been laid down) and *The Orange Book* for CD MO's. Parts of all three earlier books have formed the basis for the new Sony *Rainbow Book*, in which the Minidisc's performance standards have been recently specified in considerable detail.

There are two radically different types of Minidisc now available: one for pre-mastered non-recordable Minidiscs, which bears a strong similarity to the standard CD, and a second user-recordable Minidisc, which operates on an entirely different principle and which will incorporate serial copy management systems to preclude multiple re-recording.

The pre-recorded Minidiscs will be manufactured using techniques that are basically the same as that already developed for compact discs. These will be mass produced by means of a stamper, which produces the 'pits and troughs' which can be read by a laser and optical detection system in the Minidisc player.

The recordable Minidisc is however quite different, as its development was in part based on a far more esoteric technology, originally developed for computer-based data storage disks. These use a principle described as *magnetic field modulation.*

Each recordable Minidisc contains a relatively thin special layer of Ferri-Terbium-Cobalt, a special alloy which when heated to its Curie point, changes its magnetic characteristics. As a result the nature and direction of the local magnetic field at any point on that thin alloy layer can be instantly changed, when subjected to an appropriate externally applied magnetic field and localised heating.

In order to implement this novel recording process, a high powered laser is directed to heat a point on one side of the disc, whilst at the same time a magnetic head is placed directly opposite that spot on the other side. The magnetic head then applies the appropriate magnetic field, whose instantaneous direction conforms to the digital bit of information to be recorded. Unlike the previous generation of Magnetic Field Modulation discs, the new Ferri-Terbium-Cobalt alloy only requires a relatively low magnetic field and thus re-recording of a previously recorded disc is simply achieved by over-writing the old digital information with the new — so that the discs are re-usable, unlike the latest generation of recordable CD's.

With recordable Minidiscs, the information recorded on the disc by the combined magnetic field/laser technique is still read out by a low powered laser. The only difference is that instead of the laser detecting a pit stamped on the surface of the disc, (as it is with pre-recorded discs), the light which is reflected by the recordable MD's surface is polarised by the underlying magnetised layer.



***The recorder's rechargeable battery pack slides into a compartment at the rear of the right hand side. Also on this side are the volume control and various other control buttons — plus the earphones socket.***

This unusual phenomenon makes use of the 'Kerr Effect', as the data encoded on the magnetic layer alters the direction of the polarisation of the light reflected from its surface. It is these differences in the optical polarisation of the reflected light that are then detected by the novel optical pickup detector system, which constitutes the critical element in the Minidisc's playback head assembly. There are other equally innovative technical features in the Minidisc players. Whilst standard compact discs (CDs) have a 1.4 megabit/sec data transfer rate (i.e., two channels of 16 bits of information per sample, at a 44.1kHz sampling frequency), the Minidisc has only a 292kb/s data transfer rate.

With a diameter of only 64mm, which is only half that of a conventional CD, Sony had to economise on data transfer rates in order to be able to provide the same 74 minutes of recording or playback time already achieved by conventional CDs.

In order to achieve this, the Minidisc incorporates a digital compression system known as ATRAC — which stands for 'Adaptive Transform Acoustic Coding',




***On the left hand side of the case are the recording level control and AGC switch, plus the input and output connectors. Note that the two line input and output jacks are designed to accept either electrical or optical connectors.***

and which is very similar to the 'Precision Adaptive Sub-Code' (PASC) system developed by Philips for its new DCCs (I described this in the October 1992 issue of *EA*).

The ATRAC system facilitates effective compression of information density without significant or unacceptable changes in the audible signal quality of the reprocessed data. The nicest feature of the system is that it allows large slabs of what is in effect redundant acoustical information (which we cannot hear, as a result of masking effects) to be simply discarded, during the recording process. This relies on the fact that the missing information would not be heard during the replay process, so that you are unaware of its deletion.

One of the more critical design features of the Minidisc system is its incorporation of a shock-proof solid state memory (RAM), which stores 4M bits of replay data and acts as a 'buffer'. If a bump or movement-related shock causes the player to jump a track, then the buffer RAM continues to send its stored data to the ATRAC decoder, whilst at the same time the player's controller goes into its 'recovery action' mode. Because the RAM has the residual data, along with the addresses for that data, it is able to search back for the addresses of the last correctly-replayed block of data; so when this is found, the controller can resume storing the data back into the RAM, to ensure glitch-free, noise-free signal output.

Whilst the pre-production MZ-1s incorporated only a 1Mb buffer RAM, Sony's development engineers soon realised that the resulting 2.5 seconds of buffering was just not enough. Accordingly they increased the RAM size to 4Mb in the production models, to provide the user with a buffer which is nigh-on bulletproof.

## Measured Performance of Sony MZ-1

**1. Record to replay - Frequency response** 10Hz to 20kHz +/-0.8dB

**2. Record to replay - Linearity from clipping level**

| Nominal level | Left Output |
|---|---|
| 0dB* | 0.0 |
| -1.0 | -0.1 |
| -3.0 | -0.4 |
| -6.0 | -0.9 |
| -10.0 | -1.9 |
| -20.0 | -7.6 |
| -30.0 | -17.4 |
| -40.0 | -27.5 |
| -50.0 | -37.4 |
| -60.0 | -47.4 |
| -70.0 | -57.3 |
| -80.0 | -67.7 |

*0.dB is the onset of clipping (see attached dynamic transfer characteristics).

**3. Channel separation**

| Frequency | Right into Left dB | Left into Right dB |
|---|---|---|
| 100Hz | -76.2 | -77.3 |
| 1kHz | -69.4 | -73.8 |
| 10kHz | -51.0 | -53.1 |
| 20kHz | -45.7 | -47.3 |

**4. Distortion (@ 1kHz)**

| Level | 2nd Harmonic | 3rd Harmonic | 4th Harmonic | 5th Harmonic | THD% |
|---|---|---|---|---|---|
| 0* | -68.4 | -52.1 | -64.5 | -58.7 | 0.59 |
| -1.0 | -67.0 | -59.1 | -75.3 | -70.2 | 0.26 |
| -3.0 | -67.0 | -66.7 | -79.7 | -84.5 | 0.16 |
| -6.0 | -69.0 | -73.5 | -79.9 | - | 0.11 |
| -10 | -71.9 | -78.6 | - | - | 0.078 |
| -20 | -81.0 | -77.4 | - | -78.9 | 0.04 |
| -30 | -67.8 | -56.6 | - | -52.9 | 0.44 |
| -40 | -62.4 | -55.7 | -53.8 | - | 0.50 |
| -50 | - | - | -51.4 | -59.6 | 0.45 |
| -60 | - | -52.8 | -52.0 | -57.5 | 0.85 |
| -70 | -48.1 | - | -35.9 | - | 2.77 |
| -80 | -39.8 | - | -29.6 | - | 6.00 |
| -90 | - | - | Noise Limited | - | - |

*0dB is the onset of clipping.

**Distortion (@100Hz)**

| | | | | | |
|---|---|---|---|---|---|
| 0* | -39.2 | -46.1 | -52.2 | -60.0 | 3.37 |
| -20 | -94.1 | 95.1 | - | 103.0 | 0.0067 |
| -40 | -101.2 | -99.7 | -101.5 | -107.2 | 0.0035 |
| -60 | -53.0 | -52.8 | -54.8 | -58.2 | 0.86 |

**Distortion (@6.3kHz)**

| | | | | | |
|---|---|---|---|---|---|
| 0 | -75.3 | -83.5 | - | - | 0.052 |

**5. Signal to Noise Ratio** 81.0(Lin) 86.5dB(A)

## Three markets

There are actually three primary markets that Sony have identified for the Minidisc, and which they intend to capture. The first is the portable battery-operated market, which is a segment of the market in which the portable Minidisc players will be competing with the existing Sony Walkmans and of course all those 'look-a-likes'.

As I see it, the conventional cassette-based Walkman offers relatively poor competition, as the Minidisc player has all the aces stacked in its favour. The yuppie generation will recognise Minidisc as being a superior portable music system to place on their belt, or hang around their neck, as they go for their daily health jog and enjoy their pre-recorded music at the same time.

The second market, which appears to be larger and is just as affluent, is the mobile audio market. Combined car radio-Minidisc players, the first examples of which had already reached the US market at the end of 1992, will offer essentially CD quality in an environment which is not nearly as demanding — in terms of signal to noise ratio — as in the home.

The third market is the home hi-fidelity market, for which Sony has released its MDS-101 Minidisc Recorder. This unit duplicates all of the major features of a CD player, but unlike the CD player also allows you to *record* your Minidiscs — in much the same way as you would your tapes, but with loads of extra features (about which I'll have more to say later).

## MZ-1 impresses

The MZ-1 Portable has a top panel which immediately impresses you, with its relatively large LCD panel and two groups of logically arranged control buttons. These extend across the lower front and up the right hand side of the front panel itself, and along both sides and the front of the case as well.

The pre-recorded Minidiscs are inserted into a slot on the lower front edge of the MZ-1, and provided power is available, this turns on the unit. Beside the loading slot is the EJECT button.

On the upper front panel are three large buttons for PLAY, PAUSE, and STOP/-CHARGE — which either stops the Minidisc, or puts the battery into charge mode (provided the charger is plugged in).

Above the PLAY button are two sets of arrow buttons, one set providing search capability for rapid forward or rewind. The

second pair of buttons are for AMS (Automatic Music Sensor), which looks for the next, or previous start of a track.

At the very top of the panel are three diminutive buttons for displaying either the DATE (either the recording date, or the current time), DISC NAME (the name of the disc), or TRACK NAME (the name of the track currently being played).

Across the lower top front of the MZ-1 are 10 pushbuttons, which can either find the beginning of a track, set the clock, or set a program sequence for replaying tracks on a disc.

On the right hand side there are a series of supplementary buttons which provide less frequently used functions of RESUME (which allows you to continue playing from the point where the disc stopped playing), BASS BOOST and PLAY MODE — which if pressed once, twice or three times respectively, plays a single track, tracks in random order, or sets up a play list of up to 21 track selections. The last button on the side is the HOLD button, which locks the controls.

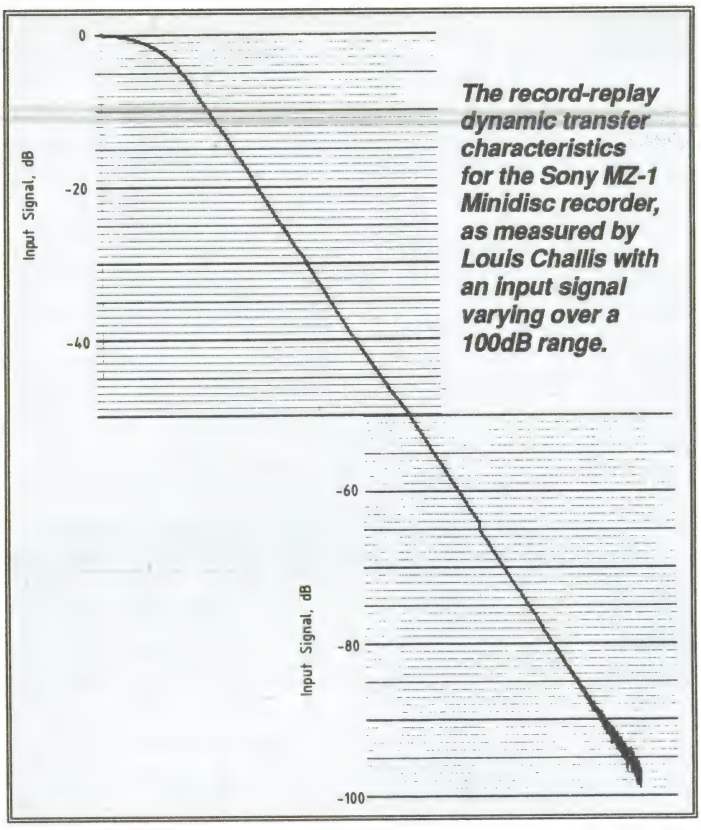
At the lower edge of the panel is the headphone volume control, with the miniature headphone socket alongside.

On the left side panel, there are additional facilities — some of which are rather novel. First are the LINE OUTPUT and LINE INPUT sockets, which are both arranged to accept not only standard electrical 'mini' 3.5mm stereo plugs, but also special digital *optical* connectors. Very ingenious!

A miniature microphone socket with integral power for electret microphones is provided, as is a small volume control to set the microphone and line input levels. Two other controls provided are a 20dB microphone attenuator switch, and an automatic gain control (AGC) switch to assist the faint hearted during recording.

On the lower front edge are controls for RECORDING and EDIT, plus others to change, erase, or add track names — also and the CLOCK SET, which requires a pin or a pen tip to activate it.

Mobile power is provided from a 9V nickel-cadmium rechargeable battery pack, which provides at least one hour and 20 minutes of recording. Recharging is achieved by means of an external universal mains power supply, which provides 10.5V DC from any mains voltage or frequency of supply (100 - 260V, 50 or 60Hz). This means that the MZ-1 can be used in any country, provided you have the right plug or an adaptor.




**The record-replay dynamic transfer characteristics for the Sony MZ-1 Minidisc recorder, as measured by Louis Challis with an input signal varying over a 100dB range.**

The unit is neatly designed with a reasonably large LCD panel on which disc or track titles are displayed, as well as recording date, record/play/pause mode, TOC (table of contents) edit mode and last but not least a signal level meter. This is marked at 0dB, -12dB and OVER, and the full significance of those figures only become apparent later, as you progress.

## Objective testing

The objective testing of the MZ-1's performance parameters presented me with some rather unusual problems, as there are currently no pre-recorded Minidiscs for testing or evaluating this equipment. As I recently discovered, Philips have produced DCC test tapes, and as far back as 1983 Philips produced special CD test discs to simplify the task of evaluating CDs.

Whilst Sony provided us with only one blank 60-minute Minidisc, TDK Australia were happy to supply two 74-minute recordable Minidiscs with which I was then able to produce the necessary software to assess the record/replay characteristics of the MZ-1.

That's of course where our first problem became apparent. Although the MZ-1's handbook does provide appropriate clues, it doesn't really fully alert the user of the sharp compression limiting characteristics that have been incorporated into the recording amplifier. This compression limiting effectively flattens out the transfer characteristics of the amplifier, above the point which is nominally marked as being -12dB on the level meter. As a result of this, when a 10dB increase in input level is applied (above that -12dB point), the resulting increase in signal level is a minuscule 2dB relative to the 10dB step in signal level. The objective testing that we carried out quickly identified this characteristic (see the data table).

There was something obviously awry in the results, so at that point I decided to set up one of my digital ramped attenuators, to plot the 'record to replay' transfer characteristics of the MZ-1.

The results which I then plotted confirmed that there is indeed a significant signal compression zone — but that the 85dB signal range below that knee in the curve has a very linear transfer characteristic. (Note that the step visible on the transfer characteristic at approximately -55dB is an aberration in the digital attenuator, and was not generated by the MZ-1).

The simultaneous evaluation of the distortion characteristics revealed similar characteristics, in terms of relatively high distortion levels within the top 10dB input range of the MZ-1, as a result of the compression. However, once the signal input level drops below the knee of the compression curve, the distortion figures are considerably better, and quite acceptable.

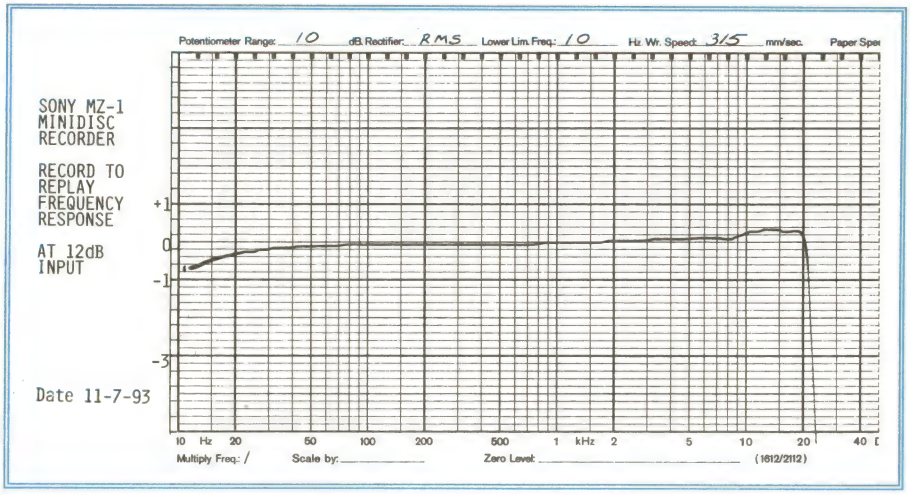
Once the signal level drops below -50dB, the harmonic distortion products increase fairly rapidly as a result of lack of bits, as much as from the ATRAC signal processing. As I subsequently discovered, I could both measure and hear those characteristics on specific items of pre-recorded and self recorded software.

When evaluating the distortion characteristics of the MZ-1, I noted with interest that the low frequency distortion characteristics at 100Hz are somewhat better than those measured at 1kHz, and once again noted how they rise rapidly once the signal input level drops below the -60dB point. The distortion characteristics at 6.3kHz are lower than they were at 1kHz, and once again this appears to be a function of the ATRAC system.

My evaluation of channel separation confirmed that it is relatively good at low frequencies, being better than 76dB be-

tween left and right channels, but this falls off with increasing frequency so that it is only -45dB at 20kHz. This modest separation, it should be noted, is still better than one could hope to achieve with a high quality phono cartridge when playing a microgroove vinyl recording.

The measured signal to noise ratio was more than adequate at 81dB unweighted, and 86.5dB(A) relative to maximum recording level. This is not as good as a standard CD, but close enough to silence complaints from all but a few of the fanatical purists. I'm sure the latter will complain that CD's are better, just as they did very vocally when CD's first hit the market, that CD's were not as good as microgroove recordings.




***There's only one frequency response plot for the Sony MZ-1 MD recorder — the recorder-replay response for an input signal level of -12dB.***

## Listening, comparisons

There weren't all that many more objective tests that I could perform with what I had available at that time, so I launched into recording some comparative software and then comparing pre-recorded Minidiscs with the matching CD's — which I was able to borrow from Sony Music.

Sony Australia had already provided me with the 'Sade's Love de Luxe' pre-recorded Minidisc, and I was able to set up my system so that I could compare it with the matching standard CD (Epic 472626-2) in an A-B, A-B sequence, as they played. This provided a very practical and convenient way to directly compare the differences in sound quality.

While the quality of the Minidisc was unquestionably good, I soon discovered that I could just detect subtle differences, which although not obvious all the time, were certainly identifiable.

The pre-recorded material in 'Love de Luxe' is not the best music to use for such an evaluation, so I then progressed to some software provided by PC Audio's 'Take Up the Trail' MD (INAK 922-2), which features far more appropriate Dixieland and Pop music. This allowed a more competent and comprehensive assessment to be performed. With the music featuring better dynamic range, and using my own test software that I created using the two TDK recordable 74-minute Minidiscs (on which I had recorded a potpourri of selected software), I was better able to assess the differences between the replay characteristics of the MZ-1, and the original software.

I soon discovered that what were initially audible nuances on 'Love de Luxe' became more detectable with the more appropriate software. But although they were detectable, they were still by no means unacceptable. Whilst performing this task I discovered that the TDK Minidiscs and their packaging were very well conceived — as, unlike Sony's blank disc, TDK had seen fit to provide write-on labels, supplemented by a clear plastic self-stick cover with which to subsequently protect it. This ensures that fingering or handling of the label doesn't result in subsequent blurring or smudging of the titles.

By the way the *price* of blank Minidiscs is obviously important, and I was advised that these will be selling for around $21.00 for the 60-minute discs and $26.00 for the 74-minute discs.

If I had hoped to find the performance identical to that of a CD, or even identical to that of the Philips DCC tape recorder, I must admit that I didn't achieve that goal. But what I did confirm was that the overall convenience of the Minidisc, as well as the rapidity of track selection, was almost on a par with the first and second generation CD players, (i.e., two seconds to find a track). Given a good set of headphones (or better still, a good hifi system), the MZ-1 quickly proves that it can give tremendous musical pleasure.

I decided to try carrying it attached to my belt, for a run along my street. I soon discovered that it's a little too bulky for jogging (unless you carry a shoulder bag); but then the MZ-1 wasn't designed for jogging. As I subsequently discovered, Sony and its licensees are producing lightweight Minidisc *players* (as opposed to recorders), with that market in view.

Regrettably Sony has stated that it does not intend to bring these miniature Minidisc players to Australia, as they feel that the market will be unwilling to accept the ultimate price.

As it happens, however, the other licensees have already stated *their* intention to import Minidisc players, and that section of the market will undoubtedly be adequately catered for by Aiwa, Sharp and Sanyo.

## In summary

Ten years ago, Sony introduced the revolutionary CDP 101, the world's first CD player. Whilst that product is clearly *passe* in 1993, the MZ-1 is equally revolutionary, and sets the ground rules for an equally exciting new development.

Whilst Minidisc software may not yet be displayed in your favourite music store, by the time you read this review the more *avant-garde* shops should be receiving their first stocks. The pre-recorded material which I have heard is 'on par' with the CD software with which I have been provided, and which I arranged to be sent to me from the USA.

Once upon a time, big was regarded as beautiful. With Minidiscs the opposite is the case, and this is an innovative technological development which is out of all proportion to its size. As I see it, Minidisc will prove to be the 'mouse that made the elephant jump', and the reverberations resulting from that jump have yet to make themselves felt in the hardware and software industry.

Were you to ask me what *I* think of Minidisc, I would venture the opinion that it has the potential to become one of the most potent forms of musical hardware to be yet developed. Although the market place will initially display some reservations, Minidisc will ultimately achieve all that Sony hoped for and will revolutionise not only the mobile audio market but the home hifi market as well.

The Sony MZ-1 Minidisc Recorder measures a compact 140 x 114 x 43mm, and weighs a mere 700 grams. The quoted Australian target price is $1500.

You should be able to find it in specialist Sony dealers, but for further information contact Sony (Australia) Domestic Products Division, 33-39 Talavera Road, North Ryde 2113; phone (02) 878 9712. ❖

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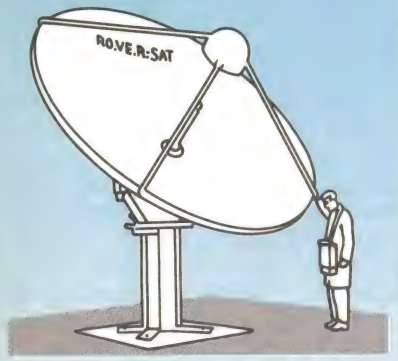
850–2050 MHz typ.
**900–2000 MHz**




In Domestic Antenna Installations



In Motorized Antenna Installations




In Professional Antenna Installations



In the laboratory for Adjustment and Testing with External monitor




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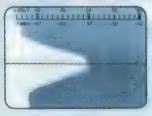
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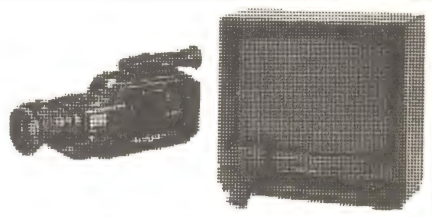
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# What's New in VIDEO and AUDIO



## Cordless sound system from Philips

Philips Consumer Electronics has launched its adaptable SBC3900 Cordless Sound System, designed for use with all TV and stereo audio systems, and to accept all types of headphones and most speakers.

The system consists of an infra-red (IR) transmitter, an IR receiver and digital quality light weight headphones. The SBC 3900 offers the concept of 'sound in silence': you can enjoy private listening of TV or audio in stereo, without disturbing others.

The SBC 3900 is very easy to operate; the mains powered IR transmitter is plugged into the audio (headphone) output of a TV radio or amplifier. The audio signal is then transmitted via IR to the lightweight, compact receiver, giving the listener exceptional freedom of movement. The receiver can accommodate up to two headphones with standard 3.5mm connectors, and/or stereo mini speakers.



The receiver has an adjustable volume control, a power on/off switch and a power level indicating LED for the environmentally friendly rechargeable batteries. There is no limit to the number of receivers which can be used with the system.

Applications for this cordless system — priced at $269 (RRP) are numerous: at home, in hotels, in hospitals — anywhere TV and stereo sound should be delivered 'in silence' and in comfort.




## Car radio/cassette includes DSP

Panasonic's CD changer control/-receiver/cassette player model CQ-R75 has digital sound processing built in, to give listeners a choice of ambience — giving the effect of listening to live music in a hall, living room or stadium.

With a recommended retail price of $899, it's claimed to be the first of its kind in this price bracket on the market. Also new to this model is the 'rock' button, which controls circuitry to enhance bass response even with regular speakers. The CQ-R75 also has a removable faceplate for security, dual illumination and a powerful 4 x 25W output. The 'progressive volume control' feature means volume increases gradually rather than returning in one big hit, after power-up or after muting has been cancelled.

For those who wish to add a multi-disc CD changer to partner the CQ-R75, Panasonic recommends model CQ-DP60 with its 32-times oversampling MASH technology.

Two other new models to join the Panasonic car audio line-up are the CQ-J01 leader radio/cassette with 2 x 7.5 watt power and the CQ-DP38 radio CD with removable faceplate.

Panasonic car audio products are available from selected car audio specialists.

## ECAP awards Monster Cable

Monster Cable has been nominated as the Car Audio Accessory of the Year by ECAP, the European Car Audio Press. This is a prestigious award and provides clear evidence of how serious Monster Cable is in promoting quality car audio.

Monster Cable can now supply not only its famous speaker wires, the Hotwires Series and interconnect leads, the Interlink Series but also the power cables and distribution components called the Power Series: innovative power distribution components covering all requirements from a simple three way power splitter through to the new Monster Cap — a one farad smoothing capacitor.

"Monster Cable is very serious about becoming the leading supplier of quality car audio installation and wiring components," states Geoff Matthews, Marketing Director, Convoy International, the Australian Distributor for Monster Cable.

## New battery packs for camcorders

Eveready Australia has broadened its Energizer range of camcorder rechargeable batteries, keeping abreast of new camera models now available. The range of rechargeable video camera batteries, now consists of 75 models, designed to fit most brands of camcorders and video lights. The Universal ENUP77 battery fits Canon, Sony, Sanyo and Panasonic video cameras, while the ENBT73 has been designed specifically with the new Sharp video cameras in mind.

## DCC portable launched in Japan

At a press conference in Japan, Philips has launched its first Digital Compact Cassette portable player, the DCC130. Further launches were planned in the United States for July, at the International Consumer Show in Berlin during August, and in Australia by October.

During the launch ceremony, further DCC portables were launched by JVC and Matsushita — co-developer of DCC — which also unveiled its DCC systems for cars. In addition, the Victor company, a subsidiary of JVC, announced the release in Japan of 110 new DCC software titles. This brings the total available in Japan, from various record companies including PolyGram, EMI, MCA and Nippon Phonogram, to 353.

There are currently 984 DCC titles available world wide. In Japan blank tapes are also being produced by six companies.

## B&W's 2000 series monitor speaker

Designed to replace the very successful V200 series, the new B&W 2000 range offers significant aesthetic and acoustic advances. The new series features a curved front baffle with a ribbed PVC moulding and specially designed self-supporting PVC integral driver grilles. The baffle ribbing sets the distinctive look of the 2000 series, with a high damping capability to deal effectively with unwanted panel vibrations.

All the bass units have cones made of specially selected acrylic damped fibre, reinforced by a supplementary layer of high damping polymer. The tweeters have also been customised with magnetic fluid cooling to reduce dynamic compression and boost the driver's failsafe properties.

B&W's expertise at fine tuning the crossover has been exploited to extract the maximum delineation between the frequency bands and produced a purer, crisper sound.

The upper bass unit in the 2004 and the single bass unit in the 2003 are directly linked to the amplifier and therefore require no crossover components at all, whilst the smaller diaphragmed bass units used in the 2002 and 2001 needs only a single small inductor to roll off the response at the crossover frequency.

Although no RRP is set for B&W speakers, retailers are expected to offer the 2000 range at prices ranging from $499 for the 2001, to $999 for the 2004. All B&W loudspeakers are covered by a full five years parts and labour warranty for domestic applications. Further information is available from Convoy International, 400 Botany Road, Alexandria 2015; phone (02) 698 7300

## Portable CDP's from Kenwood

Kenwood has introduced a range of three new portable CD players: The DPC-731, DPC-531 and DPC-331.

With their slim line features, all models offer easy to read LCD readout and offer a choice of handy accessories including AC adaptors, car cigarette lighter adaptors, 'credit card size' remote control, car cassette adaptor (DPC-731, DPC-531) and micro headphones.

Employing features normally found in high-end systems, Kenwood have used many advanced technologies including DSP (digital sound processing) (DPC-731) that can recreate the ambience of a live concert hall.

This feature is particularly beneficial when ambient background noise is high, for example in a car system. The players incorporate a one-bit dual D/A converter with eight times oversampling technology, plus Kenwood's ASCC (Active Servo Control Circuit (DPC-731) which instantly adjusts against unwanted movements such as jarring to prevent signal dropouts. Oil-damped shock absorbers further assist anti-shock and damping features.




Standard features include 22-key card remote control play (DPC-731, DPC-531), repeat (all/one shuffle), Intro Scan, LCD display and a 20-song memory.

The portable CD players are available from selected Kenwood dealers and chain stores. Prices are $299 (DPC-331), $399 (DPC-531) and $499 (DPC-731). All models are covered by a 12 months parts and labour warranty.

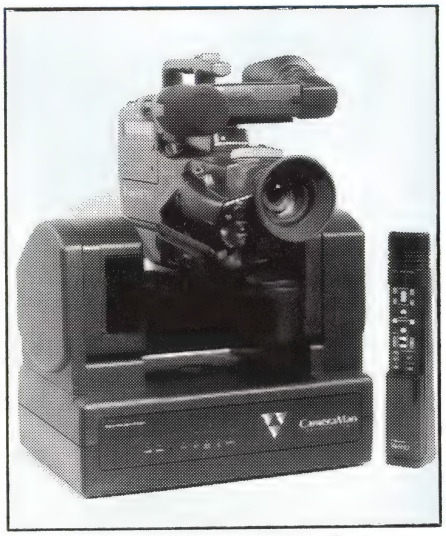
## Automated pan/tilt head

Wobbly pans, shaky tilts and jerky zooms may not disturb — if you're making home videos. However, if you are producing a company video or shooting footage to be seen by a wider audience, smooth camera operation is crucial to audience acceptance.

The answer? Eradicate the wobbles, shakes and jerks by hiring a professional cameraman — or buy a ParkerVision Cameraman. Recently introduced to Australia by the John Barry Group, Cameraman is a remotely operated camera platform that looks set to invade video making at many levels including corporate video, training videos, seminars, demonstrations — even capturing the action at a BBQ, wedding or AGM.

Smaller than a portable TV set, Cameraman accepts video cameras of almost any format — from Handycam to Betacam. In use, the camera can be controlled by anyone within 30 metres of the unit via a radio microphone which doubles as camera controller. The subject can command the camera to cover the action before its lens while picking up top quality audio.

An infra-red beam drives the unit's precision robotics, instructing the camera to pan, tile and zoom simultaneously — capturing the action anywhere in the room. Added to this is top quality sound pick up from the handheld or lapel mike — removing unwanted ambient noise and camera hum.



As if this were not enough, Cameraman can be preset to pan, tilt and zoom to any part of the room or even track a person moving behind a screen.

For further information circle 181 on the reader service coupon or contact the John Barry Group; phone (02) 439 6955. fax (02) 439 2375. ❖




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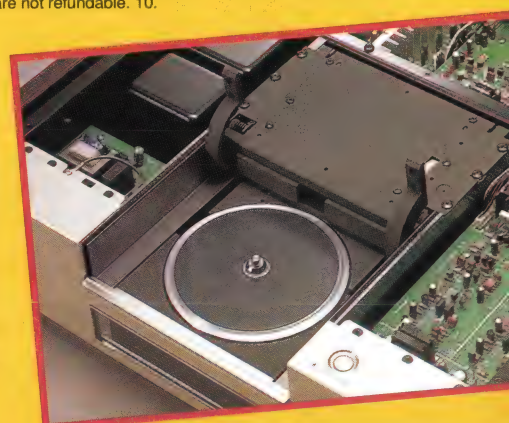
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**Hurry Offer Ends 24.9.93**



# When I Think Back...

by Neville Williams

## Australian Radio Factories - 2: A closer look at Stromberg-Carlson (A'sia)

Our story in the April,'93 issue about Stromberg-Carlson (A'sia) brought to light additional information from correspondents — some of whom are old enough to remember, but still young enough to share their recollections with other readers. As a result, we are now able to supplement our original and somewhat sparse article on this once prominent Australian equipment manufacturer.

Readers may recall that we first became involved with 'Strommies' by a chance reference in the *Sydney Morning Herald*, to Allan Freedman, grandparent of a local turf/racing dynasty which has been in the news ever since their horse 'Subzero' won the last Melbourne Cup.

Back in 1927, the *SMH* said, Grandpa Allan had come to Australia as an employee of Stromberg-Carlson, USA, 'to start wireless here'.

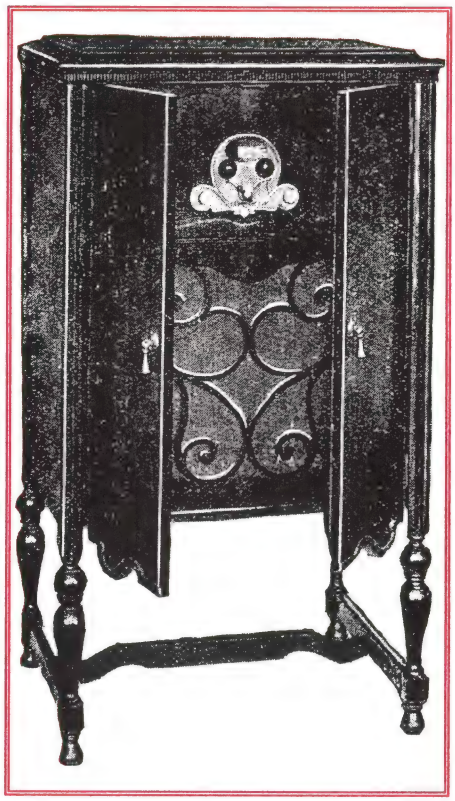
Turning back the clock, we recalled how a prominent Australian PMG engineer had resigned his position circa 1919 to form his own company — L.P.R. Bean & Co Ltd — to manufacture and distribute telephone and 'wireless' equipment. It did well and had ultimately merged with Stromberg-Carlson of the USA in 1927 to form Stromberg-Carlson (A'sia) Ltd, with the aforesaid Al Freedman occupying a key position.

Following publication of the April 1993 article, the indefatiguable vintage radio enthusiast Darryl Kasch of Maryborough, Qld, posted me copy of an early 1950's brochure entitled 'The Story of Stromberg-Carlson', prepared by the Australian Directors and detailing how it all began.

It seems that, back in the 1880's, two enterprising Swedish immigrants had met in Chicago. Noting the problems of communication in the huge, sparsely populated country, they agreed that the solution lay in the telephone — but there didn't appear to be much they could do about it.

However, when Alexander Graham Bell's patents expired in 1894, the two men decided to form a joint company to manufacture 'modern' telephones. Their names were Alfred Stromberg and Androv Carlson.

The company did so well that, in 1903, a progressive group of citizens induced them to move their business to larger premises in the rapidly expanding city of Rochester, in New York State.



***'Treasure Chest' receivers could be supplied in this polished wood console, at extra cost. The lower compartment could house the batteries and/or a dynamic loudspeaker.***

### Important company

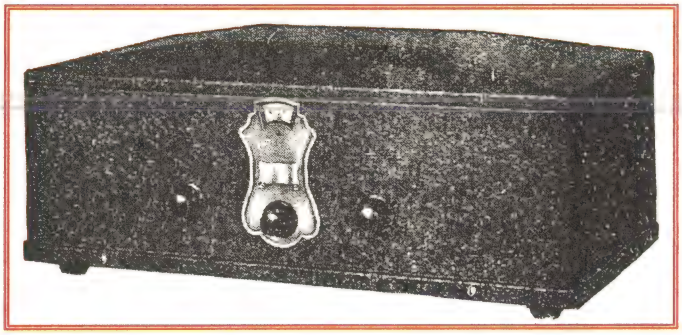
Such was the progress of the Stromberg-Carlson enterprise that, in 1909, it acquired a large slice of the business of the American Electric Company of Chicago. As a result, it became one of the leaders in the US telephone and switchboard industry, with a reputation for producing fine, reliable instruments.

S-C reportedly went on to develop the first self-contained (bell-in-base) handset in America, the first dust-proof dial, the first waterproof phone, the first X-Y switch for exchanges, and more. This was in a market which, by then, exceeded the combined total of all the telephones in Great Britain and France.

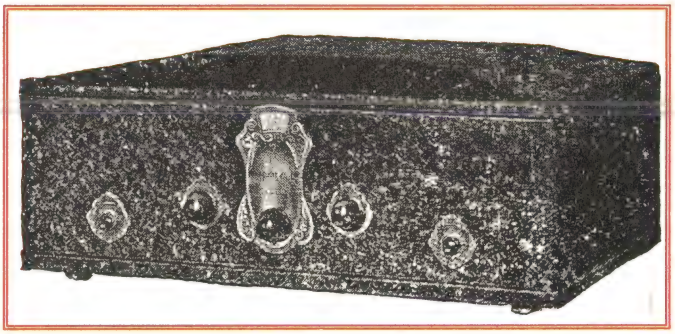
With the emergence of wireless communication came a demand for plugs, sockets and cords, plus headsets and audio transformers able to cope with music. In 1924, S-C launched a successful line of neutrodyne receivers.

According to the brochure, it was the very scale of telephone/wireless activity in the USA that influenced L.P.R. Bean to resign from the Australian PMG Department, to pursue an engineering career overseas. So he headed off to the USA in 1919, with Stromberg-Carlson of Rochester high on his calling list — along with the name of George A. Scoville.

The two had met in 1912 when Scoville, as Sales Manager of the Dean Electric Co (USA), had visited Australia to promote the sale of their telephone apparatus to the PMG Dept. The two had struck up a warm friendship and had kept in touch, with Scoville meantime quitting his job with Dean Electric to



*Left: As advertised in 'Wireless Weekly' for May 31, 1929, the Stromberg-Carlson battery-operated three valve 'Treasure Chest' — said to be the first Australian built series to use metal chassis construction.*



*Right: Also from Wireless Weekly for May 31, 1929, the 6/7-valve all electric 'Treasure Chest'. Three-valve and six-valve battery sets were also available, in the same two-tone brown and old-gold steel cabinets.*

join Stromberg-Carlson as Vice-President in charge of sales.

## New Aust. company

When Bean arrived at Strombergs in Rochester, Scoville, along with W. Roy McCanne (President) and Wesley M. Angle (Treasurer) sought to dissuade him from pursuing an American engineering career. Their advice, which he ultimately accepted, was to establish his own commercial enterprise in Australia with a view to representing Stromberg-Carlson in a market with which he was already familiar.

So, when Stromberg-Carlson (USA) joined forces with L.P.R. Bean and Co Ltd in 1927, as per our April '93 article, they were buying into a company which had been set up at their own instigation. Controlled by L.P.R. Bean and his wife Mabel, the company had won acceptance as a manufacturer and distributor of Stromberg-Carlson components, even launching into the production of items not manufactured in Rochester.

According to the brochure, Bean made his third trip to America in 1927 and was accompanied, on his return, by Wesley M Angle, in his capacity of Vice President and Treasurer of Stromberg-Carlson, Rochester. I quote: *Together, they formed the company known as Stromberg-Carlson (A'sia) Pty Ltd, into which was incorporated the business known as L.P.R. Bean & Co Ltd.* Bean was to function as Governing Director.

(*Wireless Weekly* for July 11, 1930 notes that formation of the Australian company coincided with a decision by the PMG Dept to adopt English telephone practice.)

What part, then, did Allan Harris ('Al') Freedman play in these negotiations? The short answer is none!

The timing of his arrival (1927) and appointment as Sales Manager prompted speculation, even an assumption, that he had been installed to oversee the interests the American company. The *SMH* identified him as a former employee from Rochester, but this was denied in *Radio Retailer of Australia* as far back as October 16, 1936, as noted in our April '93 article.

The *Retailer's denial is supported in letters to hand from Colin MacKinnon (VK2DYM) and from a long-time EA* reader, Mr G. Jenkins of Mortdale, NSW. Having worked at Stromberg Carlson both before and after the war, Mr Jenkins knew both Leslie Bean and Al Freedman very well.

## Bean and Freedman

Bean, he said, was born in Melbourne in May 1884, to a family which had migrated from Yorkshire, UK. He joined the PMG Dept in 1904 and rose to the position of Chief PMG Engineer of Western Australia, and later, Acting Deputy State Engineer for NSW. In collaboration with Joe Lyons (later Prime Minister Lyons) he had been instrumental in organising the Public Service Professional Union.

1919 saw him resign from the Public Service to found his own import and manufacturing business, which was later to be re-launched as Stromberg-Carlson (A'sia) Ltd. Mr Jenkins says that he was aware of the merger at the time, because two of his neighbours worked for the company and kept him posted as to who had been doing what.

Al Freedman, he said, arrived in Australia quite independently about this same time (1927). At age 25, with a science degree from Yale and management skills from Harvard, he came as a representative of the Pilot Radio and Tube Company (USA) — seeking an expanded market for their components and radios, including the legendary 'Super Wasp' series.

As it happened, Cupid intervened in the way of a shipboard romance, which saw Freedman court and marry an Australian girl — the daughter of 'Midge' McLaughlan, a prominent jockey. She provided an additional incentive to make a permanent home in Australia.

As it was, Freedman met Bean in the course of a routine visit to promote Pilot components. Bean was impressed by his qualifications and manner and, in due course, offered him a position in the new company, leading to his appointment as Sales Manager. But there was apparently more to it.

In a speech by State Government Minister Mr E.H. Spooner, reported in the above-mentioned *Radio Retailer*, Freedman is said also to have invested capital in the company, presumably by way of shares. These were subsequently redeemed by L.P.R. Bean, along with a substantial slice of the interest held by the Rochester partner.

Colin MacKinnon suggests that, with Bean holding at least 51% of the shares, Stromberg-Carlson (A'sia) Pty Ltd could better be presented as Australian owned and controlled.

### L.P.R. BEAN RESIGNS!

According to the *Wireless Weekly* Trade Supplement for December 22, 1933, the Board of Stromberg-Carlson A'sia had been sharply divided by issues such as a court case to do with past Neutrodyne patents, and an ARTS&P proposition outlawing the future manufacture and sale of receivers under anything but the maker's own brandname.

Finding himself outvoted, L.P.R. Bean had resigned his position as Managing Director — a resignation that was apparently short-lived.

Could it be that, having taken home his bat and ball, he decided to return to the game, determined buy up the whole playing field?

## First-hand experience

G.J. (G. Jenkins) says that he himself joined Stromberg-Carlson (A'sia) in late

1933, when his neighbours tipped him off that there was a job available for the asking, making sub-assemblies. Two years later, he was provided with a multimeter and given the job of checking components on the way to the assembly line, and of checking completed chassies for shorts. This opened the way to final testing and alignment, which he did until war intervened.

In the meantime, Al Freedman had made his mark as Sales Manager and Director. In consultation with furniture manufacturers Ricketts & Thorpe, he restyled cabinets destined for Strombergs in a quest for greater eye appeal.

G.J. also remembers him as a pianist of no mean skill, who later took up the organ. As such, the technical staff respected his judgment about music sound quality, good-naturedly crediting him with having 'standard' ears! (It may also help explain the Company's belated deal with Thomas organs).

On the sporting scene, our correspondent recalls that Freedman owned racehorses Dubonet, Baubon and Morna, which had varying degrees of success on the track. For good measure he also had a passion for golf and bowls.

Freedman usually went to the races on Wednesday afternoons and, on one occasion, based on that assumption, some of the sales staff took time off to enter a golf tournament at the Eastlake course. They won and were duly summoned to the dias for the President to present their trophies.

Who should be waiting for them, on the day, but President Al Freedman! Non-recognition was spontaneous and mutual, says G.J. — which was just as well, at a time when the sack was much easier to come by than another job!

As for L.P.R. Bean, Mr Jenkins says that our description of his speech problem was accurate. Far from being 'put on', however, Bean subsequently confided to our correspondent that he had suffered it from his early days. Yes, it had posed a very really problem, but he put up with it rather than avoid public occasions.

## Strombergs in the 30's

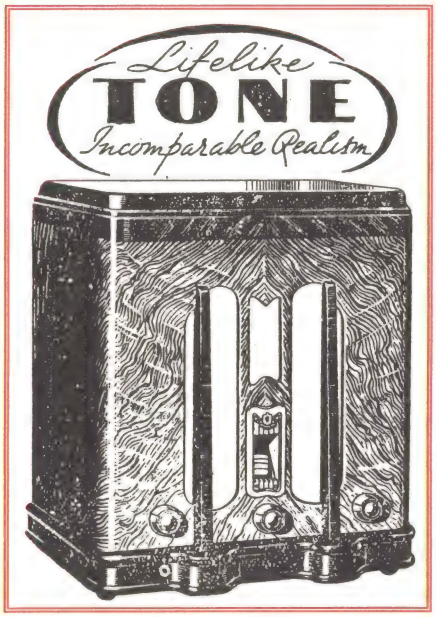
Reviewing life in the Stromberg organisation, Mr Jenkins says that 1931 was the year that put the Company on its feet with the introduction of their first superhet. Designated model NQ492, it used valves type 24, 35, 47 and 80 and had a 175kHz IF channel. Performance was streets head of the equivalent



***As advertised by Noyes Bros, Sydney, in 'Radio Monthly' for May 25, 1932, a superhet phono-radio combination model. High quality sets like this put Stromberg-Carlson (A'sia) among the industry leaders.***

TRF's, and Strommies could not keep up with the demand.

1933 saw the introduction of multi-strand 'Litz' wire which improved the




***A profusion of adjectives peppered S-C's advertisement for this set 'NZ Radio Times' for October 10, 1935. A five-valve table model superhet, it was credited with the sound quality of a full size console.***

performance of tuning coils and IF transformers, while multi-band receivers appeared in 1934. These had a switch problem, which was corrected in 1935 when the Company manufactured one similar to the American Yaxley; it carried through to 1939, when the war interrupted the manufacture of domestic receivers.

As mentioned in our April issue, Stromberg-Carlson (A'sia) opened their new factory in Bourke Road, Alexandria in 1936, but working conditions were initially no better than at Crown St. On winter mornings, the temperature was commonly around zero until 10.00am. On summer days, it could as easily reach 100°F. The installation of sisal insulation and coke burners helped matters, and created conditions where the Company could gradually replace 'boy' labour with adult females at £1.3.0 per week. They proved more dependable than their sons, and a large labour pool was available from adjacent suburbs.

Mr Jenkins says that Strombergs did well through to the late thirties, with a good share of the market — particularly in the country. They were also manufacturing receivers for Philips. (Works Director and Chief Engineer from late 1934 was Allen W. Scott, an early diplomate from the Sydney Technical College).

As production at Philips and EMI built up, production at Strombergs tapered off somewhat and a fair amount of 'staff poaching' was evident. On the other hand, demand tended to even out, moderating the one-time pattern of winter panic followed by summer shut-downs.

According to G.J., Stromberg-Carlson (A'sia) had a 'vigorous' social club in its heyday, with football, cricket and tennis matches, and social dances in the cafeteria. Long service was recognised by presentations by the Managing Director. Mr Bean's patronage, however, tended to make the activities too 'official' and the 'in-house' club was ultimately voted out of existance, to be replaced by occasional inter-company functions.

## War & post-war

Early in the war, the Company turned to the manufacture of Aldis lamps and heliographs, with a couple of specialists from Rochester being seconded to Bourke Road.

1941 saw a complete involvement in the war effort, with an emphasis on telephone and radio equipment for the Signal Corps, a ruggedised 'amenities' dual-wave receiver for the troops, and

elopment of enemy radar detec-uipment. To house the extra ac-, two more sawtooth bays were to the existing factory, plus a large tory 'igloo'.

the end of the war, Government acts lapsed and S-C management faced with the need to re-apply their nded facilities to civilian work. This ght problems with raw material ply and quality, and the need to brace new skills.

According to G.J., tuning capacitors ere produced using printing industry nc; in service, it oxidised, grew whiskers' and developed shorts. oudspeakers were put into production elying on imported cones; the supply uddenly dried up, leaving Strombergs to duplicate them in their own factory!

Totally new lines included record players made under licence to Webster, USA. Shaded-pole electric motors were added to their range, along with higher powered split phase types. Fans, radiators and pressure cookers were released, along with postwar radiograms — all in an effort to maintain viability until the arrival of television.

But the advent of TV also presented tedious problems, according to our correspondent. The parent Stromberg-Carlson (in Rochester) despatched one of their design engineers to help out, but he/they soon discovered that existing Australian receiver components were not sufficiently reliable under voltage and temperature stress, especially in the numbers required in a TV set.

## Changed priorities

Reading through the new material, I was reminded of Fred Thom's opinion quoted in our April '93 article that, somewhere along the line Stromberg-Carlson had 'simply lost its way'. From a sales-based organisation with a factory attuned to its needs, its emphasis seemed to have veered to a factory with demands that dominated corporate thinking.

G.J. says that the post-war factory was self-contained: it had a 'tool shop, lathe shop, press shop, plating, painting, cabinet polishing, coil winding, design, assembly and testing' — the lot!

Production had been re-organised around the JIT (just in time) system, the brainchild of Director W.C. Hawkins, Comptroller of Stores. Materials were ordered in bulk to ensure a favourable price structure, but with deliveries and payments dispersed at agreed intervals to match Stromberg's production schedules. Hawkins reasoned that inventory stored on site was a liability in terms of space, personnel and capital.

In the factory, dedicated test signals were distributed by coaxial cables from a central source to strategically placed test bays, so that modules could be checked and adjusted as they came off the lines. TV chassies assembled from such modules would hopefully function at switch-on!

There were separate conveyor systems: one to distribute components and modules to the assembly lines, one to step products along the lines, and a third to transport finished units to the bulk store for inspection, packaging and despatch.

With the benefit of hindsight, G.J. sees all this, plus the floating of a public company — Stromberg-Carlson Distributors — as 'grandiose expansion schemes' that locked the organisation into 'vast loans' and a dependency on vulnerable discount retailers.

### More S-C anecdotes

1. When young prospective employees applied for a job, Bean made them pay a £2 'bond' which he retained until a decision was reached. As 150 - 200 applicants could be involved and there was no haste in returning the money, L.P.R.B. didn't lose out!

2. Bean had a fixation about the blinds being lowered in the Riley Street office, to shut out the afternoon sun. If the young man responsible didn't align them to within 1/4", he would cop a tongue lashing and a 'fine' was docked from his pay. Scrooge could have learned a thing or two from L.P.R.B!

3. In 1924, Bean opposed an application by the WIA to lower the cost of an experimenter's licence: "A person intellectually fit to be a genuine experimenter would not be so impecunious". He added that the mere sending of dots and dashes did not constitute research. He himself had never learned the Morse Code and had no intention of so doing, but he did hold and use a licence OA-2LP on behalf of his company. (He was not popular with the amateur fraternity).

**(By courtesy of Colin MacKinnon. VK2DYM)**

## 'Hands-on' MD

Despite his advancing years (about 70), Bean was well and truly in charge. G.J. says that the day to day running of the Company was in the hands of a management group consisting of four working directors and department heads. It was implemented mainly in lunchtime meetings — with good food — hosted by L.P.R. Bean, who 'generally got his way'...

If one needs any confirmation of Bean's dominance of Strommies (A'sia) I can also quote a letter from Don Taylor of Wahroonga, NSW, who writes as a professional mechanical engineer and a long-time reader of *EA* with a hobby interest in electronics.

Mr Taylor first met L.P.R. Bean in 1958, when he was involved in the installation of a conveyor system at the Alexandria factory. He sensed that, at that stage, Bean was under pressure from rapidly changing technology. Solid-state devices were making their presence felt, printed circuit boards had arrived and wave soldering was being developed as a corollary of the conveyor system. I quote from Don's letter:

*I recall vividly the role that Bean played in the management of the factory. He must have been the original 'one man band'.*

*Whenever anything had to be developed, changed or decided on the production line, Bean was there in the thick of it. He spent most of his day in the factory, giving instructions to everyone from engineers to process workers. He seemed to know everyone by their first name, and was accompanied everywhere by two staff assistants, to do his bidding and carry his instructions to others in his employ.*

*To me as an outsider, the place seemed in utter chaos; but Bean himself knew exactly what he wanted and exhibited great skills of communication and leadership. Everyone in the factory regarded him as a sort of father figure.*

Consistent with this, G.J., quoted earlier, confirms that Bean's speech impediment diminished in his later years and ultimately disappeared. There is, indeed, a sharp contrast between Leslie Bean postwar, and the man who featured so prominently in the 1930's in anecdotes which process workers swapped at his expense.

Fred Whitehouse of Muswellbrook, NSW, confirms that typical anecdotes, as published, were based on fact. Says he (with commendable restraint):

*I guess it could be said that Mr Bean could be somewhat provocative at times.*

*I recall his ruling about clocking off and on again when visiting the toilet; also being searched after knocking off.*

*He also introduced piece work, with some operations rated at a fraction of a penny. Threepence each was the rate for wiring power packs — I still have a small notebook listing the numbers of*

*The Dawn of Australia's*

# RADIO
## BROADCASTING

The latest book to be published under the banner of Electronics Australia.

Written by the late Philip Geeves, OAM, FRAHS and previously unpublished, it transports the reader to the beginning of broadcasting and outlines the roles played by technical pioneers, religious sects, individual personalities and politicians.

Mr Geeves' writing reflects the vast amount of historical knowledge and experience he gathered during his years in the industry as announcer, studio manager, programming director, historian and archivist.

Many of the illustrations have been provided by AWA, a firm which played a key role in building many of the first radio stations.

Copies may be obtained by forwarding a cheque or money order to the value of $7.00 (this includes post and packaging), to:

*The Book Shop,*
*Federal Publishing Company,*
*P.O. Box 199,*
*Alexandria, NSW 2015*

## WHEN I THINK BACK

*packs that I wired each day. When work was slack, we would be stood down, being recalled by telegram when sales subsequently improved. This happened to me twice, being recalled, on the second occasion, after eleven months!*

### Freedman 'impressive'

What of Al Freedman, the Director/Sales Manager mentioned earlier? How did he react when his carefully nurtured dealer network had to co-exist with a flood of re-badged Stromberg-Carlson receivers?

A letter to hand from Doug Thwaites of Esk, Qld, indicates that Al became an exponent of post-war policy, spelling out in plain terms what I was left to deduce in the earlier article.

By way of introduction, Doug Thwaites says that, with experience gained as a TV trade teacher in the UK he was, himself, brought to Australia by Myer in 1956 to set up a TV servicing facility. He resigned in the following year to take up a position as a teacher in the RMIT, subsequently transferring to Stromberg-Carlson in 1958 as a sales engineer. In the process, he was interviewed at a sumptuous lunch in a Melbourne hotel by Al Freedman, whom he described as a very impressive person looking 'very much like Clark Gable'.

Doug was subsequently flown to Sydney and installed in a Kings Cross hotel — no expense spared — along with a representative of the firm which had been selected to handle the distribution of Stromberg-Carlson products in Western Australia.

They were wined, dined and nourished by lashings of oysters and prawns 'while being transformed into bustling executives, American style'.

From there, it was to South Australia, where Doug's job — with the help of an ex-factory engineer — was to set up a warehouse through which Stromberg-Carlson products could be distributed to SA consumers.

He also had to provide advice by phone to the WA company in relation to technical and service problems. Before TV got moving in the respective states, they did a roaring trade in stereo radiograms.

He says that he was well paid, with an entertainment allowance to cover promotional trips and dealer rallies.

At the same time, with Al Freedman's full knowledge, Doug Thwaites says that he set up a family company — under his wife's name — to market S-C products.

With the arrival of T
set up two other comp
ly and install TV a
dealers, and the other t
TV service. These ente
successful that he late
Strombergs, to devote
them.

### Formula for disaste

Good for you, Doug. But
my attention in Doug's let
philosophy which had been
cated to him during the ind
session in 1959. To quote:

*Money was no problem. St.
had set up the factory as a mass
tion line to produce their stand
chassis — real high tech for thos
with a conveyor belt system. Th
was the usual American one: ma
more than they could sell under
own name, and sell the rest under
brand names to other firms. 'St Ja
was one.*

Doug Thwaites ends his letter wit
terse observation about the ultimate f
of Stromberg-Carlson (A'sia):

*They had big ideas, but once the in
tial rush of TV had been fulfilled, th
collapsed and soon disappeared fro
the market.*

To round off the story, I turn back t
G. Jenkins. He confirms that Strom
bergs came unstuck when rival com
panies undercut their best price fo
badge-engineered receivers; this, plu
the spontaneous collapse of severa
major cut-price retailers. There wa
talk of a rescue by American Zenith
but nothing came of it and th
finance companies simply stepped in t
reclaim what they could from th
debacle.

According to G.J., Al Freedman an
his son Tony got involved in buildi
home units and government buildin
diversifying later into a stud farm
Yass, NSW. When G.J. subsequently
countered him at various race meeti
'he seemed to be enjoying his new
style'.

G.J. also kept in touch with I
Bean after the crash. He, in turn, k
touch with the stock market an
remained a councillor of the M
well into his eighties.

While conceding that the fig
somewhat rubbery, G.J. recalls t
died at age 90 'around 1970'.

One thing only remains to b
very big thank-you to t
readers who have co-opera
preparation of this story
without whose assistance i
have been written. ❖




The Navy needs more than just bright people who simply want to learn a trade.

After all, a technician in today's Navy is responsible for some of the most advanced technology in the world. From a ship's communication systems to its radar systems. From its navigation equipment to missile firing systems, the emphasis is all on high technology.

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*Alan Razali and his CRX, which has won numerous sound contests, most notably the '501 — Unlimited Watts' category in the Sound Off Contest.*

# THE SEARCH FOR THE ULTIMATE IN CAR SOUND - 2

In his second article looking at the wonders of modern car stereo systems, the author takes a look here at some of the equipment that's currently available — and what it can do. He also gives his personal reactions, after listening to a fair sampling of elaborate systems.

**by BARRIE SMITH**

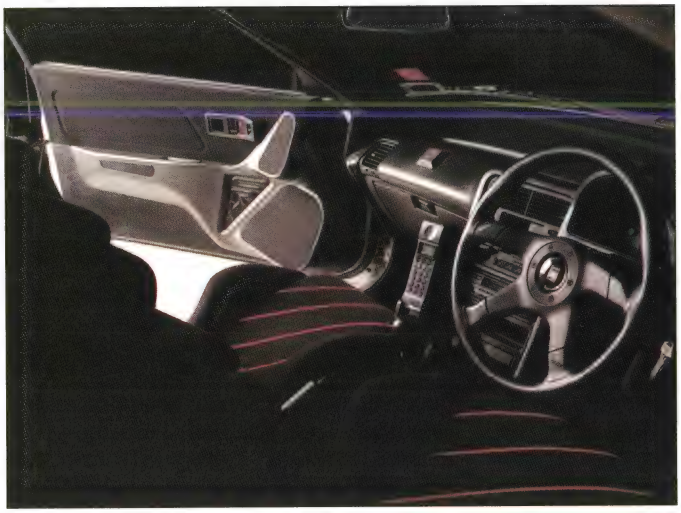
Once you delve into the product range available in mobile audio, you discover it's a very crowded field. Most of the major consumer labels are in there, plus some specialist names catering only to the car stereo market. Each has appeal. With many similarities to the video camcorder market, the hardware is visibly feature-laden.

Sanyo have a voice recognition feature in their EX-W22 system. The owner programs command words to control the operational functions of the cassette deck, tuner and CD.

An output of 27 watts per channel is standard and the system has a seven-band spectrum analyser. The company's tiny oil-damped ten-disc CD changer can be fitted up, down or angled, even under the seat (but isn't that where you always keep your CDs?).

A surround sound DSP offers six presets — user programmable — for 'hall', 'live' etc. An integral ROM chip enables the operator to mix audio input on two channels. A mixer in a Mazda?

DSP appears frequently in car stereo, either as an add-on module or built into the cassette tuner; Kenwood's KDS-P100 is half the height of a tuner so it can be squeezed into many dashboards. Its acoustic presets include Concert, Stadium, Church (hyper-Handel?) and Jazz Club. To enliven that long trek from Tokyo to Osaka, a 'Vocal Cut' facility allows a happy session of in-car





***Left: At the 'sharp end' of the Honda CRX: a radio cassette tuner, CD controller, D-A converter, cellular phone, radar detector, anti-theft alarm — and still room for two occupants. Note the neatness of the door-mounted custom speaker enclosures. Right: In this Honda CRX from WA, two 18-inch subwoofers and the spare had to share a little accommodation.***

Karaoke. The Kenwood ten-disc CD changer uses silicone-ceramic dampers and the pickup actuator is suspended with copper tension wires; D/A conversion is via four single-bit converters — two for each channel — with eight-times oversampling.

The company's power amps top out at 600W/channel, and use sophistications such as 16 power MOSFETS and 18dB/octave low-pass filters for subwoofers. One in the range of graphic equalisers has 11 bands, with a mono subwoofer range of 30 - 150Hz.

A name that pops up frequently in owner installations is Sony. The reason for this may well be found in its Unilink connection feature, linking all system components via a bi-directional 8-pin data communications bus.

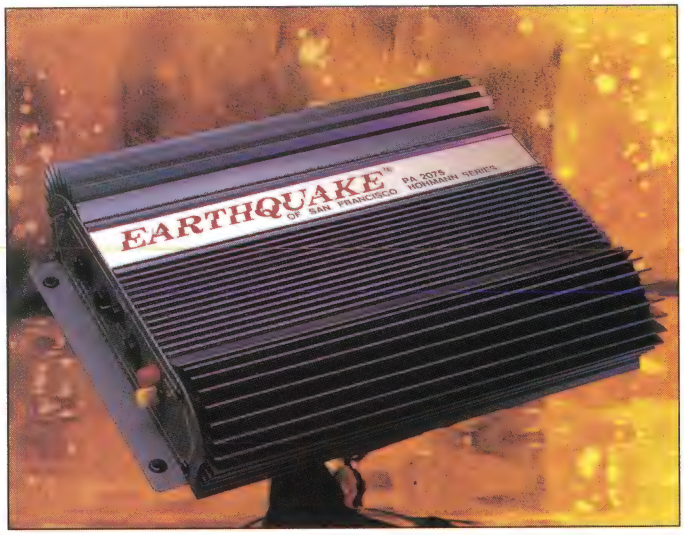
Each master unit (cassette/tuner) can control two or more slave units — e.g., two CD stackers. A disc memo feature can hold favoured tracks on 110 discs, ready for access when each disc is played. The CD players have single bit eight-times oversampling.

From Tempe, Arizona in the USA hails Rockford Fosgate — a name to strike fear in many an eardrum. Company motto: 'For Those Who Think Too Much is Just Right!' RF claims its amplifiers not only deliver more power and reliability with better sound — but 'are more radical looking than any others'. Cast aluminium heatsink-cases assist radical styling, while 'stealth' wiring and mounting are claimed to result in a 30% increase in thermal capacity and lessen the chances of theft. Amplifiers use Discrete Surface Mounting Technology.

Real time protection circuits sense unsafe output levels and apply reduction. Recent amp models have MOSFET, Pulse Width Moderated power supplies; Controlled Rail Voltage circuitry ensures tighter bass. Specs throughout the range are commonly 20Hz to 20kHz at +/-1dB — with THD of 0.1%. S/N ratio: 110dB unweighted. Bass boost reaches +18dB at 45Hz; treble lift gets to +12dB at 20kHz.

## Denon, too

Well known in more stationary circles is Denon. Some of their CD/tuner or cassette/tuner combos are equipped with their own buffer amps, but still wear a pair of preamp outputs; should you take







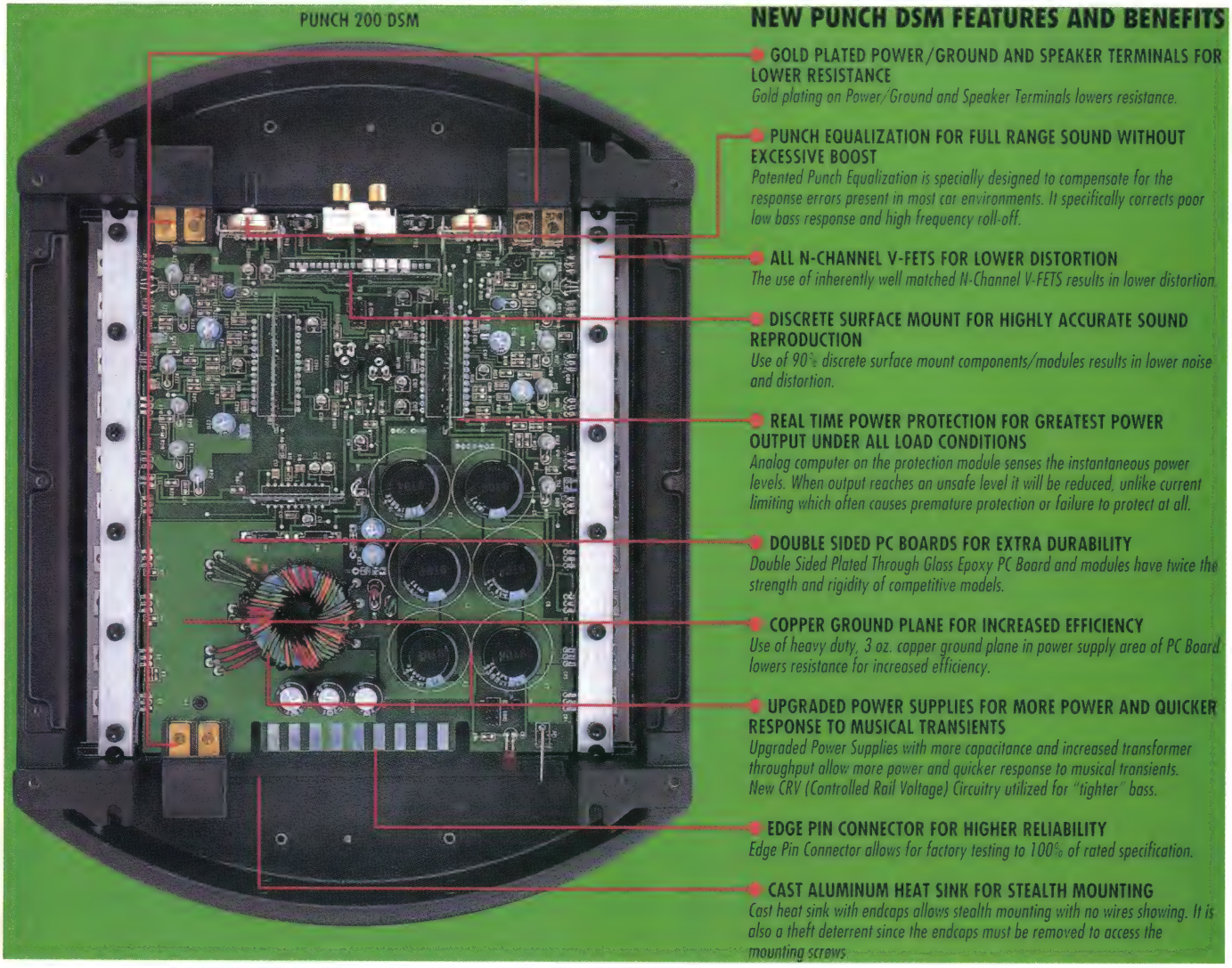
***Examples of the latest breed of high power car amps. Above is the Earthquake PA-2075, capable of delivering 75 x 2 watts into four ohm loads, while at right is the Rockford Fosgate Punch 200 DSM — capable of 200W x 2 into two-ohm loads.***

# Search for the ultimate in car sound - 1

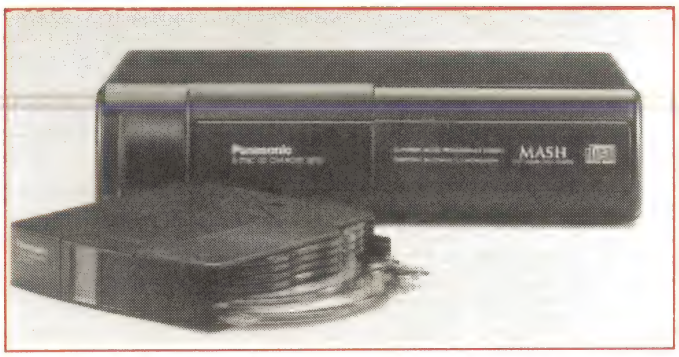




***Left: The door of a Suzuki Swift under modification. Rewiring, setting speakers off-axis and a complete replica rebuild of a car's trim are normal in installation work. This car will eventually have an Alpine head unit and CD stacker; tweeters in the air vent; 5-1/4" speakers for rear fill — plus some 10" pro woofers. Added to this lineup will be a 6" bass plus 4" mid range units. The whole system will be run from one Rockford Fosgate Punch 200 watt amplifier — the one amp will run the whole system. Right: Templates are cut to rework a car's trim and mount the speakers.***




***Reproduced from the Rockford Fosgate brochure, this view inside one of their Punch 200 DSM amplifiers gives a good idea of the kind of technology being used for mobile system power amplifiers.***







***Two samples of mobile hifi components from Panasonic; on the left is the six disc CD changer DP60, and on the right is the head unit D55E — which features a cassette deck, tuner and CD controller.***

severe exception to the colour of your tuner's dial display, an array of alternatives from purple through orange can be optioned. One of their CD changers — with a 20-bit D/A converter — can output via optical fibre or intake a digital signal.

US company Audioquest specialises in cabling. Naturally, a car audio wiring harness is an installer's delight! In their booklet on cable design, they make the intriguing claim that audio cables should be 'broken in' over two weeks, and that 'all cables are directional, from hardware store electrical cable to the finest pure silver cables'. Added is the advice to check with your dealer as regards the correct orientation.

"Now, let's see. This wire was extruded on the sunny side of the foundry in late '88. Mmmm — perhaps I should back up the Chevy to orient it."

As you move around car stereo circles, one of the names which pops up frequently — and obtrusively — is Earthquake of San Francisco. Their power amps use pulse-width modulated MOSFET power supplies and sport distinctive, echidna-like heavy fins ribbing the outer surfaces — so pretty, one owner gold anodised a pair! Frequency rated at 10Hz - 32kHz within 0.1dB, the S/N figures top out at 110dB. In speakers, Earthquake offer the full range — tweeters to subwoofers. An 18-inch subwoofer in their range demands 7500 cubic inches in a vented enclosure, with a maximum power capacity of 360 watts RMS.

## Starting place

If you're looking for somewhere to start, you could do worse than hook up a Panasonic combo of CQ-D55 cassette tuner, with 24 station presets, and a CX-DP15EN 12 disc CD stacker with MASH single-bit DAC for around $1000. The company's PR section claims you can do a Sydney-Brisbane journey and, with 12 CD's, never have to hear the same track twice. Overall, it would appear the whole blazing business of abrading your ears while burning your Pirellis can be indulged — for early days at least — with mainstream commercial components.

To show the whole game is far from static, both Panasonic and Philips have announced DCC car decks, which should present some fascinating problems for the specialists entrusted with the chore of jamming more and more gear into ever-diminishing automobile interiors. And don't forget Sony, who have automotive plans for their new MiniDisc format.

Alpine and Eurovox are most assuredly 'mainstream' — with their equipment standard equipment in such diversely priced autos as Nissan's Pulsar right up to the 300E Mercedes. The pair should really have the game by the ears, producing as they do high-end cassette/tuners, CD players, power amps and graphic equalisers.

## Personal response

So how did the upper-dollar car systems sound, when I checked them out?

To be honest, I found a few suffered from severe distortion, especially at the high end (Hertz, not dB!); but this obviously is a no-no with the connoisseur. Extreme volume I did not find disturbing, nor did it contribute to messy imaging. However I *was* aware that the multiplicity of speakers did not help one whit.

Audio 'colour' was cramped, as one would expect in a car interior little larger in cubic volume — though 'deader' — than the average toilet. A bit like looking at a rainbow through a telescope...

Me? I think I'll stick with the Ferris for a while yet. Pass me that Tex Morton cassette! ❖

## 18-INCH SUBWOOFERS

How do you stuff $15,000 worth of audio gear into a Honda CRX and make it look factory fitted? The answer is, with the owner's eager encouragement and considerable modifications to the car's interior, in both cabin and engine compartment.

Alan Razali, from Bunbury WA, had already customised the sound system of a Mitsubishi Lancer with the help of liberal lashings of Alpine and Rockford Fosgate hardware. The keys of the new CRX he handed over to the Perth installer Wally Mulik, with a casual "Let's go all the way".

'All the way' meant Mulik had to fit a Rockford Fosgate chrome shrouded Power 1000 amp, plus a pair of 18-inch subwoofers into the small hatchback. To enable access to the spare — and still fit the large speakers — the full-sized tyre was replaced with a slimline version from a Mazda MX5.

Immediately behind the front seats went the Power 1000, plus a Power 300, Punch Crossover, audio controller, a power distribution block and an Alpine six-disc CD changer. Further to the rear, midrange and tweeters in enclosures were concealed in removable panels in the parcel tray.

Front 'staging' was taken care of by three-way-split speakers, placed on-axis in specially crafted door panels. On-axis mounting permits the mid and high frequencies to fire at the ears rather than the knees, permitting a cleaner, more impressive sound stage. To this a centre channel was added, driven by a 30 watt amp.

The 'head' units — a radio/cassette tuner and D/A converter — were all Alpine, mounted in the dash and under the passenger seat respectively. The front end of the motor was removed to run a 10mm power cable and to mount a radar detector, and the doors removed to run a new wiring loom.

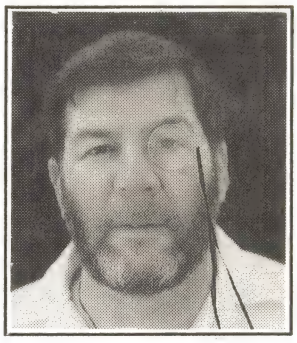
A second battery was mounted in the rear. As a finishing touch, blue fluorescent tubes were fitted beneath the car to give it a 'showroom look'.

The time for installation was 10 weeks. The equipment itself cost $15,000, labour and materials a further $8000.

Final comments by the owner: "The system is UNREAL! I'll definitely be back for more."

# Moffat's Madhouse...

by TOM MOFFAT



## Expanding the Cretiniser

The Boob Toob, the Idiot Box, the Cretiniser — alternative words for that magic box of colour and movement that has pride of place in just about every loungeroom in the land. The late Fred Hollows gave us the 'Cretiniser' term while he himself was appearing on it, the night before he died. Television — Fred's joke, our addiction. And now a new Cretiniser lurks — one with a money slot in it.

And what a bun-fight! Almost every day we see the government dodging and weaving in the wake of what was supposed to be a nice simple issue called Pay-TV. First, general outrage over the sudden blockage of the microwave distribution system promoted by former ABC journo Steve Cosser. Allegations flew over the belief that the Cosser scheme had been canned in favour of the government's 'media mates'. But when the tenders for the rival direct satellite Pay-TV scheme were announced, the big media players were foiled by a couple of allegedly penniless upstarts — who bid half a billion dollars for the two satellite licenses.

Bureaucratic heads rolled; the opposition was after the Minister's blood, and everybody involved said "No, it wasn't me! It was his/her fault". As this is being written (for the third time now) it's not known whether we are to have a ground-based microwave distribution system for Pay-TV, or transmissions for satellites direct into viewers' homes. My own guess is that we will end up with a combination of both, with satellites delivering signals into towns, and then microwave (or maybe even good ol' co-ax) distributing pictures to homes. But in the midst of all this, does anyone really care?

It's interesting to note that nobody seems to have asked potential viewers if they want Pay-TV in the first place. They never asked me — have they asked you? We don't even know for sure what is meant by Pay-TV, in the Australian context. Are they talking about a multi-channel service hired by the month, known elsewhere as 'cable', or a service which rides on cable where you pay to view individual movies or sporting events? Will people pay for this? Will you?

Late last year I made a trip to the USA where Pay-TV abounds. Actually, what they've got is Cable-TV in one of its various forms, be it via coaxial cable strung along telephone poles or Cosser-style microwave links. I spent three weeks in Albuquerque, New Mexico, visiting family and researching some articles. This was in the middle of the northern winter, and I spent a fair bit of the time snowed in. On several nights my elderly father hit the sack around 8:00pm, leaving me to entertain myself in front of his cable-TV.

Cable-TV in the American sense is a selection of around 40 TV channels which is piped into the home and paid for on a monthly basis. In Albuquerque a real coaxial cable is strung from light pole to light pole, with branch cables going off into homes. A microwave system similar to Cosser's proposal is in use in many cities, but the result is the same — the thing eventually plugs into the back of a TV set, and the viewer has a selection of 40 channels or so.

For Pay-TV, as opposed to Cable-TV, the viewer must have an extra electronic box that sits on top of the telly. Three or four of the 40 channels may be running programs 'scrambled', so they can't be viewed unless the box is energised. The box needs money to make it go — sometimes transferred down the viewer's telephone line. I believe there is even one de-scrambler box with a slot you can shove your Visa card into. You then get to watch a chosen movie or sporting event, for a fee of a few dollars.

The remainder of the 40 channels are yours for the asking, provided you have paid your monthly rental for your cable connection. In Albuquerque there are four commercial free-to-air (normal) TV stations and one PBS (Public Broadcasting). PBS is very much like our SBS. These make up five of the stations available on the cable. This is handy in bad reception areas, or in some of the places which now ban outside TV antennas.

The rest of the cable is filled with specialist stations, some excellent and some *horrible*. Contrary to popular belief, almost all cable stations carry commercials, even the world-famous Cable News Network (CNN). One would think if you paid good money for the cable system, you wouldn't have to pay again by viewing never-ending commercials. But that's the way the system works.

I found a couple of gems on the cable. One channel is an 'open university' type thing that sounds a bit dull on the surface, but its lectures are very well produced with lots of clever vision and graphics. I sat through an entire lecture on the physics of temperature and heat, enraptured. Did you know that the Fahrenheit temperature scale was designed for weather, since its 0-100 scale represents the extremes of human feeling? I didn't — but I do now.

Another top-quality service is known as the Discovery Channel. This one serves up a constant diet of first-class documentary films, sometimes of a fairly controversial nature. Many of these films are also shown in Australia on ABC and SBS.

Some cable channels specialise in constant movies. That's it — movies and nothing else. But if you pick and choose through the program guides, some truly great films will come your way. On one memorable night a movies-only channel had an absolute orgy on old horror films. Four in a row; among them *The Day of the Triffids* and *The Thing*, both original versions. I sat glued to both of them, despite the fact that some fool had seen fit to muck up two classic black-and-white films by artificially colouring them for the TV audience.

Some films and other programs are preceded by a coded number sent out along the cable. If you have a video recorder with the right little accessory, you can program it to begin recording when the correct code number comes along the cable, even if it is earlier or later than the scheduled time. The TV guide in the paper carries the code numbers; maybe *The Thing* has '1234' listed after it. You simply tell your video to record the program that has '1234' encoded at the start.

Another useful cable channel carries a never-ending weather service — very handy when you're snowed in and wondering when it's all going to end. And finally there is a channel that operates with a split screen — the bottom half has a schedule for the programs on the other 39 channels, and the top half carries continuous commercials for pornographic books: 'Call 1-800-555-1212 now to order your copy of *WHAT THE BUTLER SAW* (shipped in a plain brown wrapper)'.

I wasn't told of these things; I discovered them. My father, and his wife, never even knew they were there, although they'd been subscribing to the cable for several years. Their television diet consisted of things like *Murder She Wrote*, and *Wheel of Fortune*, and whatever football or golf happened to be going. And all of this stuff came from the local, free to air channels. They didn't even need the cable. The cable, it seems, came with the house, and they hadn't bothered to cancel the subscription.

It seems that just about every home in the USA is hooked to cable TV, nowadays. It's like the fridge and washing machine; every home must have one. But I got the impression that many cable programs were a lot like quality books people keep on their shelves. They look good, and they give one an aura of educated intelligence. But many such books are never read. It's just as important to be able to *say* "I've got cable TV", even if you never watch it.

Will Pay-TV be a big hit in Australia? Well, ...maybe. But I wouldn't want to be the one sinking a lot of money into it. As I said, even though it's freely available in America, not a lot of people appear to make full use of it. Its impact could be a lot less than first expected, like Stereo-AM radio that was overwhelmed by hordes of FM stations almost as soon as it started.

Something much more interesting will be coming our way around the turn of the century, and that's only seven or eight years away. There is a plan to run a fibre-optic cable service into homes. This technology, developed in Australia, will allow thousands of simultaneous TV channels, or computer data services, or just about anything to be reticulated to every home in the country. And the fibre-optic system will allow two-way communication. What's that good for, you say?

You might have seen the *Sixty Minutes* version of the Hewson-Keating debates before the last election. *Sixty Minutes* had a 'randomly selected' studio audience of uncommitted voters. Each was given a little black box with a knob on it.

As they listened to the politicians speak, members of the studio audience were asked to turn the knob to the right if they approved of what was said, and to the left if they disapproved. The boxes were all wired back to a central computer, which generated an average of all knob settings and displayed them on the screen as a running graph (the so-called 'wriggling worm').

This was instant audience feedback; instant voter feedback. When GST was mentioned the graph took an immediate jolt away from the Liberals, and when unemployment was mentioned it swung away from Labour. Immediate, running results.

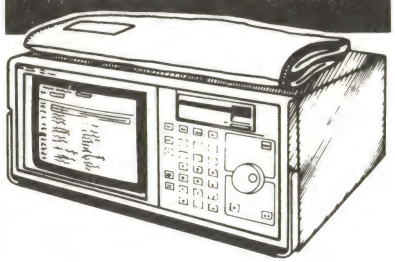
When the fibre-optic Cable-TV system comes into being, it will almost certainly include some kind of home viewer response system. If we think the politician we're watching is lying, we can swing the knob to the left. If we approve of what he says, we can swing the knob to the right. So the 'instant' opinion sample grows from a couple of hundred in the studio to millions at home. And, since viewer responses are sent back up the cable, national results can be tallied immediately and shown on the screen. In fact it's even been suggested that full-blown elections, rather than opinion polls, could be held via two-way television in the future.

Of course this system could be used to instantly rate television programs, as well as waffling politicians. Do you like this program? Turn the knob to the right. If enough viewers turn the knob to the right then the program is moved into a better time slot, and more episodes are made. More commercials will be sold into it, too. Of course, if the commercials increase too much, the knobs start swinging the other way. Eventually an equilibrium will be reached, between how good the program is and how many commercials the viewers will tolerate.

Such a system exists now, of course, in the form of the new electronic rating gadgets — 'people meters'. But these can only tell what station the telly is switched to, not the degree to which a program infuriates the viewer. I've even heard it suggested that every home will have a computer terminal instead of a simple box with a knob. So viewers can type in WHY they like or dislike a program, as well as how strong their feelings are.

Can't you imagine the power it would give the viewer: Admire Jana Wendt's eyes (yes! yes! yes!)? Hit the keys and send her a few brownie points. Don't like that news reader's tie? ZAP! Dob him in to his superiors. In fact television program managers could become a thing of the past. YOU would become the program manager! ❖


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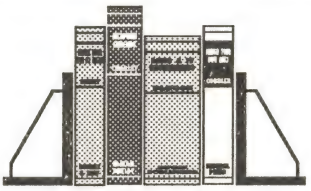
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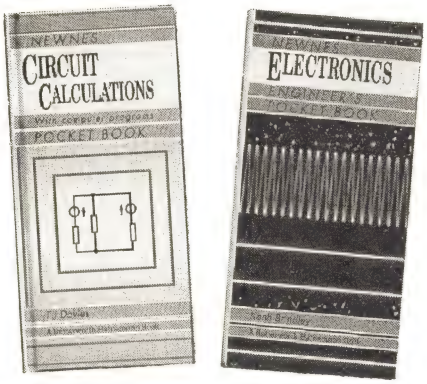
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# NEW BOOKS






## Quick references

**CIRCUIT CALCULATIONS POCKET BOOK, by T.J. Davies, and ELECTRONICS ENGINEER'S POCKET BOOK, by Keith Brindley. Both published by Newnes, 1992 and 1993. Hard covers, 195 x 95mm; 374 and 305 pages. ISBN 0-7506-0195-7 and 0-7506-0937-1. Recommended retail prices $29.95 and $34.95.**

These two handy reference books are aimed at very different audiences. *Circuit Calculations* has been written for students studying electronics and electrical engineering courses, giving most of the relevant mathematical equations. It contains over 400 worked examples, 370 problems with answers and 300 GW-BASIC computer programs to solve many of these equations.

The 20 chapters of *Circuit Calculations* cover all the standard areas for both DC and AC, and their applications in capacitors, inductors and transformers, etc. Transistor amplifiers, op-amps, oscillators and filters are also covered. The maths varies from simple alteration of units, through the network theorems to three-phase star and delta connected loads. The book forms a very useful adjunct to a student's basic text.

On the other hand, the *Engineer's Pocket Book* is a look-up reference for the practising engineer, based on the most commonly referred to items from the author's own experience — rather than a complete summary of electronics theory. This accounts for its three-part structure: components and data; miscellaneous data (like symbols, a decibel table, audio connectors, etc.); and circuits and systems. The contents page lists around 230 entries, and there is also a comprehensive index to help you find any item you may need.

The review copies came from Butterworth-Heinemann, PO Box 345, North Ryde 2113. They should be available from technical bookshops. (P.M.)

## PLL design

**PHASE-LOCKED LOOPS, Second Edition by Roland E. Best. Published by McGraw-Hill, 1993. Hard cover, 243 x 197mm, 374 pages, plus a 5.25" floppy disk with PLL design software. ISBN 0-07-911386-9. RRP is $105.00.**

The first edition of this book was published in 1984, and became one of best-regarded references on the design of the two types of PLL then in primary use: the 'classical' digital/linear PLL and the true linear PLL. Dr Best is a world authority on the subject of PLLs and microprocessor applications; he worked for IBM in Switzerland for several years before joining the senior staff at Sandoz.

In this second edition he has expanded the coverage to deal with two additional and newer types of PLL: the all-digital type or 'ADPLL', and the software PLL or 'SPLL'. All four are now covered to the same depth. In addition, as computers are now in much wider use as an engineering design tool, the new edition comes with a program on floppy disk, which simulates the behaviour of all relevant types of hardware PLL.

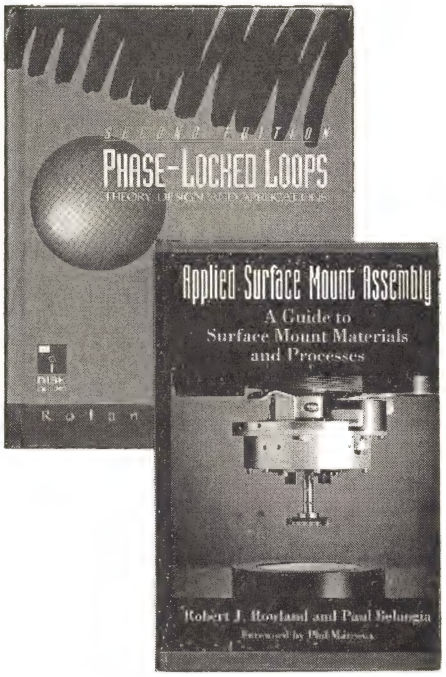
As with the first edition, the new book is thorough, readable and authoritative. This, plus its new and updated coverage, makes it an exceptionally valuable reference, for those who need to design PLLs as opposed to merely 'lashing them up'.

The review copy came from McGraw-Hill Australia, at 4 Barcoo Road, East Roseville 2069; copies should be available through technical bookstores. (J.R.)

## Implementing SMT

**APPLIED SURFACE MOUNT ASSEMBLY, by Robert J. Rowland and Paul Belangia. Published by Van Nostrand Reinhold, 1993. Hard cover, 235 x 155mm, 240 pages. ISBN 0-442-00727-2. RRP is $99.95.**

The authors of this book have spent many years implementing and improving surface mount technology for their companies. The aim of their book is to provide a thorough explanation of components, printed circuit boards and the various assembly processes — to give insight and solutions to both beginners and the more experienced.




Each of the 12 chapters in the book begins with a glossary of technical terms used in that chapter. This is a very useful feature, especially as there is an extensive use in electronics of mnemonics such as SMT, PCBs, etc. The treatment is very thorough, covering all aspects of the process: the components used, the packages available, and where and how they are placed on the PCB. Adhesive and solder paste application methods are also covered, along with soldering materials and methods, cleaning and reworking.

All chapters are well illustrated with diagrams, photos and tables, explaining all the details of the highly automated surface mount manufacturing process. While the book could give a newcomer an overall understanding of SMT, it is really a more specialised text for those heavily involved in the area.

The review copy came from Thomas Nelson, 102 Dodds Street, South Melbourne 3205. It should be available from technical bookshops. (P.M.) ❖




# TECHNICAL AND HOBBYIST BOOKS from TAB McGraw-Hill

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Homer Davidson ran his own repair business for 38 years. Packed with examples, photos and diagrams for every kind of TV circuit, this book helps you find and fix virtually any malfunction quickly and easily. Covers HDTV, stereo sound circuitry, modular chassis and large screen models. *605 pages.*

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## *Interesting circuit design:*

# THE 'QUADLINGTON' MINI AUDIO AMPLIFIER

How often have you needed a low power, low cost audio amplifier to provide monitoring facilities in a project? Often a full-blown amplifier design isn't justified, yet small commercial amplifier modules can be either too bulky, too expensive or poor in performance. The author has come up with a novel circuit design which should fill the bill...

**by ANDREW PIERSON**

Here's a small audio amplifier circuit which uses only a few dollars' worth of components, has high sensitivity and requires no conventional bias arrangements because it is inherently free from significant crossover distortion. Also described is an optional high-impedance input stage, to suit it.

As you can see from the schematic (Fig.1), the output stage of this amplifier consists of two pairs of emitter followers, Q3-Q5 and Q4-Q6. These could be considered as Darlington pairs, were it not for the fact that the polarity of the transistor in the first stage is the opposite of the transistor in the second stage.

Taking the top pair as an example, the base-emitter potential of Q3 provides a voltage *step-up* of 650mV or so, whilst the base-emitter potential of Q5 provides a *step-down* of the same amount. Therefore, the potential at the emitter of Q5 is nominally the same as the potential at the base of Q3.

Since both devices are silicon transistors and are in thermal contact, any thermal drift in the base-emitter voltage of one transistor (about 2mV/°C) will cancel the thermal drift in the other.

The bottom pair works in the same manner, allowing the input bases of each pair to be connected together and the output emitters to be connected also. The result is a class-B output stage essentially free from crossover distortion. Because the output stage uses four transistors made up of two Darlingtons (albeit with their driver stages reversed), I call this configuration the 'Quadlington' output stage.

In a conventional Darlington arrangement, both transistors source current; in the Quadlington, the emitter load resistor of the first transistor sources current for the base of the second transistor, and this current is then shunt-controlled by the first transistor. The driver transistor Q2 operates in the common-emitter mode, with the drive voltage being developed across R5. The high frequency response of the amplifier (-3dB) is limited by C4 to 20kHz. The emitter follower Q1 provides a high input impedance, whilst driving the low input impedance of Q2. C1 is the audio input coupling capacitor, and the input impedance is approximately 45k ohms with no AC feedback applied.

DC feedback applied from the output via R8, R2 and R1 to the base of Q1 stabilises the amplifier's DC operating point, and maintains a potential of about 3.0V at the junction of the emitters of Q5 and Q6. The circuit will therefore work best if the supply voltage is not allowed to fall too much, and this is why alkaline cells are recommended. C2 fully decouples the feedback at audio frequencies. C3 decouples the supply rail, and R3, R6 and R7 are included as protection from possible parasitic oscillations.

Because this circuit is intended as a small battery powered monitoring amplifier its maximum power output is modest (50mW RMS into either eight or 16 ohm loads), but this can still create a fair amount of noise. Sixteen ohms is the preferred load, as the amplifier runs more efficiently. The quiescent current of the whole circuit is about 9mA.

The lower -3dB frequency is 85Hz with a 16 ohm load and 120Hz with an eight ohm load. These figures are more than

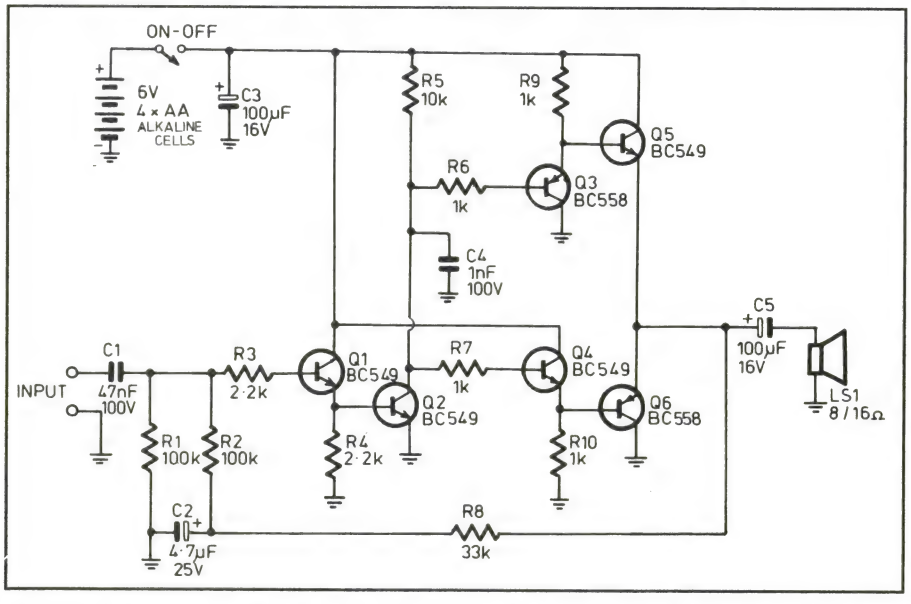



***Fig.1: The complete circuit for the author's Quadlington amplifier, in its basic form. Despite its simplicity and low cost, it can deliver 50mW into eight or 16-ohm loads, with surprisingly low distortion.***

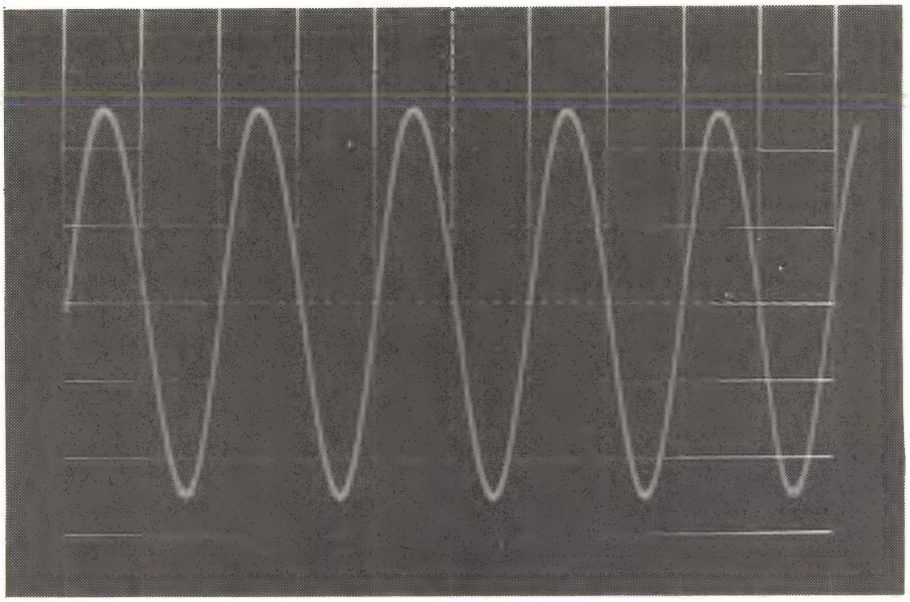


***Fig.2: The output waveform of the Quadlington amp when delivering 1Vp-p into an eight ohm load at 1kHz. As you can see there is no visible distortion.***

adequate for small speakers, but if necessary the low frequency response can be extended by increasing the value of C5. Typical input sensitivity is approximately 10mV RMS for maximum power output with an 8 ohm load.

The linearity of the amplifier can be improved by removing C2, which will introduce AC negative voltage feedback. The feedback voltage is converted into a current by R2 and R8, which lowers the input impedance to about 1.7k ohms. Note that the amplifier's gain will be reduced if this loads the source impedance of the input signal. If feedback is used, C1 should be changed to a 2.2uF electrolytic (appropriately polarised) to maintain an adequate low frequency response. If you need a high input impedance, an optional high-impedance input stage is also described shortly.

For the lack of suitable equipment, no detailed analysis of distortion was carried out. However, the results as displayed on a CRO (see waveform photograph, Fig.2) showed that the amplifier was certainly good enough to do justice to the small speakers with which it would be used.

Ideally, Q3 and Q5 should be in thermal contact (mounted back-to-back with heat transfer compound between them), as should Q4 and Q6. However, in the two prototypes which I built for evaluating this circuit I didn't worry about this, and no problems were encountered. Probably, the output power level was too low to produce significant temperature differences.

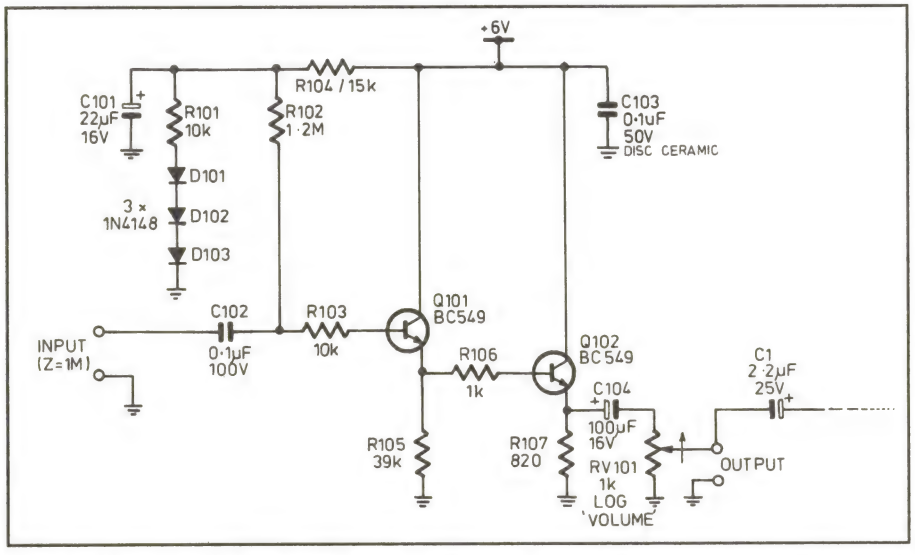



***Fig.3: The circuit for an optional high input impedance stage which can be connected ahead of the basic Quadlington amplifier, to give it an input impedance of 1M. Also shown is how to connect a volume control between the two.***

## Hi-Z input stage

This optional addition (Fig.3) provides an input impedance of about 1M ohm, and also incorporates a volume control. The two cascaded emitter followers Q101 and Q102 are connected in a Darlington configuration to produce the large amount of current gain necessary for the required impedance transformation. The voltage gain is very close to unity.

The voltage divider R104-R101 together with D101, D102 and D103 produce operating bias for the Darlington pair. The diodes provide temperature compensation for Q101 and Q102, and also establish a minimum bias potential (about 1.5V) before the voltage divider begins to work.

This improves the circuit's signal handling capability at low supply voltages. The bypass capacitor C101 prevents both ripple and fast voltage variations which might be present on the rail from being coupled to the input. The bias feed resistor R102, together with R103 and the input impedance of Q101 determine the overall input impedance, which is about 1M ohm. C102 is the audio input coupling capacitor.

R105, together with R106 and the input impedance of Q102 form the emitter load for Q101. The no-signal DC voltage at the emitter of Q102 is about 1.6V with a 5.6V supply and the output load resistor is R107, to which the volume control RV101 is AC coupled via C104. The circuit shows the correct polarisation for C1, which is part of the 'Quadlington' amplifier. R103, R106 and the rail HF bypass capacitor C103 are included as protection from possible parasitic oscillations.

The values of the coupling capacitors have been chosen to produce a very good low frequency response, so this circuit is also suitable as a general purpose audio impedance converter and level control. The suggested supply voltage range is 5-24V. With the circuit values shown and a nominal 5.6V supply, the maximum signal handling capability for a symmetrical input signal and a 1.8k ohm output load is 1.2Vp-p. If the circuit is used for other applications, the maximum allowable input signal amplitude will increase as the supply voltage is raised, and can be increased further if the circuit requirements allow the use of a higher value volume control potentiometer.

In both circuits all resistors are 1/4W 5% tolerance; the capacitors marked '100V' are polyester 'Greencaps' and the remaining component information is on the circuit diagrams. ❖

## *New Dick Smith Electronics/EA Competition:*

# We have 10 of these Sangean World Band Receivers to be won by lucky EA readers!




Dick Smith Electronics has provided *Electronics Australia* with ten of the new Sangean ATS 606 compact PLL synthesised World Band Receivers, to be offered as a prize to our readers. So here's your chance to acquire one of these state of the art receivers — each worth $249 — simply by putting your knowledge of electronics to work!

As with previous competitions, both DSE and ourselves wanted to make this a competition where our younger readers would have just as much opportunity to win the prizes as those with more experience or knowledge of electronics. But we didn't want it to be a mere lottery or 'game of chance', either... The trick was to come up with a contest which doesn't require a lot of technical knowledge, but will still involve a real challenge to your skills. Here's what we came up with, after a certain amount of head scratching. All you have to do is list as many of the surnames as you can, of scientists, engineers and inventors who have been responsible for the development of modern radio communications technology, using ONLY the letters present in these words:

## SANGEAN SYNTHESIZED WORLD RADIO COMPETITION

That's right, as long as you can make up the surname of a radio scientist or inventor from the letters in the above words, they can be added to your list. (You'll perhaps note that we've deliberately spelt 'synthesised' with a 'z', to give you this letter — it might come in handy!)

The 10 neatest entries with the largest number of names for legitimate radio inventors and scientists, made up from only these letters, will win the readers concerned a Sangean ATS 606 World Band Radio. What could be easier?

If you can't come up with enough names from the top of your head, we're sure you'll find as many as you need from past copies of *Electronics Australia*, and if necessary from an encyclopaedia. There have been an enormous number of people, over the last couple of hundred years, who have contributed to modern radio technology.

Here's a suggestion, though: if you come up with some really obscure names, it may pay you to include their full name, country, date of birth and the discovery or invention they are credited with — just so we can confirm that you haven't made them up!

**But don't delay!** You only have until the end of October — your entry must be postmarked no later than October 29, 1993. Note that no employees of Dick Smith Electronics or Federal Publishing Company, nor their families, are eligible to enter this competition; also that our judges' decision will be final, and no correspondence can be entered into following the judging...

**Post all entries to: 'Sangean Radio Inventors' Competition, c/- Electronics Australia, PO Box 199, Alexandria 2015. There is no fee for entering, but you must pay the postage for your entry!**

## *Compact, low cost multi-band receiver:*

# SANGEAN'S ATS 606 OFFERS AUTO TUNING

The latest addition to the range of multi-band receivers made by Taiwan firm Sangean is a compact handheld model offering many of the features of its larger brothers, but at a significantly lower price. The new ATS 606 also offers an 'Automatic Tuning System', which can scan a band for the strongest signals and automatically store their frequencies in its memories.

**by JIM ROWE**

Back in the May 1992 issue, we looked at the Sangean ATS 818CS — a multi-band radio/cassette combination covering from 150kHz to 29.999MHz plus the FM band, and measuring 296 x 192 x 68mm. This set is still available, and offers a nice range of features including manual tuning via either a rotary control (with two 'speeds') or keypad, scanning within any of the 13 international broadcasting bands, an adjustable BFO, an RF gain control, a choice of two IF bandwidth settings and a digital dual-time clock. We found it quite a creditable performer, and good value at the quoted price of $399.

Since then, Sangean has released a couple of similar, but rather smaller sets which sell for a significantly lower price, but lack only a few of the facilities of the larger set.

The latest of these to appear is the model ATS 606, which compared with the earlier set is quite tiny: it measures only 148 x 93 x 32mm overall, and weighs a tiny 300 grams without the three AA cells which form its power supply.

Despite this fairly dramatic size reduction, the new ATS 606 retains a surprising number of the features of the ATS 818CS. For example it tunes continuously over virtually the same range, from 153kHz down in the long wave band up to 29.995MHz at the top of the HF bands, plus the standard FM broadcasting band from 87.50 to 108MHz (with an inbuilt stereo decoder for headphone operation).

Similarly it offers pushbutton up/down tuning, two-keypress 'instant' access to the bottom edge of any of the 13 main international shortwave broadcasting bands, the ability to key in specific frequencies via the keypad, 45 memories, scan tuning, an LCD digital clock with dual-time functions and alarms, dual conversion for higher performance, a 'tuning lock' switch and inputs for an external antenna and external 4.5V DC power supply.

Of course *something* must generally be left out when the size and cost of a set are reduced signficantly, and the ATS 606 is no exception. Probably the most obvious omission is that it lacks the rotary tuning control of the larger set, relying completely on the keypad and up/down buttons. This in itself is not necessarily a major limitation, perhaps — except that there's now only one tuning step size, rather than a choice of 'fast' or 'slow'.

You do have a choice of two preset step sizes for the medium-wave band, of either 9kHz or 10kHz to suit the channel spacing, but otherwise it's all fixed. There are 9kHz steps for the LW band from 153 to 513kHz, 9/10kHz steps for the MW band from 520 to 1710kHz, 5kHz steps for the SW bands from 1.715 to 29.995MHz, and 50kHz steps for the FM band between 87.5 and 108MHz.

This fixed tuning step sequence applies even if you key in a specific tuning frequency from the keypad. If the frequency you key in isn't in the sequence, the ATS 606 will automatically select the step immediately below your desired frequency — rather than the one above, which might be closer. For example if you key in '12.984' the set in fact tunes to 12.980MHz, rather than the much nearer 12.985MHz. If you want the next 'allowed' step higher, you have to press the 'up' button yourself. These are not major shortcomings, of course, especially when you consider the set's price and the kinds of use it's designed for. But it does make the ATS 606 a little less convenient to use than its bigger brother.

Of the other functions that are 'missing' on the set, probably the one that will be most conspicuous by its absence is a BFO, to facilitate CW and SSB reception. This means that it's purely an AM receiver, for all of its LF - HF coverage. Again this may not be a major limitation for a lower-cost set that's likely to be used for general long/medium/shortwave and FM listening,



although it does mean that users won't be able to do much eavesdropping on the amateur bands, or decipher many of the shortwave broadcasters now using SSB.

Less likely to be missed, especially once you rule out SSB and CW reception, are the lack of a selectivity/IF bandwidth switch, and to a lesser extent the lack of an RF gain control. There's also no signal strength indicator — only a small 'tuning' LED which illuminates when you're correctly tuned to a signal.

Perhaps to compensate for these missing 'frills', one nice feature that the ATS 606 *does* provide is its 'auto tuning system', which when activated causes the set to scan the current band segment and search for the strongest signals. The tuning information for these will then be automatically stored in its memories, for later recall. This means that non-technical users will be able to have the set automatically 'log' and memorise their local AM and FM broadcasting stations.

The ATS feature only operates on the LW, MW and FM bands, by the way, not on the shortwave bands. The 18 memory channels available for the shortwave bands can only be used for manual storage. Of the ATS 606's total of 45 memory channels, the remaining 27 are allocated in equal portions of nine each to the LW, MW and FM bands.

The receiver's LCD panel indicates the time, in either local or alternative/UTC, when the radio itself is turned off. Then when the radio is on, it can be toggled between the radio and clock displays using the 'Display' button. In radio mode the main five-digit readout is for frequency, with smaller legends for kHz/MHz indication, band and sub-band indication, time mode, scanning mode, memory in use and so on. When the power is turned off, the display gives an indication of battery condition using the same lower row of small digits used for memory indication.

Other facilities provided on the ATS 606 include programmable 'alarm' (i.e., auto turn-on) and 'sleep' (auto turn-off) timers, an inbuilt selectable backlight for the LCD panel, and as mentioned previously a 'Lock' switch to prevent an important tuning setting from being disturbed accidentally. There's also a slider switch which performs 'Local/DX' sensitivity switching in the LW/MW/SW modes, and mono/stereo mode switching for FM reception.

A 3.5mm jack is provided to allow connection of an external antenna to the ATS 606, but this only appears to function on the LW/MW/SW bands (not FM). No information is given regarding its impedance level. There's also a 3.5mm stereo jack for external stereo 'phones, and a 1.8mm miniature concentric socket for connection to an external 4.5V DC power source.

Finally, there's a fold-down telescopic whip antenna, which extends to about 700mm long and operates on the SW and FM bands (the other bands use an internal ferrite rod), and a neat little fold-out panel at the back which allows the set to be tilted at a convenient operating angle of about 30°.

## Performance check

The small operating manual which comes with the ATS 606 is very sketchy indeed when it comes to performance specs; in fact the only parameter it specifies is speaker output power, given as 'Nominal 180mW for 10% THD'. However we ran our instruments over the sample receiver supplied by DSE, and came up with some quite respectable figures for a model at this price level.

The sensitivity for 10dB signal to noise ratio varied quite a bit over the LW/MW/-SW range, as you might perhaps expect. Down in the LW band it ranged from 40uV at 153kHz down to 25uV at 513kHz, while in the MW band it varied from 25uV at 522kHz down to about 5uV at 1710kHz — which is more than adequate as the AM stations are all quite strong.

On the shortwave band the sensitivity was 5uV at the 1.7MHz end, improved gradually down to 1uV at 10MHz, drooped again slowly to reach 2.5uV at 20MHz, and then improved again slightly to reach 2.2uV at 29.995MHz. This was with the set's sensitivity switch in the higher 'DX' position, incidentally, and with the signal generator's output terminated in the correct 50 ohms and connected to the external antenna jack. All of which means that the receiver is reasonably and usefully sensitive, although not particularly 'hot'. The effective bandwidth was constant at +/-3.5kHz for all of this range, so that its selectivity is quite reasonable for AM reception.

On the FM band, it wasn't as easy to get a reasonable measure of sensitivity because the external antenna jack doesn't seem to operate on this band; we were accordingly forced to clip the generator's active output connection to the rod antenna, with its unknown and possibly varying impedance level. Still, the figures obtained for 10dB S/N ratio with a 1kHz modulating signal and 20kHz deviation were 10uV at the 87.5MHz end, and 30uV at the 108MHz end — which are quite reasonable. The effective bandwidth was close to 200kHz over the band.

We tried checking the maximum audio output level at the headphone jack, but this gave a maximum level before visible clipping of only 25mW (0.5V RMS across 10 ohms). Presumably the ATS 606 must have a series resistor or divider fitted, to reduce the available output for the headphone jack. We assume that figure quoted in Sangean's spec would have to be measured directly across the speaker voice coil inside.

When operated from an external 4.5V DC supply, the receiver drain was a tiny 200uA in off/clock mode, rising to around 70mA in normal operation. This should result in quite acceptable operating life from the three AA cells used, especially if you use alkaline cells.

During our listening tests, with both the internal antennas and an external antenna, the ATS 606 performed quite well for the kind of reception intended. As expected its sensitivity and selectivity are quite adequate for most AM signal reception, only causing a few hassles in very crowded areas of the bands. The performance on FM reception was also fine, and all one could reasonably expect from a set of this size.

We didn't detect many obvious 'birdies' due to spurious internal signal pickup, perhaps because of the set's moderate sensitivity. Similarly the image rejection seemed to be quite acceptable, with the only minor hassle being a bit of breakthrough on the LW band from the stronger local AM stations, when the set was switched to its higher 'DX' sensitivity setting.

To summarise, then, the Sangean ATS 606 is a nicely made little receiver with quite impressive performance considering its compact size and the quoted retail price of $249. With its range of bands, it should have a lot of appeal for general shortwave and broadcast listening.

The internal dual-time digital clock and alarm facilities may also make it a good choice for travellers, particularly those who want something better than the usual AM/FM/clock radio portable. The ATS feature would make it suitable for travelling, letting you 'log on' very quickly to the local broadcasters in each region.

The sample ATS 606 reviewed came from Dick Smith Electronics, which now has the model available in all of its outlets, identified by the catalog number D-2847.

DSE is also making available 10 of the new receivers as prizes, to be offered to *Electronics Australia* readers in a competition. So there's a good chance you may be able to win one for yourself, by putting your imagination to work. You'll find details of the competition nearby, in this very issue. ❖

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## Pantec 622

- *20kΩ/V analog*
- *9 functions 28 ranges*
- *40μA movement*
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- *3% fs accuracy*

**$65***



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- *Automotive model*
- *Frequency function for MAP/MAF, RPM crankshaft position*
- *Duty cycle for EGR valves*
- *Fast bargraph*
- *Dwell*
- *Temperature*
- *Holster*

**$575***



## Appa 103

- *3 3/4 digit*
- *4000 count*
- *0.75% accuracy*
- *42 seg bargraph*
- *Min/max hold*
- *Data hold*
- *Memory store*
- *Water resistant*
- *Holster*

**$310***



## Appa 76

*Tests –*

- *Resistors*
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- *Trimmers*
- *Diodes*
- *SCRs*
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- *Batteries etc*

**$151***



## Fluke 83

- *0.3% accuracy*
- *Min/max average recording*
- *Duty cycle*
- *Capacitance*
- *Frequency*
- *Zoom bar graph*
- *Relative meas.*
- *Holster*

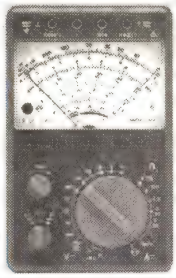
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## Pantec 30XT

- *20kΩ/V analog*
- *30A dc and ac*
- *1A/5A ranges for current clamps*
- *Phase detector*
- *2.5% accuracy*
- *Carry case*

**$179***



## Fluke 29/ 79-II

- *0.3% dc accuracy*
- *Smoothing*
- *4000 count*
- *63 segment bargraph*
- *Capacitance*
- *Frequency*
- *Holster*

**$430***



## Pantec 2030

- *3 1/2 digit*
- *Autoranging*
- *1999 count*
- *0.8% accuracy*
- *Auto ranging*
- *20mA/10A current*

**$104***



## Fluke 73-II

- *0.4% dc accuracy*
- *Touch-Hold*
- *3200 count digital display*
- *31 segment bargraph*
- *Manual/Auto Ranging*
- *10A current*

**$215 ***



## Appa 96

- *3 1/2 digit*
- *0.5% accuracy*
- *41 segment bargraph*
- *20A current*
- *Memory offset*
- *Water resisitant*
- *Data Hold*
- *Holster*

**$173***



## Fluke 87

- *4 1/2 digit mode*
- *1ms peak min/max recording*
- *0.1% accuracy*
- *True rms*
- *Analog pointer*
- *Backlight*
- *20kHz bandwidth*
- *Holster*

**$690***



## Appa 23

- *Automotive*
- *Large display*
- *Dwell*
- *Tacho*
- *Duty cycle*
- *0.5% accuracy*
- *Auto power-off*
- *Water resistant*
- *15A current*

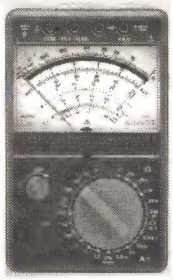
**$173***



## Pantec 50XT

- *High sensitivity 50kΩ/V*
- *36 ranges*
- *2.5% accuracy*
- *Continuity buzzer*
- *Capacitance*
- *Carry case*

**$154***



## Fluke 21/75-II

- *0.4% dc accuracy*
- *Touch-Hold*
- *3200 count digital display*
- *31 segment bargraph*
- *Manual/Auto Ranging*
- *3 current ranges*

**$313***



## Pantec 2035

- *3 1/2 digit*
- *0.5% accuracy*
- *Manual ranging*
- *200μA/10A current*
- *Capacitance*
- *Diode/transistor*

**$115***



## Philips 90 Series Scopemeter

- *50MHz scope*
- *Waveform storage*
- *3000 count DMM*
- *dBm,dB V and W*
- *Soft keys, Menus*
- *12cm 240x240 pixel screen*
- *Holster*

***from $1995****



## Appa 98

- *3 1/2 digit*
- *0.5% accuracy*
- *Frequency*
- *Capacitance*
- *41 segment bargraph*
- *Memory offset*
- *Holster*

**$219***



## Pantec 2045

- *3 1/2 digit*
- *0.5% accuracy*
- *Auto/Manual ranging*
- *200μA/10A current*
- *Temperature with K type tc*
- *Logic*

**$207***



## Fluke 23/77-II

- *0.3% dc accuracy*
- *Touch-Hold*
- *3200 count digital display*
- *31 segment bargraph*
- *Manual/Auto Ranging*
- *Holster*

**$342***



## Pantec 5XT

- *20kΩ/V analog*
- *36 ranges*
- *40μA movement*
- *Diode test*
- *12.5Aac/2.5Adc*
- *Continuity buzzer*
- *Carry Case*

**$127***



## Fluke 10

- *4000 count digital display*
- *1.5% accuracy*
- *Beeper*
- *Sleep Mode*
- *2 year warranty*

**$111***



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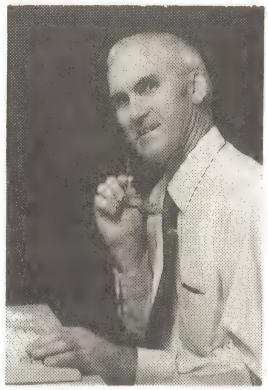
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# FORUM

Conducted by Jim Rowe



## *Assorted brickbats and bouquets — but none about fancy audio cables!*

As a change from some of the topics we seem to have been debating endlessly without being able to resolve, I've picked a few different ones this month. There's a response from the firm which developed a circuit simulator program I reviewed recently, a little more info about low-level electromagnetic fields, a reply from one of our contributors who was criticised in the June column for a claim he made about the 'sonic qualities' of coupling capacitors, and a missive from a reader criticising the prose style of our audio reviewer...

I don't know about you, but currently I'm a bit weary of topics like fancy audio cables. I know some people can get very excited about them — either for or against, but our 'discussions' about them rarely seem to reach a satisfactory resolution. In many ways they seem to be similar to discussions about politics or religion — generating a great deal of heat, but little light. Neither side seems to be able to convince the other to change their minds, and we always have to break off with the protagonists 'agreeing to differ', and withdrawing to lick their wounds and rest up for a future rematch.

So this month, let's give those never-ending topics a well-earned break and explore a few others. (Does anybody disagree? I thought not...)

### Simulator review

First, the topic of circuit simulators. You may recall that the July issue carried a review I had written about recent upgrades to the *IsSpice* circuit simulator package, produced by the firm Intusoft of San Pedro, in California.

I guess you could summarise the review by saying that while I was generally very impressed indeed by what the package can *do*, I was pretty critical about quite a few aspects of its user interface — especially the areas affecting installation and upgrading various parts if the package.

Well, not surprisingly there has been a response from Intusoft, written by its vice-president Charles Hymowitz. It's a very friendly and constructive response, and in that respect entirely consistent with the 'we're listening' image that this company has given in the past. However Mr Hymowitz does quietly point out that one or two of my criticisms were at least partly invalid, as you can see:

*Thank you very much for the review, which was great. I found all of your comments valid and we will take them to heart with improvements in the future. However, I would like to make some comments.*

*SpiceMod — You might have pointed out that Intusoft is the first and only vendor to support a Berkeley SPICE-compatible model for IGBTs, and SpiceMod is the only program to be able to make IGBT models from data sheets. Yes, indeed, this program could use the interactive plotting capability you recommend. In the Windows/Windows NT version we are working on, however, all of the products will be much better integrated and it's quite possible we will implement the cross-product communication you suggest. Also the next version will integrate SpiceNet and SpiceMod with a 'Library Manager', in order to help with the model addition process.*

*Note that the 'Generators' section in the Browse menu has both AM and FM signal generators. If you can give us the specs (generic parameters) for the composite video signal, I can make a subcircuit for it too. It's easy!*

*Installation — Your comments about the installation process are correct. However, for new users who purchase an ICAP/4 system, the process is simple. We have removed the need to edit the IsEd batch files to add the CMD specification and, of course, the user doesn't have to worry about any past directory structure changes. The reason for not making the 'APPEND — Alternate Installation' the default method is that the Append function does not work in all DOS versions (DOS V3.2 and earlier, also DR DOS).*

*The Append command only allows you to execute and READ (Read-Only) files along the Append path. This can cause problems if someone tries to edit and save changes to a file on the Append path using IsEd (such as a library file brought up by using the 'Open Select' function in IsEd).*

*Also, if the user buys an ICAP/4 Deluxe package (which includes the RF and Vendor Op-Amp libraries), he does not need to run the SINDEX utility. The package comes ready to go!*

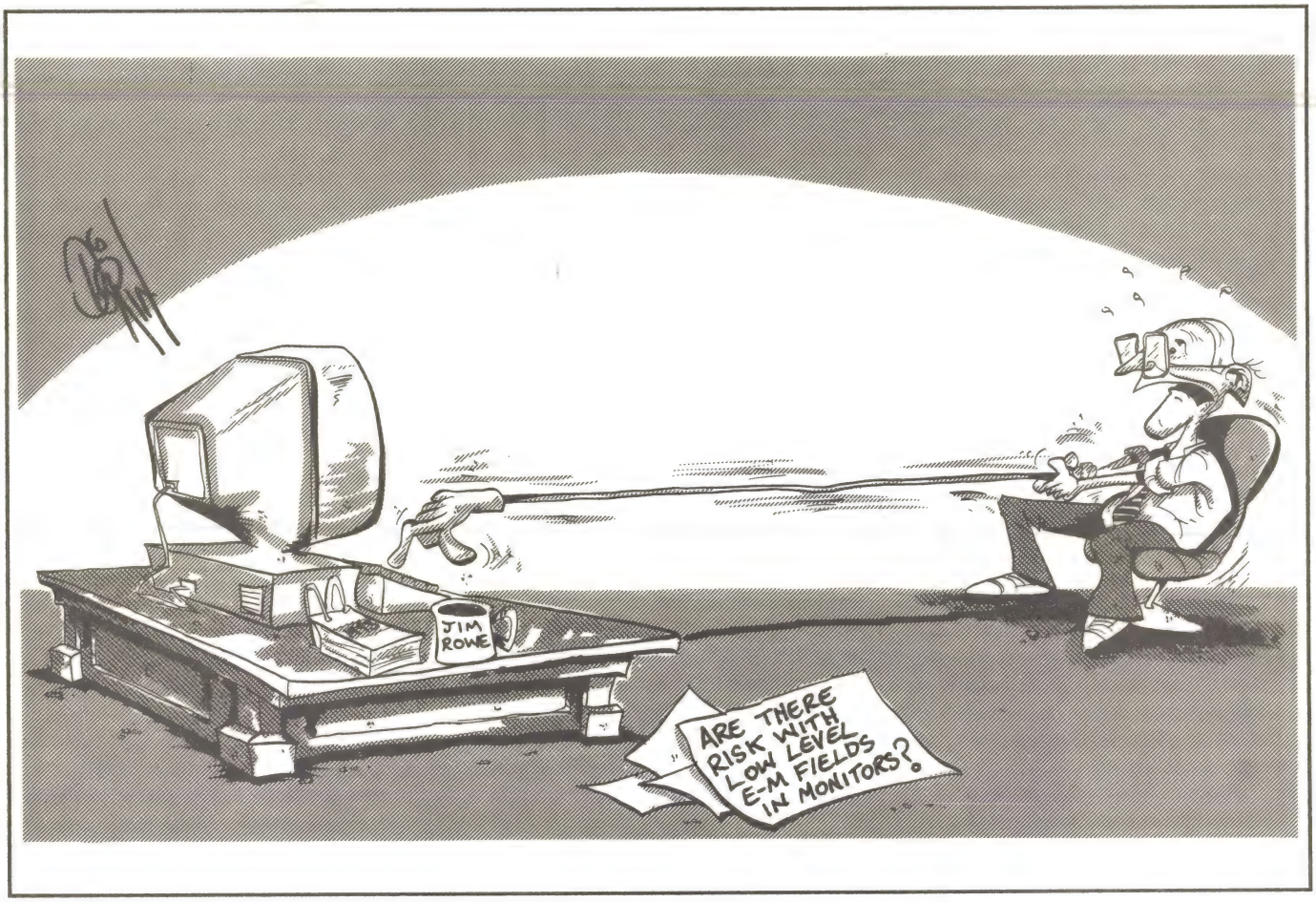
*I know that past updates have been an installation nightmare. That's what happens when you have to break old programs in order add features.*

Thanks for those comments, Mr Hymowitz. It's nice to know both that you take such an interest in reviews of your package outside the USA, and that you respond so constructively to any criticisms made in them.

### I missed 'em...

I must confess that I hadn't spotted those subcircuit models for the AM and FM signal generators, though; you're quite right to take me to task for missing them.

If you *are* able to add things like a composite-video generator (both PAL and NTSC), an FM stereo multiplex signal generator and an FSK generator for testing things like a phase-locked loop model, that would certainly be great. While you're at it, what about a model for PLL chips like the 4046 and its HCMOS half-brother, the 74HC4046A? These would be very handy indeed.




I do appreciate that for people like Charles Hymowitz and his colleagues at Intusoft, steeped in simulation theory and practice, making models for fancy chips and special signal sources is probably a 'piece of cake'. But for most of we ordinary mortals, still trying to come to grips with the use of simulation as a day-to-day design tool, the lack of pre-cooked models for these things can bring you to a halt. It's a bit like having to stop working on your main project, because you have to design and build your own test equipment before you can proceed!

Basically my comments in the July review were intended mainly to give this kind of 'ordinary user feedback', not just to Intusoft but to other firms producing simulator packages. It's reassuring that Intusoft seems to have accepted the comments in that way, and plans to use them in making further improvements to their own package. I wish all software and hardware developers had this kind of constructive philosophy, and I look forward to seeing Intusoft's future upgrades — they should be worth waiting for!

Now let's change the subject, to look at a bit more information I've received about the topic of low-level electromagnetic fields and their possible health risks.

## Monitor radiation

This is an area where many people have expressed concern, despite the fact that as yet, there is very little in the way of solid and objective evidence either way. You may recall that we've looked at the topic once or twice before, once in connection with bedside digital clocks and the other with regard to experiments being performed with mice.

If there *does* turn out to be a potential health risk from low level fields, one obvious situation where many of us would be affected is computer monitors. Speaking as one who spends a good proportion of my waking hours nowadays seated only 500mm or so in front of a PC monitor, driving a wide variety of software, I'm certainly most interested in this possibility.

No doubt because of this, my attention was caught recently by a press release put out by NEC Home Electronics Australia Pty Ltd, advising that in future all of their well-known 'MultiSync' range of monitors would fully comply with the low emission standards for VDU's established under the Swedish standard MPR 2.

I suppose the reason why I found the release of particular interest is that in the absence of much hard evidence about the risks associated with low level E-M fields, most of the equipment makers seem to have been simply denying that there's a problem at all. I was therefore interested in seeing what NEC said about it, in announcing their new low-emission models. After all, if stray fields aren't a problem, why would you bother to reduce them?

In any case, press releases like this often give valuable information on the current state of knowledge (perhaps inadvertently), as part of their preamble or background material.

Anyway, here's the part of the NEC release that I found of interest. By the way, 'nT' stands for nanoteslas and 'mG' stands for milligauss, both of which are units of field intensity.

*Reacting to recent articles in the press and on television highlighting possible links between VDU emissions and a higher incidence of certain cancers, NEC spokesperson Mr Geoff Cottee explained "In October 1991 we addressed the safety issue in Australia by introducing our FG series monitors, complying with the Swedish MPR 2 standard. This standard sets a limit of 250nT (2.5mG) on magnetic emissions in the low frequency bandwidth (ELF), the area that*

*allegedly gives researchers most cause for concern. NEC take the position that as a responsible manufacturer and market leader in multi-frequency monitors we must offer products that meet the lowest international emission standards, notwithstanding the lack of proven medical evidence, or the absence of Australian standards".*

*Recent independent tests of monitors in the USA show low frequency magnetic emissions on some brands of monitors to be as high as 7000nT, or 28 times the Swedish limit. NEC state that until it is possible for authorities to specify an absolute safety level, all monitors marketed in Australia should have the lowest emissions possible to minimise risk. Since the main sources of the allegedly harmful emissions are from the power supply and vertical deflection circuits within the monitor, add-on shields are of limited use.*

*"The monitor needs to be designed from the ground up to minimise emissions; it cannot simply be an afterthought", said Geoff Cottee.*

*Another misunderstanding set straight by NEC was the subject of cost. Some recent articles have suggested that MPR 2 compliant monitors are considerably more expensive than noncompliant alternatives, and subsequently are not being adopted by Australian users. Geoff Cottee however corrected this by explaining that "Nowadays monitors fall into two broad categories, the first being the 14" market segment... Characteristics of these monitors include lesser quality, performance and limited ergonomics, with very few complying with the MPR 2 emission standard. The other category is the 15" to 21" market, typified by our FG series monitors. This category uses larger, clearer screen technology with better resolution and performance, and in our case MPR 2 compliance... There is very little price difference within this segment between MPR 2 compliant and noncompliant models".*

*"We are finding Australian users, particularly government departments and large corporations, are now moving to the better quality monitor and subsequently getting low emission protection as a bonus", Geoff Cottee added.*

So there you are. There probably isn't a problem, firms like NEC would have us believe, but just to make sure they're reducing the emissions from their monitors to comply with the Swedish standard. That's fair enough, I suppose. In the absence of firm knowledge, it's always best to err on the side of caution — especially where health matters are concerned.

It's a bit of a worry that the fields from some monitors seem to have been measured at levels as high as 7000nT — although the release doesn't say much about how this was measured, and in what direction and distance from the monitors concerned.

NEC did send some further information regarding the development of the MPR 2 standard, and I'll be happy to publish this in a later issue if there's sufficient interest. However there doesn't seem to be much there about exactly *why* the Swedes established their emission standards, and the results of any relevant research studies. If anyone has more information on this aspect, I'm sure we'd all be very interested.

In the meantime, I must confess I'm especially glad that the 17" Philips monitor which the company recently upgraded me to, mainly for the sake of my tired old eyes, also happens to comply to the MPR 2 standard!

Now let's change the subject again (good doing this, isn't it?), to the question of audio coupling capacitors.

## Capacitor sound

In the June column, I published a letter from Graham Byrnes of Brunswick in Victoria, criticising a few things we had recently published in the magazine. One of these was a statement made by valve amplifier designer and contributor Tean Tan, in his September 1992 article, about the claimed undesirability of using polyester capacitors for signal coupling in audio amplifiers — due to their 'high distortion'. Mr Byrnes described this claim as 'nonsensical'.

I guess it's again not surprising to learn that Tean Tan doesn't agree with this, and has written a response. Here's what he has to say:

*The other important factors which affect the sonic qualities of capacitors are well documented in an article published in the March 1980 issue of the US magazine 'Audio', by Walter G. Jung and Richard Marsh, from Laurence Livermore Labs at the University of California in Berkeley. It is a very long technical paper (15 pages) and a brief summary is outlined here. This article can be sent to you if requested.*

*The findings are as follows:*

*The other factors which affect the sonic quality are dissipation factor (DF), dielectric absorption (DA), temperature vs. capacitance stability, insulation resistance vs. temperature, etc.*

*The DF is defined as the angle in which it deviates from an ideal capacitor, i.e., cotan θ = Rs/(Xc-Xi). The lower the value, the closer it approximates to an ideal capacitor.*

*The DA is defined as the ability of the capacitor to store and discharge the electrons stored. It can be measured using the procedure as specified by the MIL-C-19978D, a US military standard. The smaller the value, the better the ability to store and discharge the electrons.*

*How do these DA and DF parameters relate to the sonic quality? According to M/s Jung and Marsh, the DF is primarily a contributor to the phase and amplitude modulation, while the DA reduces or compresses the dynamic range.*

*This makes sense, as at higher DF values there will be a larger phase shift hence greater phase distortion. A high DA value reduces the transient capability of the signal that passes through it, most commonly described as 'loss of dynamics'. The descriptions such as 'blurred sound' and 'loss of dynamics' can be attributed to high values of DF and DA respectively.*

*The DF should remain fairly constant over the frequency and temperature ranges. The capacitance should also remain fairly constant over both frequency and temperature ranges. This makes sense; as the amplifier warms up the sound should 'stabilise', i.e., remain in focus and not 'drift', and at the same time also remain 'dynamic'. These aims can be achieved through the use of high quality capacitors (polypropylene and polystyrene) in modern day moderately priced amplifiers. A summary of a comparison between the various type of capacitors based on the parameters such as DA and DF, etc., is shown in Table 3 (enclosed), which is an extract from the article by M/s Jung and Marsh.*

*Most audio enthusiasts are well aware that changing the polyester capacitors (especially the coupling capacitors) to polypropylene or polystyrene capacitors dramatically improves the sound. Some audiophiles even go to the extent of picking the brand of capacitors to put in the amplifiers. A cheap upgrade and one that is readily available in Australia is the WIMA polypropylene.*

*I can write more, but I think this is sufficient to indicate that capacitors do affect the sound quality. I suggest those who are sceptical about this do in fact try it out for themselves.*

Thanks for those further comments, Mr Tan. I haven't tried to reproduce the table from Jung and Marsh's article, because your copy was very faint and we would have had to reset it completely. Hopefully it's sufficient to note here that

the DF figures given for metallised polyester, polycarbonate, polypropylene and polystyrene capacitors are 0.3 - 1%, 0.1 - 0.3%, 0.01 - 0.03% and 0.01 - 0.03% respectively, while the corresponding DA figures are 0.3 - 1%, 0.1 - 0.3%, <0.1% and <0.1% respectively. The variability of DF with frequency is described as medium, medium, very low and very low respectively, while its variability with temperature is described as medium/high, medium, very low and very low. Presumably these figures and comments are all the result of a series of measurements made by either the paper's authors or others.

In short, then, and as Tean Tan suggests, Jung and Marsh seem to suggest that there *are* quite significant differences between the various kinds of plastic film dielectric capacitor, when it comes to these particular performance parameters. Which is fair enough, I suppose, although it's difficult to judge the degree to which the parameter differences quoted would result in measureable or even discernable differences in amplifier performance. I also find myself getting a bit skeptical when tables summarise data in such vague qualitative terms as 'medium/high', 'medium', 'high' and 'very low' — don't you?

I'd certainly like to see a copy of the full Jung and Marsh article, Mr Tan, to study it at length. But I'd also be very interested in learning if anyone has actually been able to *measure* the distortion attributable to using metallised polyester coupling capacitors, and the reduction achieved by substituting polypropylene or polystyrene types. From the little bit of Jung and Marsh's paper I've seen, you'd think if the parameter differences between them are so significant, you should be able to measure the resulting differences in amplifier distortion, as well.

## Purple prose?

Now let's change the subject one more time for this month, and look at an extract from a fax that arrived recently from Mr R. Grant, of Chapel Hill in Brisbane. Mr Grant is Secretary/Treasurer of the IREE's Brisbane Audio Group (BAG), and wrote partly in that capacity and partly as a private person and hobbyist. I gather he works in the audio industry, possibly as a service engineer.

His fax was quite long, and much of it was commenting on loudspeakers, amplifier earthing, hifi industry marketing hype and those long thin things which are used to make connections between various items of audio equipment (the things we're not going to talk about this month — remember?). I might be able to quote from these comments in a later column, but for the present we'll confine ourselves to some further comments he makes, about Louis Challis's audio reviews. Like Graham Byrnes, quoted in the June column, Mr Grant is obviously not entirely happy with Louis' writing style:

***Reviews by Louis Challis:*** *I have left this until last, in order that I don't ramble on. These reviews are a very interesting part of the magazine and I would not like to see them stop, but what needs to happen is that Mr Challis must take a course in Plain English Writing.*

*I don't think I have ever seen such rambling, almost self-indulgent explanations of aspects of performance, which in some cases degenerates to sheer gobbledegook. I have put an example below — this was in EA December 1992, and I ask the question "What on earth is he trying to say?"*

*I quote: 'My appraisal of what Pioneer have set out to do, and what they have actually done, is of course somewhat different from their naively stated position. This is because what they have done would be considered heretical if they were to state it in clear and positive terms (which of course they have not). Whilst I must acknowledge that what Pioneer has achieved is laudable in an aural sense, it is nonetheless regrettable that they had to adopt such a circumspect way of sanitising their philosophy (and the nature of their circuitry). for fear of discouraging would-be buyers.'*

*'The bottom line is...'*

*Hurrah, hurrah! We have actually got to a 'bottom line'. My suggestion would be to forget all the above pernickety waffle and just use the paragraph starting with 'The bottom line is...'*

*Yes, yes, I hear Mr Challis rushing to defend his cherished prose with anguished cries of 'Out of Context', etc, etc. This does not alter the fact that this was a very long-winded and poorly constructed piece of English, IN or OUT of context. There are many other examples, but I won't bore you with them.*

*I believe that Mr Challis is doing himself a great dis-service with this style, and ask that you work with him to improve it. I would not like to see the 'sizzle leave the bacon', because reviews should have some excitement about them; but a little more focus would be great. A competent technical person he may be, a great author he is not. Over to you!*

Hmmm... Thanks for those comments, Mr Grant. No doubt Louis Challis will

*Continued on page 97*


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READER INFO NO. 9

# THE SERVICEMAN

## Hosing down the TV, and debugging an alarm — literally!

I have a very mixed bunch of stories for you this month, folks. There are three interesting reminiscences from a retired TV serviceman in South Australia, an intriguing tale about a very frustrating security alarm problem and another item from my own bench, about removing annoyingly visible teletext lines.

I thought we'd open the account with a series of anecdotes from E.J., of Meningie in South Australia.

By his own admission, E.J. has been servicing television sets for a good many years. In all that time he has learned a trick or two, and his first story shows how he used one of those tricks to give an unpleasant customer his cum-uppance.

Then, he relates the story of his good deed after some of the worst floods seen around Adelaide in living memory. And finally, an amusing story about the young people he met at one customer's home...

*I have been interested in electronics for most of my life, and from 1959 until retirement in 1984, was involved in the repair of thousands of television sets. During that 25 years I had many interesting experiences, three of which I would like to share with you and your readers.*

*Attending to the calls of so many customers, it is inevitable that from time to time one will meet a person who immediately irritates. On one occasion the door was opened by the man of the house, who at once asked me how long I had been servicing televisions!*

*When told about 20 years, he replied, "Well, I suppose you should know a few things by now!" Then he embarked on a long spiel to say he had "... an understanding of electronics, sufficient to know that it would be an AGC fault, causing an extra strong signal to make the picture expand off the screen when the signal level was raised by turning up the brightness!" Really!*

*Biting back an appropriate comment, I thought "Here's someone who needs to be taken down a peg or two".*

*Suspecting that I might not know how, he rushed over to the set and asked if I wanted it turned on. As the bristles climbed on the back of my neck, I said "No! I don't want it on".*

*The set was a Philips K9, and I knew that the most likely cause of a picture that bloomed was a faulty focus resistor soldered to the tripler; I was determined I was going to fix this one without ever seeing the fault.*

*On swinging out the large signal panel, one look at the discoloured 8.2 megohm focus resistor confirmed my suspicions. I endured the beer-laden breath from the customer as he leaned over the set, intent on seeing that I did the job properly.*

*Because this type of fault was so common I always carried several focus resistors in the tool box, thus saving me an extra journey to and from the van.*

*The resistor was quickly soldered in place, the back cover replaced and the set lifted into the corner. I now told the customer he could switch on the set.*

*It came to life with a beautiful picture, as is typical of a Dutch-made K9. Normally, I would check the picture focus before replacing the cover, but in this case I decided to take a chance, and it worked. No adjustment was needed.*

*The customer stepped from his soap box and in an incredulous voice said — "Wow! You actually fixed it without turning the set on and checking the fault". My simple answer was that over a period of time we do eventually learn a few things, and said no more as I felt I had received my reward.*

*In 1983, the Ash Wednesday fires ravished large areas of South Australia. Then within a few weeks there were catastrophic rains through the Barossa Valley, which caused water to flood many homes.*

*A few days later, my neighbour asked if I could possibly salvage the television and stereo belonging to his sister, whose home had been inundated to a depth of almost a metre.*

*The equipment arrived next day, forlornly sitting in the back of a utility. At a glance I could see that little could be done for the stereo, as it had been switched on at the time of submersion, resulting in the destruction of most of the copper tracks on the PCB's.*

*Turning my attention to the television, I found it was a Philips K9 and had been completely submerged. Normally the back cover is easy to remove, but this one resisted. Finally it parted company from the set, to reveal the cabinet was about three parts filled with damp mud!*

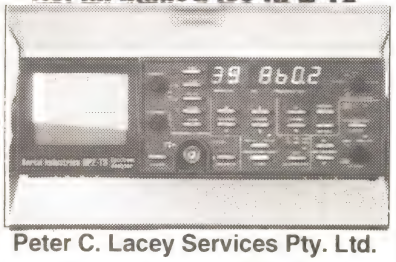
*I stared in disbelief. How could I possibly salvage it? My friend told me it had not been switched on when the water arrived, and this was subsequently proven when no damage to printed tracks was revealed. It took our combined strengths to lift the TV to a platform near the workshop.*

*Using the hose, I washed away the*


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READER INFO NO. 10

*mud — making sure it was totally removed from inside the cans covering transformers, coils, filters etc., and also the yoke, rotary tuner and the power supply.*

*It looked strange to observe the water-covered components and tracks glistening in the sunlight. In fact, the set looked in pristine condition! Never before had I envisaged squirting a jet of water into a television set!*

*An examination revealed no structural damage, except for the speaker cone. I told my neighbour I would completely strip the set and dry everything in the sun for as many days as I deemed necessary.*

*With an air hose I removed as much water as I could, then stripped everything from the cabinet, laying the components on newspaper, to dry in the sun. In the initial stages the components were periodically moved on the paper as it became wet underneath.*

*I decided not to remove any components from the large signal panel, and only the removable modules from the small signal panel — this allowed me to dry their plug-in connectors.*

*CRC 5-56 was used to protect the mating surfaces of all connectors, including the modules, and carefully used on the transformer in the switch-mode supply, AC line filter, EHT transformer and the yoke — any excess being blown away by the air hose.*

*The rotary tuner was given special attention by stripping, washing, drying and spraying it completely. It came up rather well, so with a smear of silicone grease where needed, I felt sure it would be OK.*

*Rather than simultaneously removing the dozens of connecting leads and risk losing track of where they belonged, I decided to individually remove, dry and spray each connector, adding a very thin smear of silicone grease on the chassis mounted portion, before reassembly.*

*My chief concern was the cabinet, which was made of particle board. After removing the picture tube, I hosed every trace of mud from the cabinet and the tube, then dried the cabinet as much as possible, using an old towel.*

*The cabinet appeared undamaged, so in an effort to save it, I remounted the picture tube in the hope that it would help to prevent distortion as the cabinet dried. I reasoned that the cabinet would be better preserved if it did not dry too quickly, so it was placed tube face down on the towel, in the shade of a gumtree where it could be rotated occasionally, and allowed to slowly dry in the wind.*

*My neighbour called the next day and stared in amazement at the array of parts drying in the sun, and asked if I was confident of correctly replacing them. After telling him that I usually threw away anything that was left over, he smiled and left me to further nurture the parts.*

*It being a weekend, I could give the drying parts special attention and at night, to make sure that they were safely covered from any moisture. As the weather remained fine, the parts were left to dry for the next week, while I went about my usual workload in the field.*

*The following weekend I commenced the job of a final dryness check. To ensure the power and EHT transformers, yoke etc. were really dry, they were twice warmed thoroughly using my wife's hairdryer (after she had inspected what I was about to do with her appliance!)*

## JUST FOR A LAUGH!
## Power Restored!

There was a massive blackout about mid-morning, just as Mum was driving home from a shopping expedition. Her threeannabit-year-old found it hard to understand why there were no lights in the shops, no traffic lights on the roads, no radio, no TV or video, no stove to cook lunch on. Even the clock had stopped. It was all just too much for his little mind to comprehend. Nothing that he cared for now worked...

Until, after a visit to the little room, he came racing back yelling "Mum! Mum! Everything's alright again. The toilet works!!"

***(Contributed by Anne-Marie Snow, of Gellston Bay in Tasmania)***

*I was amazed to find that the cabinet had dried without distortion, this being proved by the perfect fit of the back cover. Even the brown veneer covering had remained intact. The front panel closed perfectly. I couldn't believe my luck!*

*With this encouragement, I set about the task of reassembly. I noted that the usual green protection given to printed tracks in Philips TV sets had done its job well. At first I was concerned that some moisture may be under the heatsinks of the colour difference amplifiers, so out with the hairdryer again.*

*Warm air was also blown into the open tops of the cans covering various components, also the focus adjustment pot. A new speaker was fitted. Everything went back together (and there were no leftover parts to be thrown away!)*

*I phoned my neighbour, to say the moment of switch-on was about to occur. He was present in about two minutes!*

*As a precaution, the first switch-on involved only the power supply, as it also included the AC circuitry. I was relieved to note all voltages were present and the dial lamp was glowing. After noting that there was no bubbling or hissing emanating from the supply, I reconnected the various power supply plugs and we were ready for the big test.*

*I offered my friend the opportunity to be the first to turn the set on, but he said "No way! I'm standing right back!"*

*For obvious reasons, on switch-on I expected either a loud bang as the EHT objected, or hissing accompanied by smoke. To my amazement, the sound poured forth — followed a few moments later by a colour picture! I just could not believe it.*

*A careful inspection of the rear of the set indicated nothing amiss, so it was left to run for 10 minutes and inspected again. All being well, a blanket was placed over the rear to allow the interior temperature to rise and remove any remaining moisture.*

*After an hour, the blanket was removed, a further inspection showed nothing unusual was happening, so the set was left running for four hours; still nothing amiss. The final touch was to adjust the convergence, as all the pots and inductor slugs had been moved during the drying process.*

*That was nine years ago. The set is still working well and its only service in that time was three years later, to replace a focus resistor. Full marks to Philips!*

*Although I had spent many hours on the salvaging of the set, I considered it to be a challenge to my few skills, the end result being very successful.*

*Under the circumstances, with the severe losses the owners had already suffered, I was pleased to tell the customer there would be no charge and that this would be my contribution towards their recovery.*

*With tears in their eyes they took the set home, leaving me with a warm glow in my heart. Anyway, most of the work had taken place over two weekends, and had not really interfered with my usual workload...*

*The final story is one of human interest and illustrates the possible hazards to be met during a television repairman's work.*

*I received many calls which indicated I should enter by the back door. On one such occasion I had almost reached the wire door when it burst open, to reveal four large teenage girls bearing a com-*

*pletely naked 15 year old boy. They charged down the garden path and tossed him into the swimming pool!*

*Somewhat taken aback, I said to the girls that I hoped I would be spared that treatment. They laughed and said I would be spared, but to ask their brother for the details. I did not see the girls again, but shortly after the boy appeared dressed in a pair of shorts, a sheepish grin on his face and said he supposed he should explain.*

*It transpired that for most of the morning the boy had been rubbishing his sisters to the extent that they threatened to throw him in the swimming pool. Overhearing them, their mother called from the kitchen, "You'd better not! You'll get his clothes wet". The boy told his sisters "Ha ha! That's the end of that, so like it or lump it!"*

*As one, the four girls grabbed him, ripped off his shorts and underdaks, lifted him up and the rest is history. He had no chance against the four larger girls, but later admitted that he had stuck his neck out once too often.*

*I asked him if he was embarrassed at being forced to reveal all to his sisters. He replied "No! They've seen me naked before, mostly as I walk from the bath room to my room".*

*I didn't pursue the matter of when the other times might have been, as I thought in my mind — well, it takes all kinds to make a world!*

Well, E.J., that last one just about takes the cake, as far as I'm concerned. I reckon that young fellow deserves a medal for courage at least, talking like that to four big sisters. I wouldn't have been game to rubbish my two younger sisters, let alone twice as many older ones.

Anyway, thanks for those stories, E.J. They are the sort of tales that makes a nice change from the highly detailed servicing stories that are the stock-in-trade of this column.

## Entomology lesson

Now we are going back to one of those 'alarming' stories submitted by A.L., of Beverley Hills in NSW.

If you remember, A.L. is involved with the design and installation of electronic alarm systems, and his first story was one of considerable gravity. This time we become involved with natural history, biology and other esoteric sciences:

*This story describes the case history of a series of false alarms which drove the technicians, management, and the unfortunate client almost to the brink of insanity, before the cause was indentified and remedied. I call it 'A Lesson in Entomology'.*

*An alarm installation in a private residence in one of Sydney's leafier suburbs was successfully commissioned, and was handed over to the client. A few days elapsed and the client attempted to set the alarm. He left the house by the prescribed exit route and was about to drive off, when the peace of the afternoon was shattered by 110dB of screaming sirens.*

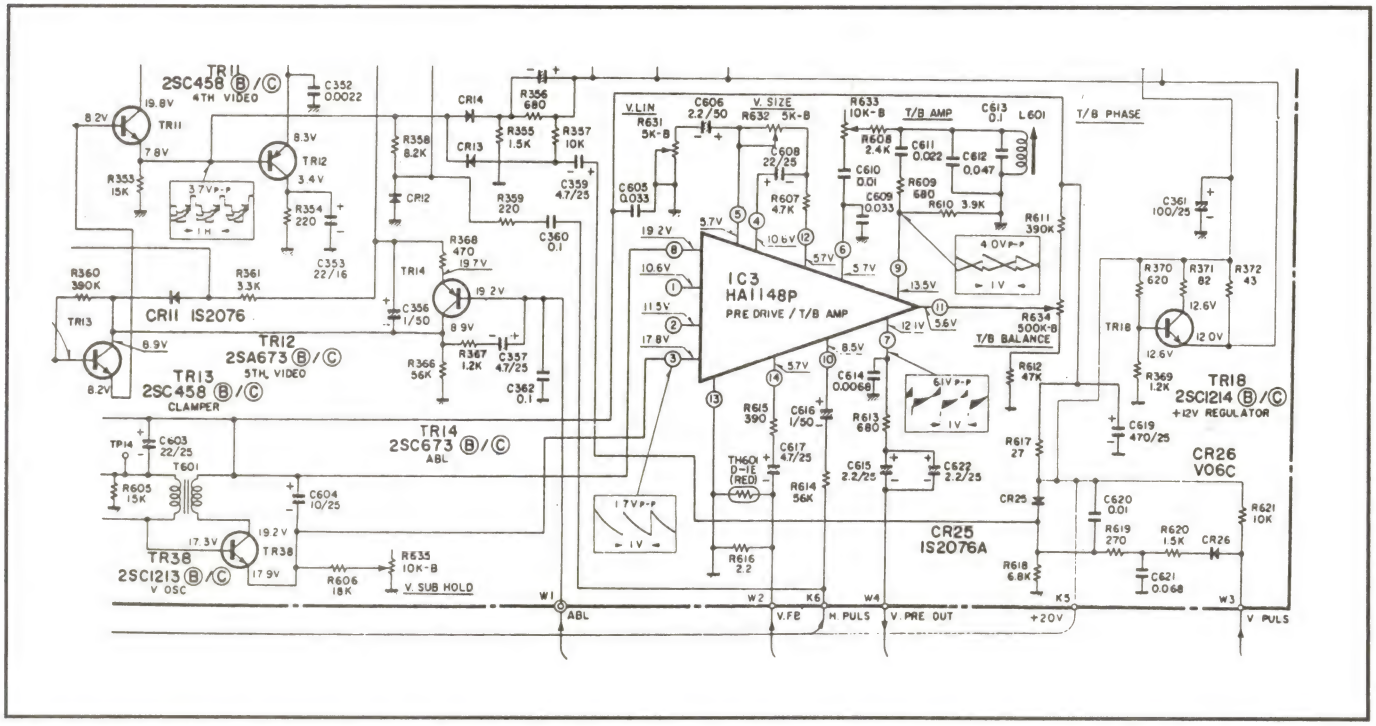
*Thinking that he had mistaken the setting procedure, he reset the alarm and attempted to re-arm the system. He was just getting into his car when all hell broke loose again.*

*Several attempts later and after a series of frustrating phone calls to the security company, he was apoplectic with rage and demanding the attention of the Managing Director. A serviceman was sent, post haste, and the client was pacified when a faulty passive infrared detector (PIR) was identified and replaced under warranty, with copious apologies for the inconvenience caused and assurances that "This will fix the problem".*

*The proper functioning of the alarm was demonstrated and all was OK, for a few days. The next we heard from the client was a red-hot memo from the office of the MD.*

*It seared its way across the Branch Manager's desk like an incendiary bullet, and came to rest in the Service Manager's in-tray, with the BM in hot pursuit. The client had approached the MD through the old-boy network, and was after someone's blood.*

*This time the Service Manager and a*




***This extract from the schematic for a Hitachi CEP 288 colour television shows the final video stage and blanking circuitry. Capacitor C359, visible at top centre, is the one which needs to be increased in value to remove the annoying teletext lines.***

*technician were sent to the site, with dire warnings of human sacrifice and other unmentionable fates if the problem was not fixed.*

*A test of the installation revealed that the new PIR was the cause of the false alarms. The PIR was demounted and dismantled, and only when the enclosed optical section was opened were the culprits revealed.*

*A colony of minute brown ants had taken up residence in the PIR. They had emerged from the wall cavity and had entered the PIR through the cableway in the swivel mount assembly. The coating on the printed circuit board appeared to be the attraction, and the little beasties were causing the alarms by walking over the surface of the pyroelectric detector, modulating the background infrared radiation by their movements.*

*An inspection of the external wall revealed that the house was of brick veneer construction, with decorative wooden panels below the windows. These panels extended almost to ground level and were not sealed at the sides or bottom, giving access to the wall cavity for any small creature.*

*The ants were identified as Argentines, and the client was advised to have the wall cavities fumigated and the decorative panels sealed. As an interim measure the wall cavity and a new PIR were sprayed with a residual insecticide, and no further problems were experienced.*

Thanks for that story, A.L. I've heard of little brown beasties upsetting various household activities, but never to the extent of causing false triggering of an alarm system. That's something new to be aware of!

## Teletext lines

And now to finish up for this month, here's a short story from my own workshop.

Back in February, I wrote about a problem with teletext lines on an old National colour TV. In that story I mentioned that other brands also suffered from the same problem, although at that time I hadn't come across one.

Well, now I have — and this time it was a lot easier to correct the trouble. In fact, the cure was so quick and easy that the story hardly rates as a subject for these pages. However, since so many readers use these notes as a source of solutions for their own problems, then passing on this tip may well save them a lot of time.

The set was a Hitachi CEP288, an early model that uses the PAL-3A chassis. In this case the teletext lines extended one third of the way down the screen, and as I received the set, they were accompanied by a further raster of retrace lines right to the bottom.

The picture was really showing its age, with low contrast and weak, washed-out colour. The brightness control had been wound up as far as it would go, and it was this that was causing the retrace lines to be visible. I reduced the brightness and increased the contrast. This eliminated the retrace lines, but of course the picture was then so dark as to be unwatchable. The set obviously needed some internal attention.

I lost no time in getting the back off the cabinet, intending to increase the brightness by tweaking the 'screen' control. However, my enthusiasm was short-lived, since this set does not have a *single* screen pot...

### Fault of the Month

**Sharp VCR, model 8300**

**SYMPTOM**: Loads tape and begins to play, then stops. With cover removed, it can be seen that the drum is not rotating.

**CURE**: The drum motor was defective. This model uses a standard type of brush motor, and in this case one of the brushes had been bent backwards, probably by rotating the drum backwards.

*This information is supplied by courtesy of the Tasmanian Branch of The Electronics Technicians' Institute of Australia (TETIA). Contributions should be sent to J. Lawler, 16 Adina Street, Geilston Bay, Tasmania 7015.*

Instead, it has separate R, G and B screen pots, on the tube base board. These pots effectively do the same job as the single pot in later models, but require more careful adjustment in order to retain correct colour balance.

Trying to lift the brightness with these three-pot screen adjustments often reveals a defect associated with the age of the picture tube. I sometimes find that I can't get a proper balance, since one gun has aged more than the other two.

In this case I was lucky, since it seems that all three guns had aged equally and I could get a nice gray screen with no trace of the flyback lines. When I switched to colour bars, the set displayed as good a picture as any I've ever seen on a set of this age. So far so good, but I still had to try to remove the teletext lines.

The service manual for this model included an elaborate block diagram which clearly explained where the V and H blanking pulses were introduced to the luminance chain. Quite often this information is not given in the block diagram, and tracing the blanking circuits in the main diagram can be an exercise in frustration.

Not so in this case — I was able to go straight to the appropriate diodes and from there, trace back to the obvious 'villain of the piece'.

Vertical blanking pulses are derived in the vertical driver stage and are fed via C359, a 4.7uF 25V electro, to the isolating diode CR13 then to the fourth video amplifier TR12. I was prepared to bet a dud diode to a duck dinner that the capacitor was faulty.

Well, I nearly won the bet, because the capacitor WAS in the process of failing. It was drying out, and its capacity had fallen to about 2.2uF. In most cases this value would probably work OK, but it made sense to replace it so I fitted a new and full value 4.7uF cap. Unfortunately, it made no difference to the appearance of the teletext lines. They were still flickering away, in a most distracting manner. Clearly, I would have to do something more drastic.

As it turned out, the cure was no more difficult than increasing the value of C359 by a factor of times. If you remember the February story, I tried increasing the value of the coupling capacitor by nominal amounts and only cured the problem when I reached a vastly increased value.

This time I used the same technique, but started with a 100uF capacitor, just to see what would happen. Well, the sound came up but there was no sign of a picture. In fact, the blanking was now so severe that it removed every trace of video!

So I halved the value, to 47uF, and tried again. This time it worked and there was a perfectly normal picture, with no trace of teletext lines. This job took only about half an hour, only a quarter of that taken for the National set. It might have been more good luck than good management, but I like to think that I am learning from experience!

It's a funny thing about these teletext lines. I had in the workshop another set of similar age, (a Precedent fitted with a Toshiba chassis,) which showed no signs of the lines even when sitting alongside the Hitachi, and fed with signal from the same antenna outlet!

It all has to do with the efficiency of the vertical blanking circuit, I believe. Some sets have a good system, others not so good.

Well, that's all for this month. I have more stories from contributors for next month so keep watching. ❖

## *Construction Project:*

# 68705 Microcomputer

This project lets you use a 68705 microcontroller in virtually any way you want. Program the 68705 (perhaps with our development system package described in March 1993), then plug it into the microcomputer system described here. It has lots of on-board interfacing facilities, including I/O ports, keyboard, LCD module, an RS232 interface and a D to A converter: more than enough to satisfy any application.

**by ROBERT PRIESTLY**

In March 1993, we presented a low cost development system for Motorola's 68705U3/R3 and P3 single-chip microcomputer ICs. Now, as promised we describe a — well!

What do you call something that can be a computer, a complete controller, an educational tool, a real-world interface and...? To make it simple we've settled for a 68705 microcomputer, but even that name doesn't really tell it all.

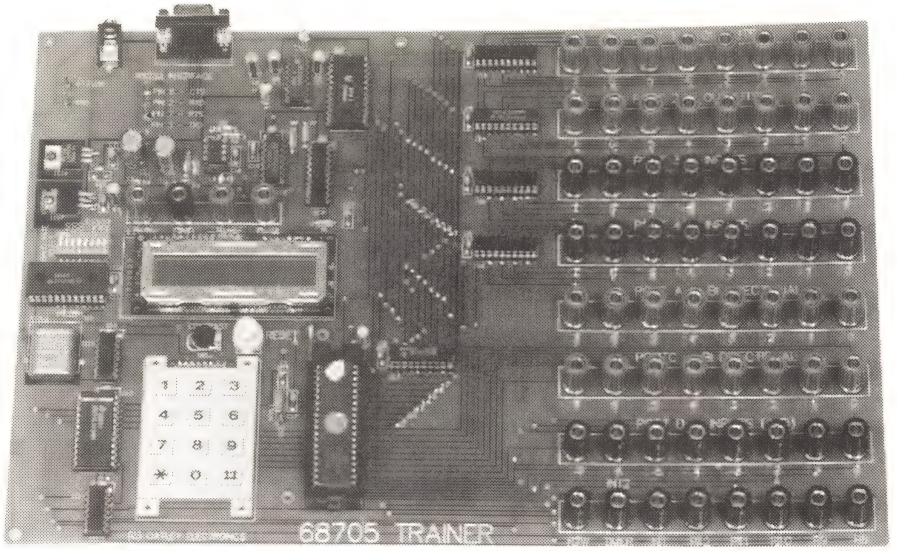
As the lead photo shows, the unit is built on a single PCB, rather like a motherboard in a PC except that here the board itself forms the basis of a computer system. It has a display, keypad, serial and parallel I/O ports, which are all coupled to the microcontroller IC. This IC (the CPU) supplies the data, addressing, control and interrupt lines, and does all the data processing and storage.

There are also a number of discrete support circuits, including two 8-bit latched output ports, two 8-bit input ports, a D-A converter, an RS232 serial communications port (with selectable baud rate), a two-row by 16 character liquid crystal display module and a 3 x 4 matrix keypad. It also has external connections to the A, C and D ports of the 68705 microcontroller.

The microcomputer can address 12 ports. Seven of these are built on the board, and the select lines for the remaining five are taken to terminals so you can built extra ports if necessary.

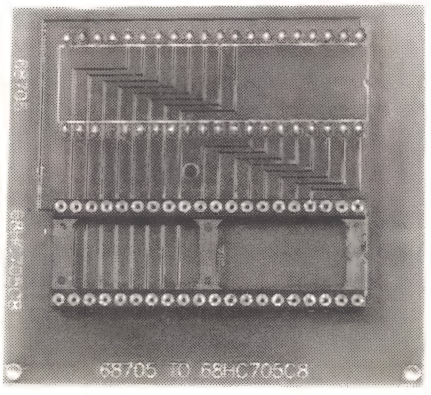
The function and address of each port is listed in Table 1. So as you can see, this project is a versatile support system for a pre-programmed microcontroller IC. What you make it do is up to you. The important thing is that all the essential hardware to interface (and use) the microcontroller is available on the one board.

Another feature is that all connections to the ports are with 4mm terminal posts.




***This photo is of the prototype and revisions have since been made. The new design is therefore slightly different, especially in the area above the display.***

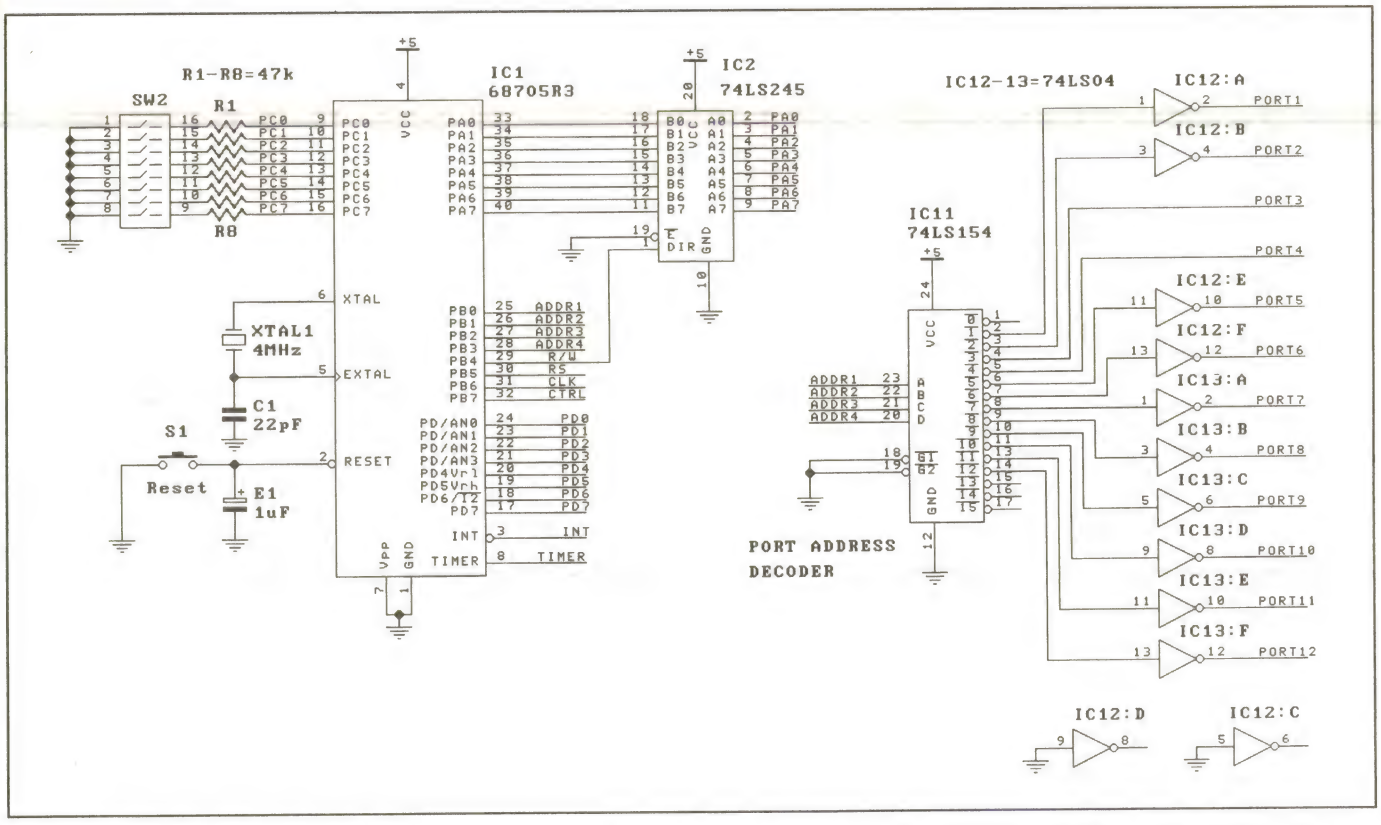
This makes the system easy to interface with other equipment, so it's ideal for use in schools and other educational institutions. Of course, you don't have to fit the 4mm terminals if your budget doesn't stretch that far. Instead you can connect external devices directly, with leads soldered to the pads that normally take the 4mm terminals.




***The piggy-back adaptor for the 68705CB microcontroller. It plugs into the ZIF socket on the main board and the microcontroller IC plugs into the socket on this board.***

The design as it stands suits the 68705R3 and the 68705U3 Motorola microcontrollers. However, any microcontroller IC can be used with the unit as long as it has enough I/O lines to supply the necessary signals to drive everything. To achieve this, some kind of piggy-back PCB is needed to connect the microcontroller correctly to the board. Piggy-back PCBs have already been designed for the 68HC705C8 and 68705P3 Motorola series. Because of its limited I/O no keypad interface is provided for the 68705P3.

Like the 68705 development package, this project will be available in kit form only from Oatley Electronics. A




***Part 1: This part of the circuit shows the microcontroller and the port address decoder. Port B of the microcontroller addresses the 1-of-16 decoder IC11, to select one of the 12 ports.***

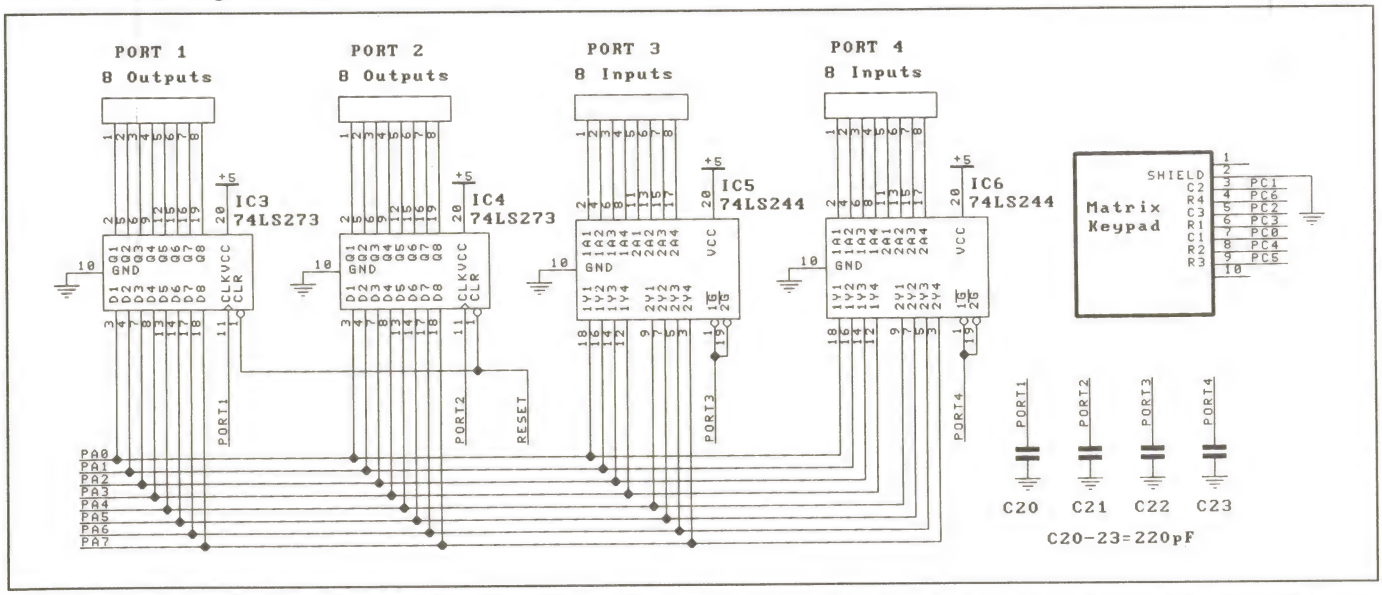
short form kit will be available, which includes a high quality double-sided plated-through silk-screened PCB, demonstration software and the LCD module. See end of this article for more details.

## Circuit description

The whole unit is made up of several relatively simple digital circuits. The result is a rather large circuit (and PCB), where each section connects in some way back to the microcontroller IC1. Port A of the 68705 is the bi-directional data bus for the board. Connected to this bus are the octal latches IC3 and IC4 for the two output ports (port 1 and port 2) and the 3-state octal line drivers IC5 and IC6 for input ports 3 and 4.

Also connected to this bus are IC7 (the octal latch for the D to A converter), the data inputs of the liquid crystal display module and the parallel data inputs of the asynchronous communications interface adaptor (ACIA) IC9. Finally, port A is extended out to eight terminals for external interfacing via the octal buffer of IC2.

Port B of the 68705 is used as an addressing and control port. Consequently all port B I/O lines have to be initialised as outputs. The first four bits of port B (bits 0-3) are used to select one of the 12




***Part 2: The input and output ports are shown here, along with the keypad. These devices are selected by the port address decoder and data is transferred via port A of the microcontroller.***

possible ports. These four lines are labelled ADDR1 to ADDR4 on the circuit diagram, and connect to the address inputs of IC11, a 1-of-16 decoder.

The outputs of this IC are active low, which means the selected output is a logic 0, with all others a logic 1. This suits ports 3 and 4, as IC5 and IC6 are enabled with a logic 0.

However, all other devices on the unit are enabled with a logic 1, so the outputs of IC11 are inverted with IC12 and IC13. As already mentioned, the outputs labelled PORT 8 to PORT 12 are not used by the unit itself, but are brought out for external use.

Output 4 of port B (PB4) is a control line and functions as a read/write line. To write to a device this line is switched low, which can be done with the instruction BCLR 4,PORTB (bit clear 4 of port B). This line connects to IC2, IC9, the LCD and to a terminal post for external use.

PB5 is used as a register select (RS) line for both the LCD and the 6850 ACIA. The RS line lets you write to either the control or the data register of these devices.

PB6 is used exclusively by the 6850 ACIA IC9. This line supplies a clock source for the 6850 when serial communication is required. All reading and writing must be synchronised to this clock line when addressing the 6850.

PB7 is used to reset IC10, a serial baud-rate clock generator type MC14411. The appropriate baud rate for IC9 is selected by the DIP switches of SW1. Obviously, only one switch in the bank should be closed at a time, as they are wired as an 8-way selector switch.

Port C of the 68705 can be used in two ways: to scan the on-board matrixed keypad, or as bi-directional I/O lines to an external device connected via terminals to the unit. When port C lines are initialised as inputs, they are pulled low by resistors R1-R8. These resistors can be isolated with the DIP switches of SW2.

**TABLE 1: Port addresses & function**

| Address PB 0-3 | Port number | Function |
|---|---|---|
| 0001 | PORT 1 | Output data latch IC3 |
| 0010 | PORT 2 | Output data latch IC4 |
| 0011 | PORT 3 | Input buffer IC5 |
| 0100 | PORT 4 | Input buffer IC6 |
| 0101 | PORT 5 | Output data latch IC7 D-A converter |
| 0110 | PORT 6 | LCD module |
| 0111 | PORT 7 | ACIA |
| 1000 | PORT 8 | External use |
| 1001 | PORT 9 | External use |
| 1010 | PORT 10 | External use |
| 1011 | PORT 11 | External use |
| 1100 | PORT 12 | External use |

Port D is an input port only and is directly connected to eight terminal posts for external interfacing purposes. If you are using the 68705R3 microcontroller, this port can be used for A-D sampling.

The RS232 port comprises IC14, a voltage level shifter chip type MAX232 which is used to transform the TTL level signals to and from IC9. This port can be connected to the serial port of a computer for two-way serial communications.

The MAX232 has an internal inverter that produces a -9V supply. This voltage is connected to IC16, a 3-terminal -5V regulator which supplies the board with -5V. Access to this supply is provided, but it should not be loaded to more than 20mA.

The regulated +5V supply to the board is provided by IC15, which is supplied with an external DC voltage of between 9V to 12V. A 9V supply reduces the heat developed by the regulator and if you are using a 12V supply, you'll need to fit a heatsink to IC15.

## Construction

Construction should be straightforward, as the PCB is silk screened to show where everything goes. For this reason, we haven't included a layout diagram here, as apart from the external plugpack, everything mounts on the board.

***Part 3: The D to A converter, LCD module and the RS232 serial port are in this part of the circuit. Data is transferred via port A of the microcontroller, and each device is selected by the port address decoder in part 1. Ports A, C, D and the control port are directly connected to the microcontroller.***

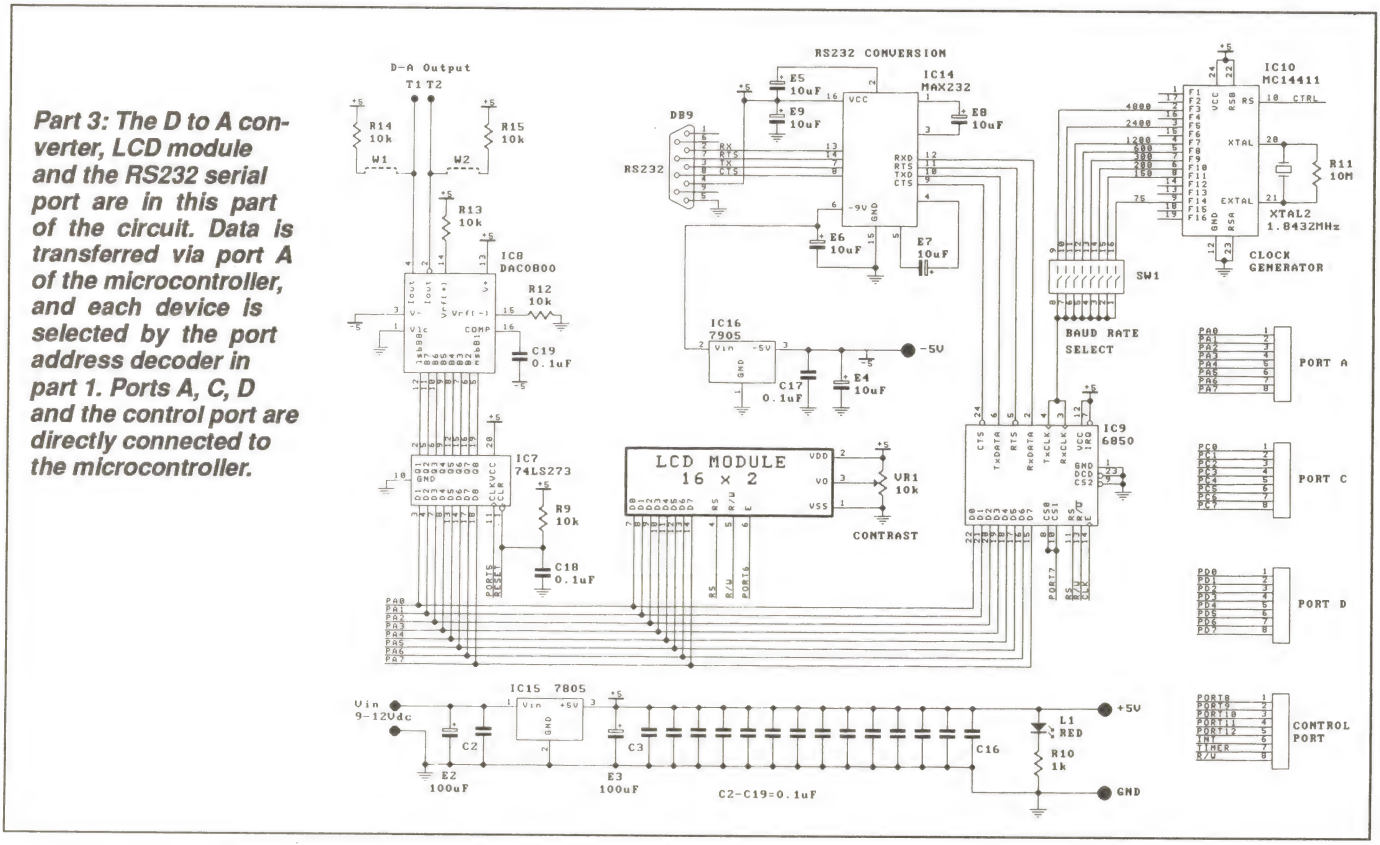


**TABLE 2: Instruction set for LCD module**

| Instruction | Code | | | | | | | | | | Description |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | RS | R/W | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | |
| clear display | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Clears display, returns cursor to home position (address 0) |
| return home | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | X | Returns cursor to home position, returns the display being shifted to original position. DD RAM contents not changed |
| entry mode set | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | I/D | S | Sets the cursor move direction and specifies or not to shift the display. These operations are performed during data write and read. |
| display ON/ OFF control | 0 | 0 | 0 | 0 | 0 | 0 | 1 | D | C | B | Sets ON/OFF of all display (D), cursor ON/OFF (C), and blink of cursor position character (B). |
| cursor and display shift | 0 | 0 | 0 | 0 | 0 | 1 | S/ C | R/ L | X | X | Moves cursor and shifts the display no change to DD RAM contents |
| function set | 0 | 0 | 0 | 0 | 1 | DL | N | F | X | X | Sets interface data length (DL) number of display lines (L) and character font (F) |
| set CG RAM address | 0 | 0 | 0 | 1 | $A_{CG}$ | | | | | | Sets the CG RAM address. CG RAM data is sent and received after this setting. |
| set DD RAM address | 0 | 0 | 1 | $A_{DD}$ | | | | | | | Sets the DD RAM address. DD RAM data is sent and received after this setting. |
| read busy flag & address | 0 | 1 | BF | AC | | | | | | | Reads busy flag (BF) indicating internal operation is being performed and reads address counter contents. |
| write data to CG or DD RAM | 1 | 0 | write data | | | | | | | | Writes data into DD RAM or CG RAM |
| read data from CG or DD RAM | 1 | 1 | read data | | | | | | | | Reads data into DD RAM or CG RAM |
| | I/D: 1 = increment by 1, 0 = decrement by 1<br>S =1: accompanies display shift<br>S/C: 1 = display shift, 0 = cursor move<br>R/L: 1 = shift to right, 0 = shift to left<br>DL: 1 = 8 bits, 0 = 4 bits<br>N: 1 = 2 lines, 0 = 1 line<br>F: 1 = 5 x 10 dots, 0 = 5 x 7 dots<br>BF: 1 = busy, 0 = can accept instruction<br>X = don't care | | | | | | | | | | DD RAM: display RAM<br>CG RAM: character generator RAM<br>$A_{CG}$: CG RAM address<br>$A_{DD}$: DD RAM address, same as cursor address<br>AC: address counter used for both DD and CG RAM address |

All subroutines use the X register to pass data

```
************** DEFINE LABELS ***************
DDRA    EQU  $00     define address of DDRA
DDRB    EQU  $01     define address of DDRB
PORTA   EQU  $03     define address of PORT A
PORTB   EQU  $04     define address of PORT B
*****************************************************
                     Main body of program - initialise
        LDA  #$FF    load accum = $FF
        STA  DDRB    init port B as outputs
        LDA  #$00    load accumulator with $00
        STA  PORTB   de-select all external devices
                     place user code starting here
```

**Listing 1** **Subroutine - write contents of X register into IC3**

```
WRITE_IC3  LDA   #$FF      load accumulator with $FF
           STA   DDRA      make port A outputs
           BCLR  4,PORTB   enable write line
           STX   PORTA     store contents of X reg on bus
           LDA   PORTB     read contents of port B
           AND   #$F0      preserve bits 4-7
           ORA   #$0       set bits 0-3 for address
           STA   PORTB     enable IC3
           LDA   PORTB     read contents of port B
           AND   #$F0      preserve clear  bits 0-3
           STA   PORTB     disable IC3
           RTS             END OF SUBROUTINE
```

**Listing 2** **Subroutine - read contents of IC5 and store in X reg**

```
READ_IC5   LDA   #$00      load accumulator with $00
           STA   DDRA      make port A inputs
           BSET  4,PORTB   enable read line
           LDA   PORTB     read contents of port B
           AND   #$F0      preserve bits 4-7
           ORA   #$03      set bits 0-3 for address
           STA   PORTB     store new address in port B
           LDX   PORTA     read data byte out of IC5
           LDA   PORTB     read contents of portB
           AND   #$F0      preserve bits 4-7, clear bits 0-3
           STA   PORTB     de-select IC5
           RTS             END OF SUBROUTINE
```

**Listing 3** **Some control codes to initialise/control LCD module**

```
           LDX   #$01      clear display control code
           JSR             CONTROL_LCD
           LDX   #$02      return display to home position
           JSR             CONTROL_LCD
           LDX   #$38      set display for 2 lines, 8 bit, 5x7
           JSR             CONTROL_LCD
           LDX   #$06      cursor shift with data write
           JSR             CONTROL_LCD
           LDX   #$0C      display on, cursor off, no blink
           JSR             CONTROL_LCD
           LDX   #$C0      move cursor to new line
           JSR             CONTROL_LCD
```

**Listing 4** **Subroutine - initialise control register of LCD module**

```
CONTROL_LCD LDA  #$FF      load accumulator with $FF
            STA  DDRA      make port A outputs
            STX  PORTA     put control code on bus
            BCLR 4,PORTB   enable write line
            BCLR 5,PORTB   set RS line to control
            LDA  PORTB     read contents of port B
            AND  #$F0      preserve bits 4-7
            ORA  #$06      set bits 0-3 for address
            STA  PORTB     enable LCD module
            LDA  PORT      read contents of port B
            AND  #$F0      preserve bits 4-7
            STA  PORTB     disable LCD module
            RTS            END OF SUBROUTINE
```

**Listing 5** **Subroutine - write a character to the LCD module**

```
WRITE_LCD   LDA  #$FF      load accumulator with $FF
            STA  DDRA      make port A output
            STX  PORTA     put character on bus
            BCLR 4,PORTB   enable write line
            BSET 5,PORTB   RS line select  write to display
            LDA  PORTB     read contents of port B
            AND  #$F0      preserve bits 4-7
            ORA  #$06      set bits 0-3 for address
            STA  PORTB     enable LCD module
            LDA  PORTB     read contents of port B
            AND  #$F0      preserve bits 4-7
            STA  PORTB     disable LCD module
            RTS            END OF SUBROUTINE
```

**Listing 6** **Subroutine - read control status of ACIA**

```
ACIA_CTRL_R LDA  #$00
            STA  DDRA          make port A inputs
            BSET 4,PORTB       enable read (R)
            BCLR  5,PORTB      Select control register (RS)
CR1         BRSET 6,PORTB,CR1  wait here until enable low
            LDA  PORTB         read contents of port B
            AND  #%11110000    preserve bits 4-7
            ORA  #$07          set bits 0-3 for address
            STA  PORTB         enable ACIA
CR2         BRCLR 6,PORTB,CR2  wait here until enable high
            LDX  PORTA         read ACIA control  register of bus
            LDA  PORTB         read contents of port B
            AND  #%11110000    preserve bits 4-7
            STA  PORTB         disable ACIA
            RTS                END OF SUBROUTINE
```

We recommend you use IC sockets, in case your future experiments lead to one or two IC failures. A 40-pin ZIF socket is needed for the microcontroller IC, as this IC will be in and out of the board for programming.

The keyboard and the LCD module solder directly to the PCB. When soldering, use a small temperature-controlled iron, as some of the IC pads are rather small because tracks pass between them.

The two voltage regulator ICs sit flat on the board, and a heatsink is needed for the 7805 (IC15) if you use a 12V plugpack.

As you can see in the photograph of the microcomputer, the prototype is fitted with 4mm terminal posts. While these make it easy to connect other devices to the microcomputer, they are not essential, as you can solder directly to the pads.

A 3.5mm phono type socket is used to connect the external DC supply. This socket solders directly to the PCB, and the earth of the socket is negative. Once you've constructed the board, and after you've thoroughly checked for construction errors, power the board with a 9V to 12V DC (300mA) supply.

However, nothing much will happen until you insert a pre-programmed microcontroller. Otherwise, LED 1 should light, and you might see a few odd characters on the LCD module. The contrast of the display is adjusted with VR1, but you'll probably need to wait until you've got some software operating before you can adjust the display.

## Developing code

Developing software usually starts by constructing flow charts to help define the problem, writing the program in a text editor, assembling the code using a suitable cross-assembler, then running a 68705 simulator development package to test the operation of the program. Once you're happy that the program is working correctly, it's then burnt into a 68705 micro-controller and tested in the microcomputer.

It's always advisable to 'dry run' and debug the program in a simulator first, as it will save you a lot of debugging time. Quite often the simplest coding mistake will result in the most catastrophic result (Priestley's Programming Law!). To help those who are not experienced programmers of the 68705 family, here's a few hints. Also, we've included a number of sample program listings you can use in your programs.

To WRITE data to one of the output data latches (ports 1 or 2) make port A an output by writing $FF into Data Direction Register A (DDRA).

Next store the required data byte in port A, enable the write line by clearing port B bit 4, then select the appropriate device to write to by storing its address in port B bits 0-3. For example, to write data to IC3, store $01 in port B bits 0-3. This enables IC3, which then latches the data from port A to the output of IC3. A $00 is then stored in port B bits 0-3 to disable IC3. A similar method is used for writing to each device on the board. The only difference is to select the appropriate address.

It is best to incorporate I/O routines into subroutines to allow the same piece of code to be called anywhere in a program. This saves memory space, debugging time and makes it much easier to follow a program through. Listing 1 shows a data write routine to port 1.

To READ data from a port, make port A an input port by writing $00 into the Data Direction Register A (DDRA). Enable the read control line by setting port B bit 4 to a 1, then select the appropriate device address to read. Refer to the example in Listing 2.

To display information on the LCD module requires two separate software operations: control and data operations. The control operations set up the features of the display such as display on/off, cursor blink/no blink, while the data operations write the actual data to be displayed to the LCD module. The

*Continued on page 103*

## PARTS LIST

### Resistors

All 1/4W:

| | |
|---|---|
| R1-R8 | 47k |
| R9,R12-15 | 10k |
| R10 | 1k |
| R11 | 10M |
| VR1 | 10k trimpot |

### Capacitors

| | |
|---|---|
| C1 | 22pF ceramic |
| C2-19 | 0.1uF monolithic |
| C20-23 | 220pF ceramic |
| E1 | 1uF/16V electrolytic |
| E2,E3 | 100uF/16V electrolytic |
| E4-E9 | 10uF/16V electrolytic |

### Semiconductors

| | |
|---|---|
| IC1 | 68705 microcontroller |
| IC2 | 74LS245 bi-directional buffer |
| IC3-4,IC7 | 74LS273 octal latch |
| IC5-6 | 74LS244 octal buffer |
| IC8 | DAC0800 D-A converter |
| IC9 | MC6850 ACIA |
| IC10 | MC14411 clock generator |
| IC11 | 74LS154 1 of 16 decoder |
| IC12-13 | 74LS04 hex inverter |
| IC14 | MAX232 RS232 interface |
| IC15 | 7805 TO220 +5V regulator |
| IC16 | 7905 TO220 -5V regulator |

### Miscellaneous

| | |
|---|---|
| LCD | Hitachi 2 x 16 LCD module |
| XTAL1 | 4MHz crystal |
| XTAL2 | 1.8432MHz crystal (large) |

Silk-screened PCB, 340mm x 225mm coded OERP/2; 8-way DIP switch; 3 x 4 matrix keypad; 2 x plug-in links (W1 and W2); 69 x 4mm terminal posts (if required); 3.5mm PCB phono socket; PCB mount DB9 plug; TO220 heatsink; +9V to +12V, 300mA plug pack; PCB mount pushbutton (for RESET); 40-pin ZIF socket; PCB pins (for take-off points).

*This project is copyright to Oatley Electronics. Kits of parts for this project are available from:*

Oatley Electronics
5 Lansdowne Parade,
Oatley West, NSW 2223.
Phone (02) 579 4985
Postal address (mail orders):
PO Box 89, Oatley West NSW 2223.

PCB, all on-board components, sample software, 69 4mm terminal posts...$345
Microcomputer PCB and software disk...$160
2 x 16 character LCD module.....$18
Set of 69 4mm terminal posts.....$60
All other components on PCB.....$110
P&P .....$5

TABLE 3: Definition of 6850 ACIA register contents

| data line number | Buffer address | | | |
|---|---|---|---|---|
| | RS = 1, R/W = 0 Transmit data register Write only | RS = 1, R/W = 1 Receive data register Read only | RS = 0, R/W = 0 Control register Write only | RS = 0, R/W = 1 Status register Read only |
| 0 | data bit 0 | data bit 0 | counter divide select 1 (CRO) | receive data register full |
| 1 | data bit 1 | data bit 1 | counter divide select 2 (CR1) | transmit data register empty |
| 2 | data bit 2 | data bit 2 | word select 1 (CR2) | data carrier detect |
| 3 | data bit 3 | data bit 3 | word select 2 (CR3) | clear to send |
| 4 | data bit 4 | data bit 4 | word select (CR4) | framing error |
| 5 | data bit 5 | data bit 5 | transmit control 1 (CR5) | receiver overrun |
| 6 | data bit 6 | data bit 6 | transmit control (CR6) | parity error |
| 7 | data bit 7 | data bit 7 | receive interrupt enable (CR7) | interrupt request |

# IECS

*SHOP: GRND. FLR., 289 LATROBE ST., MELBOURNE, VIC 3000*
*OFFICE: 1ST. FLR., 289 LATROBE ST., MELBOURNE, VIC 3000*
*MAIL ORDER & CORRESPONDENCE: TO OFFICE ADDRESS.*
*PHONE:(03)602-3499 FAX:(03)670-6006*

ACN 007 296 924
**ELECTRONICS & COMPUTER SUPPLIERS**

**FREE CALL MAIL ORDER HOTLINE (008)335-901**
**ALL MAJOR CREDIT CARDS WELCOME**

NORMAL PRICES CHARGED UNLESS AD PRICES QUOTED. ERRORS & OMMISSIONS EXCEPTED.
**SHOP HOURS:** MON.~THURS. 8:30~5:30 / FRI. 8:30~8:00 / SAT. 9:00~1:30

## NO BRAND DISKETTES




THESE DISKETTES ARE TOP QUALITY, AND JUST AS GOOD AS SOME OF THE "KNOWN" BRANDS.
WHY PAY FOR FANCY PACKAGING?
**FULL SATISFACTION GUARANTEED BY REPLACEMENT OF FAULTY DISKETTES.**

| DESCRIPTION | 1+ | 10+ |
|---|---|---|
| 5.25 360K DSDD | $4.75 | $4.50 |
| 5.25 1.2M DSHD | $8.50 | $8.25 |
| 3.5 720K DSDD | $8.50 | $8.25 |
| 3.5 1.44M DSHD | *SEE BELOW* | |

## ECLIPSE DISK STORAGE BOXES

-WE JUST RECEIVED PALLET LOADS OF THSE QUALITY, DURABLE **AUSTRALIAN MADE** PRODUCT.
-TO MOVE THESE ITEMS QUICKLY, WE ARE OFFERING THEM TO YOU AT **BELOW WHOLESALE PRICE**.
-A VERY POPULAR AND FAST SELLING ITEM THROUGH OUR RETAIL SHOP.

| | NORMAL PRICE | SALE PRICE |
|---|---|---|
| 3.5" 40 PIECE CAPACITY NO LOCK | $6.95 | ***$4.95*** |
| 3.5" 90 PIECE CAPACITY LOCKABLE | $9.95 | ***$7.50*** |
| 5.25" 100 PIECE CAPACITY NO LOCK | $9.95 | ***$7.50*** |
| 5.25" 125 PIECE CAPACITY LOCKABLE | $11.95 | ***$8.95*** |

## POSTAGE RATES

| | |
|---|---|
| $1.00 ~ $9.99 .... | $3.00 |
| $10.00 ~ $24.99 .... | $3.50 |
| $25.00 ~ $49.99 .... | $4.50 |
| $50.00 ~ $99.99 .... | $6.00 |
| $100.00~ $199.99 .... | $7.00 |
| $200.00~ $499.99 .... | $8.00 |
| ***$500.00 PLUS ..... FREE*** | |

**CARRIER CHARGE:**
METROPOLITAN MELBOURNE $7.00
COUNRTY VIC. & INTERSTATE $12.00

**N.B. DOES NOT APPLY TO COMPUTER SYSTEMS. ONLY SMALL ITEMS WILL BE SENT BY POST.**

## STOP WASTING YOUR VALUABLE TIME!!



- EVEN ON A 486 MACHINE, FORMATTING 1.44M DISKS SEEMS TO TAKE FOREVER!!
- WE NOW STOCK **PRE-FORMATTED DISKETTES.**
- 100% ERROR FREE.
- AFFORDABLE PRICE.

NEW

**3.5" 1.44M $11.80** PER BOX OF 10

## FLOPPY DRIVES

1.44M 3.5" FDD ..... **$75.00**
1.2M 5.25" FDD ..... **$90.00**

***1 YEAR WARRANTY!!***
JAPANESE BRAND

## HARD DRIVES

VERY RELIABLE, AND FAST ***CONNER PERIPHERALS*** VOICE COIL IDE DRIVES.

80M CP30084E **$319.00**
120M CP30104H **$349.00**
170M CP30174E **$399.00**
250M CP30254 **$499.00**

***2 YEAR WARRANTY!!***

## DRIVE ADAPTORS

IF YOU'RE INSTALLING A NEW DRIVE INTO YOUR SYSTEM, THEN YOU MAY NEED SOME OF THESE ITEMS.
NOT ALL COMPUTER CASES HAVE THE APPROPRIATE CONNECTIONS OR BAYS.

3.5 HDD BRACKET ..... **$9.95**
3.5 FDD BRACKET ..... **$8.95**
3.5 DATA ADAPTOR .. **$5.95**
3.5 POWER ADAPT ... **$4.50**
5.25 POWER Y-ADPT. **$4.95**

## COMPUTER CASES

- VERY STURDY & STYLISH.
- ALL HARDWARE INCLUDED.
- COMPLETE WITH POWER SUPPLY & CABLE.

| | | |
|---|---|---|
| FLIP-TOP | WERE $89 | ***NOW $79*** |
| MINI-TOWER | WERE $115 | ***NOW $99*** |
| FULL-TOWER | WERE $245 | ***NOW $195*** |

## MOTHERBOARDS

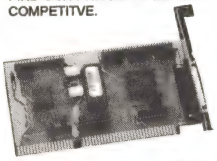
386SX-33 ..... **$145**
386DX-40 128K .... **$229**
486SX-33 ..... **$425**
486SX-33 256K .... **$450**
486DX-33 256K .... **$799**
486DX2-50 256K .. **$1055**
486DX-50 256K .... **$1095**
486DX2-66 256K .. **$1295**

ALL 486DX BOARDS WITH 2 X VESA LOCAL BUS SLOT.

***ALL BOARDS WITH FULL 12 MONTH WARRANTY***

## PERIPHERAL CARDS

- WHETHER YOU'RE REPLACING A FAULTY CARD OR INSTALLING AN ADDITIONAL CARD, WE CAN OFFER YOU THE RIGHT CHOICE.
- COMPARE OUR PRICES WITH OTHER DEALERS. YOU'LL FIND OUR PRICES TO BE VERY COMPETITVE.



XT CLOCK ..... **$22.50**
XT/AT SERIAL (1 POP.) .. **$19.50**
XT/AT PARALLEL ..... **$19.50**
XT/AT GAMES ..... **$19.50**
AT MULTI I/O (2S,1P,1G) **$25.00**
AT IDE/FDD ..... **$22.50**
AT IDE/FDD MULTI I/O .... **$39.00**
MONO/CGA GRAPHICS .. **$45.00**
512K TRIDENT VGA ..... **$69.00**
1M CIRRUS VGA ..... **$95.00**

**VESA LOCAL BUS CARDS**
1M CIRRUS VGA ..... **$175.00**
IDE I/O CONTROLLER .. **$120.00**

***1 YEAR WARRANTY!!***

## QUALITY MOUSE AT ECONOMY PRICE!!

THE FAMOUS
**TRUEMOUSE**

- THREE BUTTONS.
- SELECTABLE BETWEEN MOUSE SYSEMS & MICROSOFT MODES.
- UP TO 800 DPI.
- WITH PAD & HOLDER.

NORMALLY $29.50
***NOW $25***

WE ARE SO CONFIDENT OF THIS PRODUCT THAT WE ARE OFFERING A **7 DAY MONEY BACK GUARANTEE** IF YOU ARE NOT COMPLETELY SATISFIED FOR ANY REASON. THE TRUEMOUSE IS ALSO COVERED BY 12 MONTH WARRANTY.
N.B. ALL RETURNS MUST BE IN ORIGINAL PACKAGE & CONDITION.

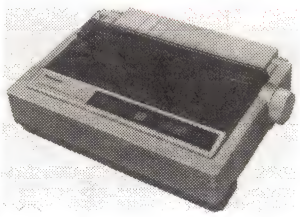
## BNC CONNECTORS

- SUITS STANDARD RG58AU COAX CABLE.
- IDEAL FOR VIDEO OR ETHERNET APPLICATIONS.



| | |
|---|---|
| LINE PLUG (SOLDER) | $2.50 |
| LINE PLUG (CRIMP) | $2.95 |
| LINE SOCKET (SOLDER) | $2.85 |
| PANEL SOCKET | $2.50 |
| SOCKET/SOCKET JOINER | $3.95 |
| T-PIECE SKT/SKT/SKT | $4.50 |
| T-PIECE SKT/PLUG/SKT | $6.50 |

## Panasonic KX-P1121



FEATURES:
- 24 PIN PRINT HEAD.
- 80 COLUMN WIDTH.
- IMPACT DOT MATRIX.
- 3 DRAFT & 3 LQ FONTS.
- 192cps PRINT SPEED (DRAFT).
- 14K INTERNAL BUFFER.
- TRACTOR & FRICTION FEED.

- A TOP BRAND PRINTER PACKED WITH FEATURES.
- THE NAME PANASONIC ENSURES YOU WILL GET QUALITY AND TROUBLE-FREE OPERATION.
- QUIET OPERATION OFFERS LESS DISTRACTION.

UNBELIEVABLY LOW PRICE OF ***$399***

## CERAMIC CAPACITOR CLEARANCE!!

- WE ARE OVER-STOCKED WITH THE FOLLOWING SELECTED VALUES.
- AS YOU CAN SEE, THERE ARE MANY POPULAR VALUES.

NORMALLY $0.15 EACH
ALL FOLLOWING VALUES
***$5.00 / PACK OF 100***

| | | |
|---|---|---|
| 1pF | 2p2F | 3p3F |
| 3p9F | 4p7F | 5p6F |
| 15pF | 18pF | 22pF |
| 27pF | 68pF | 82pF |
| 100pF | 220pF | 330pF |
| 390pF | 560pF | 4700pF |
| 6800pF | 8200pF | 0.01uF |

OFFER VALID FOR THIS MONTH ONLY OR UNTIL STOCKS LAST.

## PRINTER CABLE SELLOUT!!

- CHEAPEST PRICE AROUND.
- 1.8m LENGTH DB25 PLUG TO CENTRONICS PLUG.
- QUALITY MOULDED CONSTRUCTION.

NORMALLY $10.80 **NOW $4.90**

## SEMICONDUCTOR SUPER SALE!!

- PRIME SPEC DEVICES FROM MAJOR MANUFACTURERS.
- NOT SOME FACTORY FLOOR REJECTS SOME OTHERS ARE OFFERING.
- MOST ARE MORE THAN **50% OFF** NORMAL PRICE.

| | NORMAL PRICE | SALE PRICE | | NORMAL PRICE | SALE PRICE |
|---|---|---|---|---|---|
| 1N4001 | $0.10 | **$0.05** | 2N4400 | $0.40 | **$0.25** |
| BR64 | $2.95 | **$1.50** | 8085 | $7.35 | **$3.50** |
| BR354 | $5.50 | **$2.95** | 8259 | $6.50 | **$3.50** |
| BT137-500 | $3.40 | **$1.95** | MAX232 | $9.95 | **$4.50** |
| 4N33 | $1.75 | **$0.95** | 308N | $1.50 | **$0.75** |
| MOC3041 | $3.95 | **$1.95** | 318N | $2.95 | **$1.50** |
| BC107 | $0.95 | **$0.50** | 386N-1 | $1.40 | **$0.70** |
| BC178 | $0.60 | **$0.45** | 75492 | $2.00 | **$1.20** |
| BC317 | $0.45 | **$0.25** | 80C96 | $2.50 | **$1.00** |
| BC556 | $0.20 | **$0.15** | 80C98 | $2.50 | **$1.00** |
| BC559 | $0.15 | **$0.10** | 74HC20 | $0.85 | **$0.50** |
| BD140 | $0.85 | **$0.45** | 74ACT374 | $2.90 | **$1.50** |
| BD647 | $1.50 | **$0.75** | 4011 | $0.80 | **$0.40** |
| MPSA05 | $0.80 | **$0.40** | 4028 | $1.15 | **$0.60** |
| TIP32C | $1.20 | **$0.75** | 4042 | $1.20 | **$0.60** |
| 2N2219A | $0.90 | **$0.60** | 74F175 | $2.05 | **$0.90** |
| PN2222A | $0.30 | **$0.20** | 74LS126 | $1.00 | **$0.45** |
| PN4250A | $0.45 | **$0.30** | 74LS373 | $1.70 | **$0.90** |

OFFER VALID FOR THIS MONTH ONLY OR UNTIL STOCKS LAST.

## SELF-FUSING BUTYL RUBBER TAPE

- JAPANESE NITTO BRAND.
- 0.5mm THICK, 20mm WIDE, 10m ROLL.
- EXCEPTIONAL WEATHERABILITY AND OZONE RESISTANCE.
- EXCELLENT RESISTANCE TO WATER, MOISTURE, AND CHEMICALS.
- PROTECTS WIRE JOINTS AGAINST CORROSION.
- MUCH MORE SECURE THAN ORDINARY PVC TAPE.
- IDEAL FOR AUTOMOTIVE AND MARINE USE.

NEW

GREAT VALUE @ **$9.95**

READER INFO NO. 11

# DICK SMITH ELECTRONICS

# Build it yourself AND SAVE

## Infrared Light Beam Relay



Ideal as a doorminder for a shop or business, or to monitor sensitive areas around the home. This simple project triggers an alarm for a one-second period when someone walks through the beam, so it can be connected to a buzzer or trigger a relay depending on the application. It's a full-form kit with all components, PCB, case, front panel label, plug pack and a relay to maximise the applications.

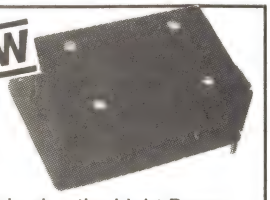
Cat K-3120

$49.95 SILICON CHIP Dec '91

## NEW

*Increases The Range Of The Light Beam Relay Kit*

## Light Beam Extender



Designed to go with our existing Light Beam Relay project (K-3120). By disabling the internal transmitter circuit of the original project (K-3120) and using the Light Beam Extender in its place, you can have a greater range. It uses a 555 timer IC and a transistor to pulse two IR LED's at a frequency of about 2kHz and effectively increases the working range to about 5 metres - two and a half times the original. Comes complete with all components, hardware including an IC socket for the 555 timer and a mini zippy box to house your project.

Cat K-3122

SILICON CHIP July '93 $9.95

## NEW

## Incircuit Transistor Tester




SILICON CHIP Sep '93 $22.95

You'll find this Transistor Tester extremely handy for indicating whether or not transistors are working properly and for distinguishing between NPN and PNP types. It can test both small signal and power transistors and, if faulty, indication will be given by a LED display. Additionally, the kit can be used to test transistors that are already in circuit so you'll find it invaluable for trouble-shooting. Kits will come complete with all components, PCB, hardware (including test clips), case and a pre-punched silk-screened front panel.

Cat K-7218

## NEW

*Quality Home Movie Editing*

## Colour Video Fader



You'll solve all your messy editing problems once you build this colour video fader! Now you can make clean edits from one scene to the next on your VCR without having to buy a top-of-the-line model! The video fader accepts any colour or black and white composite PAL video signal and can fade it smoothly down to a black screen and back up again, providing you with a professional transition from one scene to the next. Plus, it lets you create special effects with its additional "wipe screen" facility. Comes complete with all components, PCB, hardware including easy-to-mount one-hole 2.1mm DC socket, zippy box, IC sockets, front panel and case side labels.

Cat K-5410

SILICON CHIP Aug '93 $32.95

## NEW

*Automatically Controls Temperature*

## Temperature Control Switch



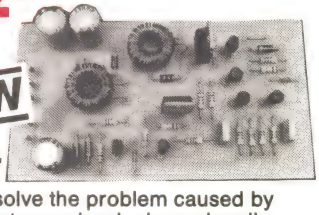

An ingenious kit that proves very useful for many applications such as: Ovens, room temperature control, fish tank heaters, animal enclosure heaters or cooling devices such as fans and water pumps. With a maximum allowable load of 7.5 Amps (1800 VA), the temperature controller automatically switches the power on or off when the temperature goes below or above a set threshold. The project utilises our existing Y-5011 dual display digital thermometer, which comes complete with internal and external temperature sensors and can be programmed to sound an alarm if the temperature is below or above a certain threshold. The kit comes in full form with all components, hardware, digital temperature module, deluxe case, flush mount mains socket, pre-punched screened front panel and pre-punched rear panel.

Cat K-3130

EA Aug '93 $99

## NEW

## 5V DC To ±12VDC Converter



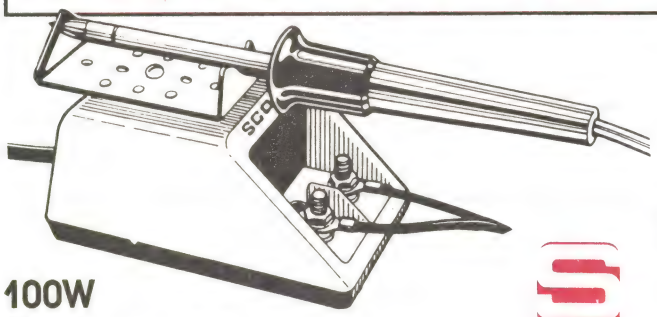
A low-cost project designed to resolve the problem caused by using plug packs when your projects require dual supply rails. No plug packs that are readily available supply this and, while there are alternatives to obtaining dual supply, they are considerably more complicated and time consuming. This kit will produce separate positive and negative 12V rails (at currents of up to 100mA) from an input supply of anything between 5 to 10VDC and you can easily adjust the output voltage to suit your own application. Plus, it can run on any source of power including: Rectified DC voltage from the mains, solar or car battery. Comes in short form, complete with all components and PCB.

Cat K-3229

SILICON CHIP Sep '93 $18.95

**Please Contact Your Nearest Store For Availability As Some Kits May Still Be In Production.**

# See us for all your SOLDERING EQUIPMENT



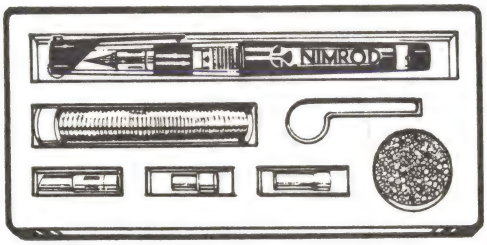
## 100W Soldering System

SCOPE

With manual temperature control, the Superscope is a heavy-duty iron that heats up fast - from cold to operating temperature, in just six seconds. It has a huge 100-watt capacity, auto-off function and long-life stainless steel barrel. With matching high quality, low voltage transformer (4V @ 30A), it comes in a tough polypropylene case with iron rest.

Cat T-1640

**$149**




NIMROD®

**BONUS GAS REFILL**

*Soldering On The Go!*

## Portable Soldering Kit

**SAVE $10**

This butane-powered, temperature-controlled (400-1300*C) soldering iron comes with many accessories: Includes stand, solder (with dispenser), tip cleaner, hot air tip and hot knife tip. It's ideal for outdoor work (no power point is required) and packs neatly into its own cushioned case.

Cat T-1395 *Bonus Gas Refill (N-1085) valued at **$6.95**

**$64.95**



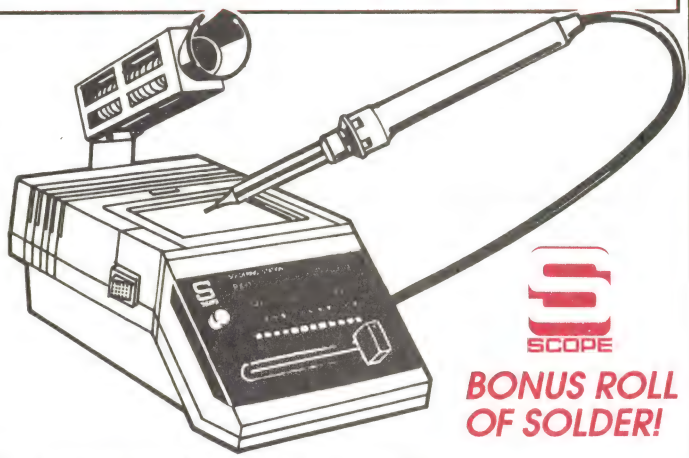
**25% OFF!**

## 5-Piece Soldering Kit

A quality Scope soldering iron that comes complete with resin-core solder, an iron stand and cleaning sponge, plus two screwdrivers. It's an ideal general-purpose iron that's rated at 20W 240V.

Cat T-1650

**$29.95**



SCOPE

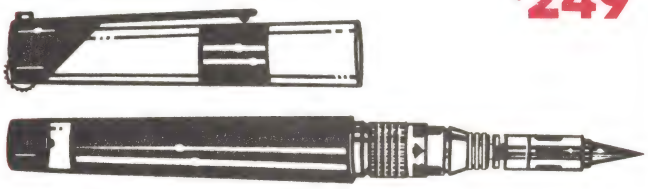
**BONUS ROLL OF SOLDER!**

## Scope PX-1 75W Soldering Iron

Perfect for serious soldering at an affordable price. It features accurate temperature control, (200-450*C), an easy to read twelve-zone, three-colour bargraph temperature read-out, the latest Japanese tip technology (zirconium/tungsten) and an incredibly lightweight iron. The PTC element means that it idles at 45W, but the minute you put it under load it delivers up to 75W (this dramatically reduces temperature drift).

Cat T-1010

**$249**

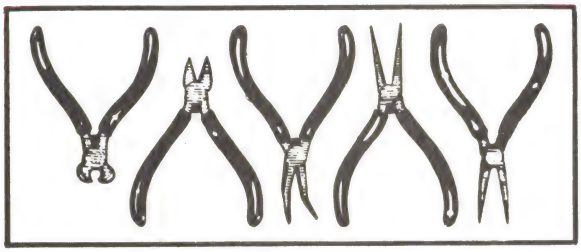


## Butane Soldering Iron

Four tools in one! This pocket-sized butane powered soldering iron offers fully adjustable temperature control (400-1300*C) and a transparent gas window so that you won't run out in the middle of the job. Plus, with the optional tips you can turn it into a handy blowtorch, hot knife and hot air gun.

(Gas not included). Cat T-1385

**$39.95**



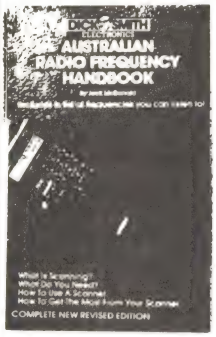
## 5-Piece Plier Set

A quality set of drop forged high carbon steel pliers. With 127mm bent nose, 127mm flat nose, 115mm diagonal cutting and 115mm end cutting types in a handy plastic pouch.

Cat T-3295

**$29.95**

# TUNE IN ON FREQUENCIES!




## Dick Smith's Australian Frequency handbook

An essential book for anyone into scanning. This edition provides you with information on using your scanner, as well as codes and marine bands. It includes a glossary of scanner terms, frequency directory and more!

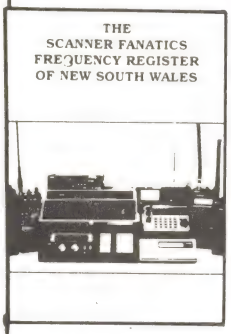
Cat B-9601 **$12.95**




## Register Of Government Radio Frequencies NSW/ ACT/ Victoria

A frequency list of Government services in NSW, Canberra and Victoria. Includes frequency allocations and radio codes for Police, Fire Brigades, State Emergency Centres and more. Other frequency allocations include Foreign Embassies, QANTAS airways and the Department of Defence.

Cat B-4100 **$29.95**




## Scanner Fanatics' Frequency Registers

The complete listing of scanner frequencies covering the 35MHz to 900MHz range. If you want to listen in, you'll almost certainly find the frequency in these books: Ambulance, Police, State Emergency Services, Aviation, plus hundreds of other frequencies. All the scanners listed in the series operate over 5 watts or more. Now also available for South Australia, Northern Territory and Tasmania. **$24.95**

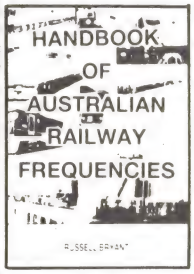
| | |
|---|---|
| N.S.W. | Cat B-4102 |
| Queensland | Cat B-4108 |
| Victoria | Cat B-4104 |
| West Australia | Cat B-4106 |
| South Australia and Northern Territory | Cat B-4110 |
| Tasmania | Cat B-4111 **$19.95** |




## Listening Into Aircraft Radio

The most comprehensive monitor's guide to air traffic frequencies, terminology and procedures available! Tells you where to find air traffic control, military aircraft and air ambulance frequencies. Plus, it has aeronautical addressing and reporting, typical messages, tracking an aircraft in flight and a list of books and magazines to enhance your monitoring.

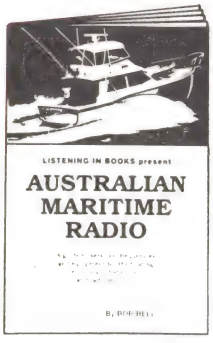
Cat B-4112 **$24.95**




## Australian Railways Frequencies Handbook

Railways enthusiasts and avid scanner fanatics will love this one! It gives a complete listing of Australian Railways (and New Zealand Railways) radio frequencies, glossary of railway terms, an explanation of radio terms, track and gauge data, locomotive rosters and system maps.

Cat B-4114 **$19.95**




*For Quiet Days At Sea!*

## Australian Maritime Radio

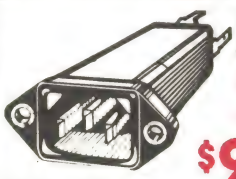
This handy book was written especially for the boating enthusiast, fisherman and radio monitor and it contains all the vital statistics and important information on services, frequencies and equipment.

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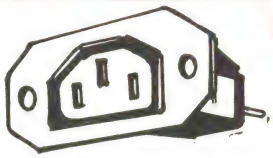
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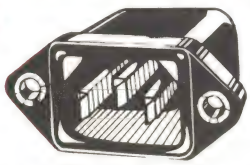
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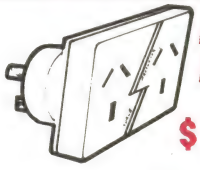
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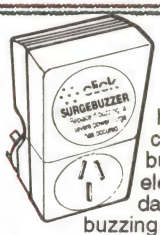
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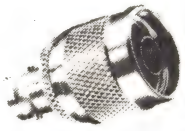
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**STORES ACROSS AUSTRALIA AND NEW ZEALAND**

# Circuit & Design Ideas

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

## Variable supply for masthead amp

By varying the supply voltage to my masthead amplifier, I have been able to improve the quality of my TV reception on both VHF and UHF. It has allowed me to reduce interference and to peak the channel selected (which reduces the amount of 'snow'). However, just why it works, I don't know!

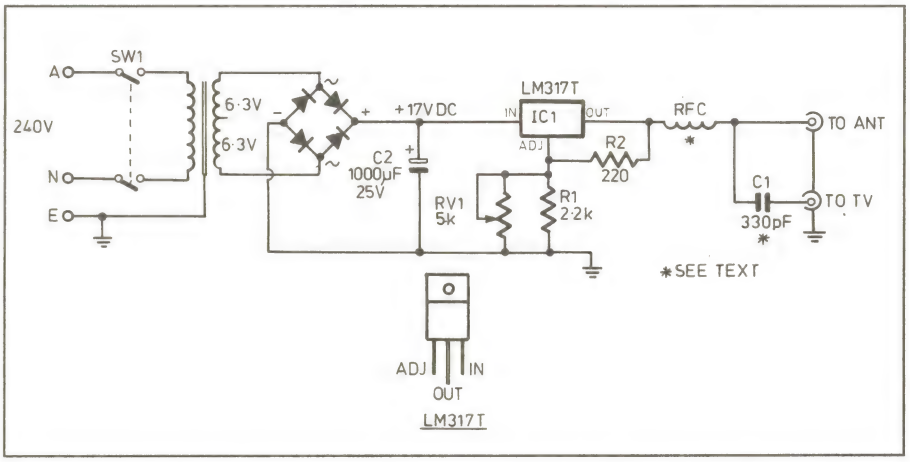
The 12V output from the secondary winding of the transformer is fed via a bridge rectifier and smoothing capacitor to an LM317T regulator (IC1), which is capable of varying from 1.2V - 37V. The regulated output then goes via a radio frequency choke (RFC) to the TV masthead amplifier (an OM350 IC).

The parallel combination of the 2.2k resistor R1 and the 5k variable resistor RV1 (I don't know of anyone who makes a 2k pot) limits the maximum output voltage to approximately 12V. The approximate output voltage is given by the formula: $V_{OUT} = 1.25V \times (1 + R2/R1)$.

The RFC consists of six turns of 22 B&S enamel wire, wound on a 13mm balun core (DSE Cat. R-5445). And the value of capacitor C1 varies when you inspect different published masthead amplifier circuits. An *ETI* UHF circuit used 330pF, its VHF circuit used 1nF, while a Dick Smith design had 10nF. The most recent *EA* VHF-UHF design (May 1992) also used 1nF.

I have used my circuit with two masthead ICs (OM350 and OM321), and varying the supply voltage improved the reception for both. For example, for a VHF Victorian TV channel, approximately +8V supply reduced snow and interference by 30%; and for the UHF 'Prime, Southern Cross, approximately +3V reduced the snow by 50 - 70%.

A. Wasylenko,
Mt Gambier, SA **$40**




## Lights after dark

I needed a circuit to turn the lights on after dark, then off again in the morning. It had to be economical on power drain, and run off a power supply that varies from 12-15V DC. (This is because my power system is solar/hydro and the battery bank is 12V DC).

The attached circuit is the final design, and fulfills the need very nicely — it only draws around 10-15mA when not triggered.

I used a surplus 3-pole 2-way relay of Fuji brand, but almost any 12V relay with a coil resistance greater than 60 ohms can be used. My LDR is one from a pack of surplus types, unbranded (obtained from Tandy), and all the types in the pack worked with the circuit.

Values are not critical. The 10k resistors (R1-R3) could be reduced to 4.7k or increased to 15k or 18k, and the circuit will still work properly.

Note, however, that if the values of R2-R4 are decreased too much then the quiescent currents through transistors Q1 and Q2 will increase. I tried several brands of 555, from a Motorola through to a CMOS type, and an unbranded one — all worked OK, though some had a bigger hysteresis than others.

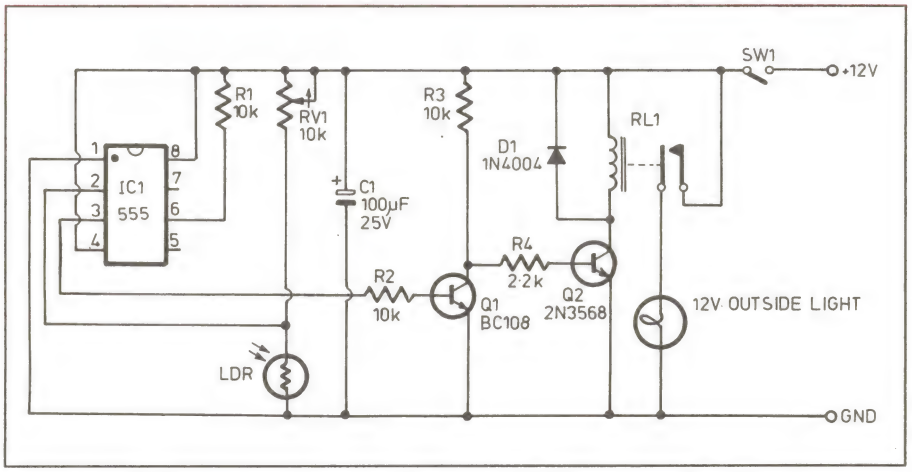
The 10k pot RV1 could be a trimmer or an old pot from a TV, etc., and can range from 500k down to 5k. Just don't expect as fine a control with a 500k pot, as it will be a mite touchy to adjust.

(If you do use a 500k pot, then put a 100k resistor in parallel to reduce the range).

The power supply can be anywhere from 6-20V (with the appropriate relay). Orientate the LDR towards the sun and cover it with a small glass jar. I originally used a plastic film can, but the UV got to it in the space of six months.

My unit is built into a small box, 150mm square, and mounted beneath the fuse box with the light mounted on top.

Peter Laughton,
Albion Park, NSW **$40**



## 'Over-drive' circuit

This circuit is a professional quality over-drive and can give excellent results even with low cost guitars.

The control is exercised by a Tshebyshev low-pass filter, composed of IC1 (741), resistors R8 and R10, and capacitors C7 and C8. Its frequency is chosen in accordance with the characteristic tone of the human voice. The cut-off frequency is calculated by the equation:

$$f = 1/(2 \times \pi \times \sqrt{(R8 \times R10 \times C7 \times C8)}) = 2.12\text{kHz}$$

All guitars have an effective 'built-in' filter because of the nature of their sensing element. The inductance of the pickup coil, along with its associated capacitance, acts as a low-pass filter. If the sensing element has a large number of turns, it produces a powerful signal, with its cutoff frequency range from 1-2kHz. A cheaper element will have fewer turns, and its frequency cutoff will be from 2-5kHz. If there is a low resistance in the volume control in the guitar, or a low input resistance in the over-drive circuit, this can shunt the filter — and the filter won't work properly.

If the filter in front of the over-drive does not have a large Q-factor, then the sound will be poor and 'flat'. This will also happen if the filter has too high a cutoff frequency. Moreover, in these cases, the over-drive will produce a lot of crosstalk harmonics which decrease the sound quality.

The schematic shows a design that overcomes these problems. The input low-pass filter R3/C4 suppresses RF noise from radio stations. The first stage of the circuit (around Q1) is configured as a source follower.

The resistance of R4 or R5 may be changed for bias voltage adjusting. A FET is used to keep the input resistance sufficiently high to avoid overloading the guitar filter. As well as having a high input impedance, a FET also produces less noise.

The second stage (IC1) is the low-pass Tshebyshev filter mentioned earlier. Its Q-factor may be changed by trimpot RV1 — but playing the guitar with a very high Q-factor must be avoided because of possible self-oscillation of the filter. For high accuracy, a 10-turn trimpot may be used.

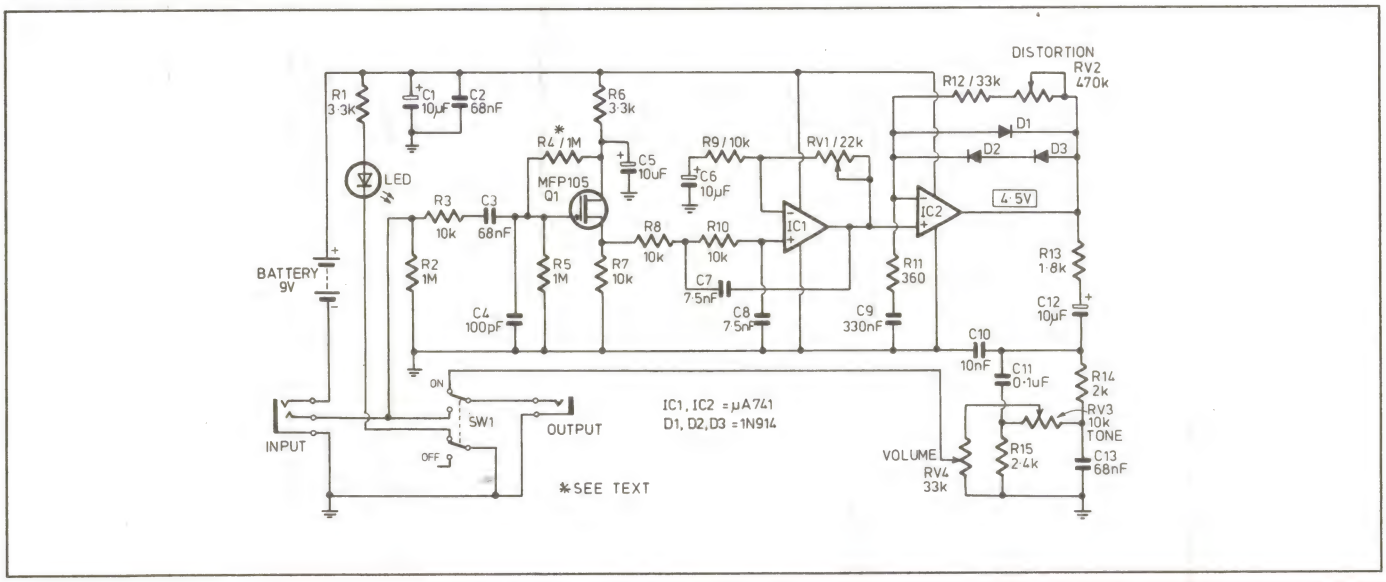
The third stage (IC2) is a clipper-amplifier, together with a non-linear high-pass filter. It is the 'soul' of any good over-drive. Most amateur fuzzes and over-drives consist only of clipper-amplifiers, and their results are poor. If an input signal is low, this stage works as a high-pass filter-amplifier. It has a gain between 39 and 63dB (determined by the setting of RV2) for frequencies below the cutoff of 1.3kHz (determined by R11/C9).

For high input signals, it has a flat characteristic over the full frequency range — the diodes D1 - D3 clip any large feedback signal, giving a constant gain. Note that there are two diodes (D2, D3) in the feedback path when the output of IC2 is positive, but only one (D1) when negative. The extra diode compensates for the larger voltage drop across R12 + RV2 in the first case, caused by the larger current flowing into the inverting input NPN transistor of the IC.

Finally, the output low-pass filter R13/C10 rejects part of higher output harmonics to make a 'softer' sound, while pot RV3 provides a loudness-balanced tone control and RV4 is used for volume control.

Alexei Kouznetsov,
Pennington, SA **$45**

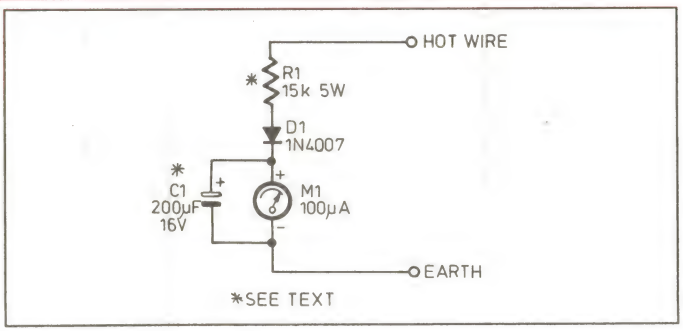
*(Editors Note: The author quotes an unknown type for resistor Q1. Any audio N-channel JFET like the MPF105 should be suitable.)*




## Electric fence tester

This circuit was built, using junked parts, to be able to measure the voltage on an electric fence. It gives a full scale reading up to 7.5kV, and indicates a reading (on low power units) where some of the fancy digital units don't.

The values of resistor R1 and capacitor C1 are chosen to give a full scale reading. R1 should be as high as possible, while C1 will give a slow or fast response, depending on the value selected. Since most of the voltage drop occurs across R1, C1 need only have a low voltage rating. I housed the unit in a small plastic box, with two insulated alligator clips used to make the connections to the hot wire and earth. The unit has been left connected to an electric fence for 24 hours without any damage to the circuit.




G. Fella,
Dandenong, Vic **$30**

## *Construction Project:*

# IMPROVED DECODER FOR ACS SIGNALS - 1

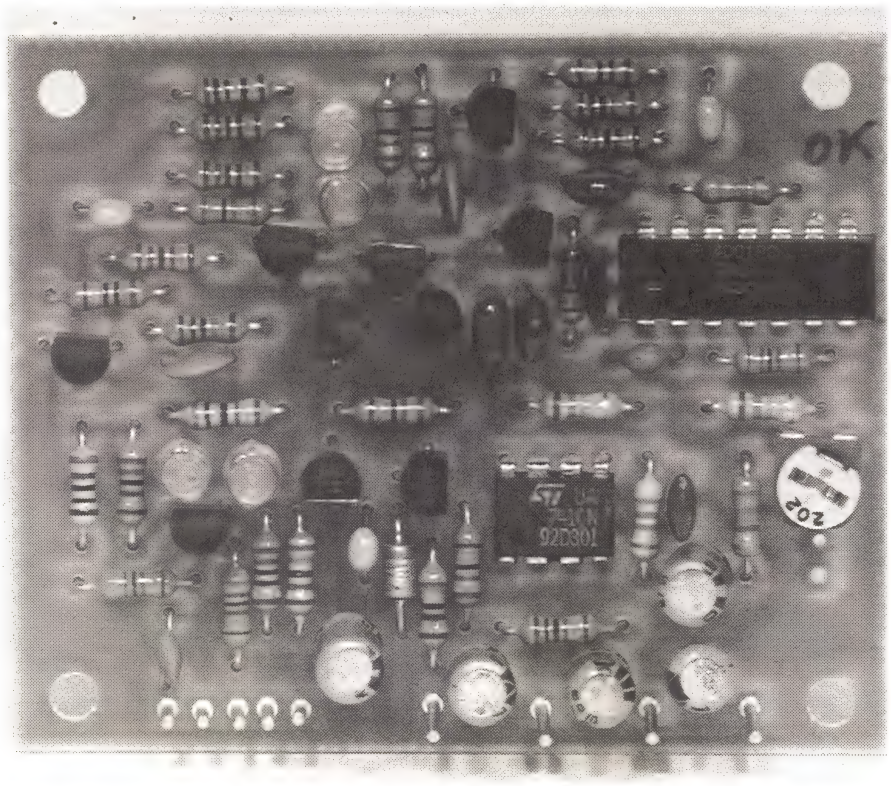
As some *EA* readers may be aware, many of Australia's FM broadcasters are now radiating either one or two 'piggyback' ACS subcarrier signals in addition to their main programme. All you need, in order to listen to these 'hidden' signals, is an FM receiver fitted with an ACS decoder. This article describes a new low cost decoder, which can receive either of the standard subcarriers at the flick of a switch, and has also been designed to overcome some of the other shortcomings of earlier designs. In later articles, we'll show exactly how to fit the new decoder into two readily-available FM radios.

**by BOB PARKER**

What is an ACS decoder and why would you add one to your FM radio, you might well ask. Well, 'ACS' stands for Ancillary Communication Service, and refers to the technique whereby an existing FM broadcast transmitter is used to carry one or two special-purpose audio channels in addition to its normal stereo signal. Only a receiver equipped with a matching decoder can recover the ACS audio; all normal FM receivers behave as though it doesn't exist, and your favorite FM station may be transmitting one or two additional programs without having given you the slightest hint of their presence!

But who uses this transmission system, and what for? Probably the biggest users are the companies who distribute background music to shopping centres, offices etc., who are no longer tied to using Telecom landlines as they were before ACS was available. And then there are some supermarket chains, who supply their own programmes to their stores.

Other organisations use the ACS system to broadcast programs such as news and special-interest/foreign language material, to people they provide with radios fitted with ACS decoders.



*This view of our new ACS decoder is almost twice actual size. It's really tiny!*

### How ACS works

The usual FM stereo transmission consists of three components: a Left-plus-Right mono signal, a 19kHz 'pilot tone' and a multiplex Left-minus-Right signal. These together modulate the carrier with a composite stereo signal occupying the frequency band from 30Hz to 53kHz.

The additional ACS channel(s) are added by frequency modulating a 67kHz and/or 92kHz subcarrier with ACS audio. Then these subcarriers are mixed at relatively low level with the existing composite stereo signal, and used to modulate the main carrier.

Before modulating its ACS subcarrier, the audio signal is first subjected to a large amount of dynamic range compression; then high frequency pre-emphasis — which, after complementary de-emphasis in the receiver, helps to combat noise.

At the receive end, the ACS decoder basically reverses the modulation process. First it 'takes a sniff' directly from the FM receiver's discriminator output, before any stereo decoding or de-emphasis can annihilate the high-frequency ACS subcarrier(s).

Then it filters the selected frequency-

modulated ACS subcarrier from amongst the normal stereo signal components and any other ACS subcarrier, recovers the audio signal from the modulation, and applies high frequency de-emphasis.

(For those interested in the finer technical points of ACS, I recommend reading 'Piggyback FM Broadcasting Reaches Australia', in *Electronics Australia*, August 1987, page 90.)

## Limitations

Under reasonable conditions, the ACS system can give very good results for its intended uses — even in portable FM radios. But at the same time, it has definite limitations.

The ACS signals are mono, and their frequency response extends to only about five or 6kHz — so don't expect to hear scintillating treble. You'll also need a reasonably strong signal to avoid excessive hiss, because the FM station uses a relatively low effective deviation for the ACS signals.

It's also only fair to warn you in advance that multipath reception conditions degrade the performance of the ACS system. In television these conditions cause 'ghosts', and in FM broadcasting they produce spurious amplitude and phase modulation.

In its mild form, the result is that the primary FM audio 'leaks' into the ACS audio to varying degrees (and poor receiver IF/detector design can have the same effect). At its worst, distortion on the primary channel modulation peaks can completely break up the ACS audio with loud crackles and hisses.

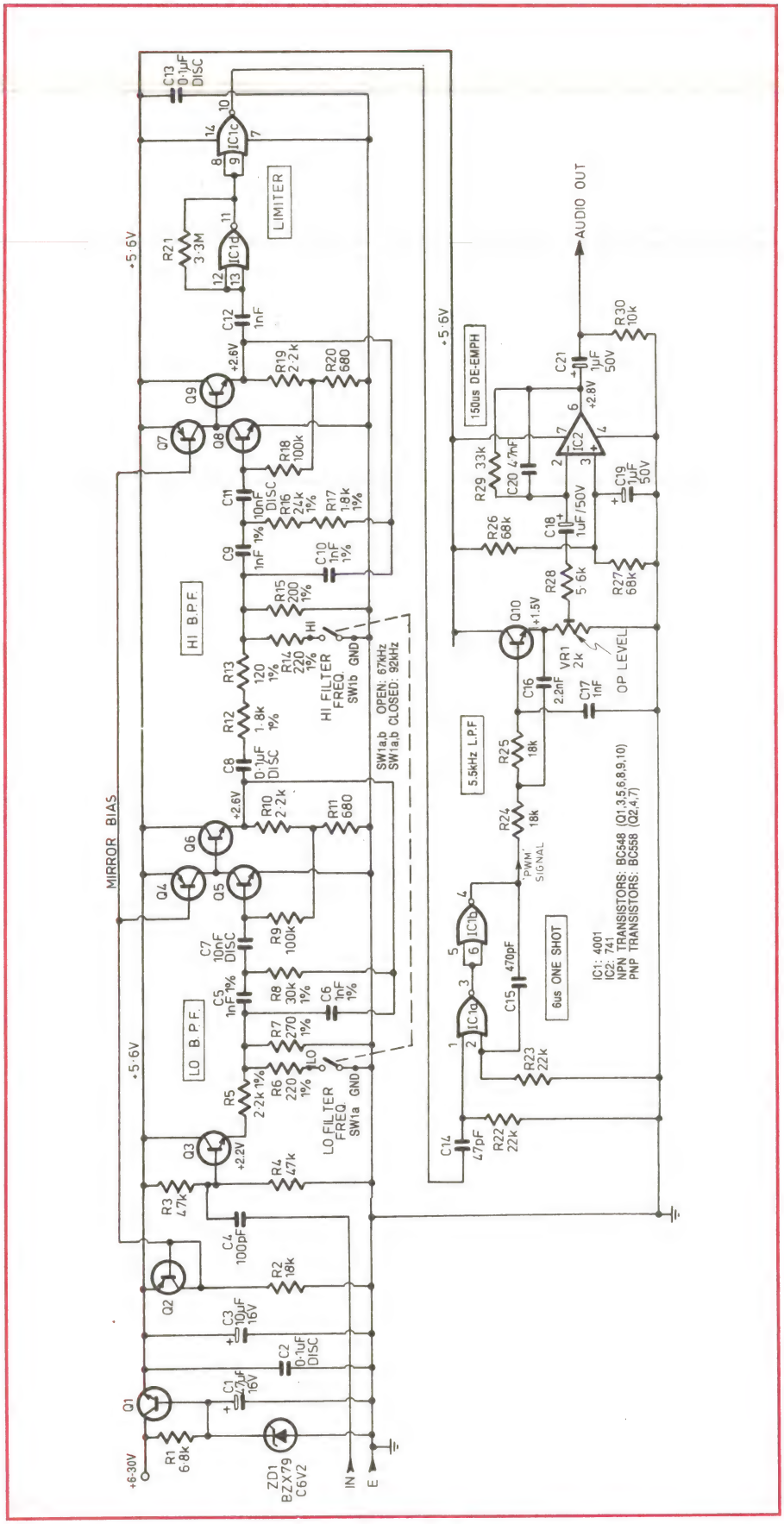
While these multipath problems can affect a whole district, the problem can almost always be largely alleviated by repositioning and/or re-orientating the receiver's antenna.

## Our new decoder

In order to make this design flexible and compatible with the widest possible range of FM receivers/tuners, it can be powered from a supply of anywhere between +6V (or a bit less) to around 30V, with a current drain of less than 10mA. It requires no adjustment, except to match its audio output level (of up to about 500mV RMS) with that of the receiver in which it's installed.

With everything except the switches mounted on a PC board measuring only 67 x 54mm, it is compact enough to be fitted inside all but the smallest receivers and tuners.

As noted earlier it can be switched to decode either the 67kHz or 92kHz




***As you can see from the schematic, the decoder uses only two low cost ICs plus a handful of discrete transistors, resistors and capacitors. The only setting up adjustment is VR1, used to control the audio output level.***

# Improved decoder for ACS signals - 1

standard ACS subcarriers, using a simple two-pole switch.

By the way, if you live outside Sydney, Melbourne or Canberra, where FM stations are *known* to be transmitting ACS signals, we suggest that before building the decoder it would be a good idea to check with your local FM stations and/or the Department of Transport and Communications to establish whether or not there are ACS transmissions in your area. You may be unlucky, and have no ACS signals to decode in your area!

## How it works

Transistor Q1 functions as a +5.6V power supply regulator and active filter. A discrete design was chosen because it has a lower minimum voltage drop than an IC regulator.

Input coupling capacitor C4 blocks any DC component present at the receiver's FM discriminator, and in combination with R3 and R4 largely attenuates all frequencies below the ACS subcarriers. Emitter follower Q3 ensures minimal loading of the discriminator output, while providing a low source impedance to the following bandpass filter.

In order to extract one subcarrier and its (relatively wide) frequency deviation of about +/-6kHz, from the rest of the signals present, the circuit uses two frequency-switchable active bandpass filter sections of the multiple-feedback type in cascade.

Unfortunately this filter configuration, while simple, requires far more gain from its amplifier section at the subcarrier frequencies than any normal IC op-amp can provide, and that's why the circuit is full of transistors (remember those little black things with only three legs?). Q5 and Q8 are configured as normal common-emitter amplifiers, but instead of resistors as their collector loads they have Q4 and Q7 functioning as constant current sources, which increases their voltage gain enormously.

Q4 and Q7, along with reference transistor Q2, form a 'current mirror' circuit, in which the collector current of Q2, determined by R2, is almost exactly duplicated in Q4/Q5 and Q7/Q8. Emitter followers Q6 and Q9 are required to drive the stages following each filter section, and provide impedance matching.

The frequency of the first filter section is preset by the values of R5, R7, R8, C5 and C6. These are all 1% components, so no adjustment is required. With SW1a open, the centre frequency is about 59.2kHz, while with SW1a closed and R6 in circuit, the centre frequency shifts to 84.7kHz.

The second filter section works on exactly the same principle, the difference being that with SW1b open, its centre frequency is 74.2kHz while with SW1b closed it becomes 98.8kHz. So the overall result is that with SW1a and SW1b both open, the combined filter responses pass the 67kHz subcarrier and its frequency deviation; alternatively with SW1a and SW1b both closed, they pass the 92kHz subcarrier and its deviation.

By the way, the 1% tolerance 1nF polystyrene capacitors used for C5, C6, C9 and C10 are currently stocked by Dick Smith Electronics (Cat.No. R-2780). That's the only 1% tolerance polystyrene cap that seems to be readily available, which is why I designed the circuit to use this value...

After extraction by the 'front end' filters, the selected subcarrier is applied through C12 to the inputs of CMOS NOR gate IC1d. Because of R21, this gate 'self-biases' and functions as a high gain amplifier, with a severely clipped output. This clipped signal is then given the same treatment by IC1c, the output of which is a square wave with very sharp edges.

In FM receiver terms the foregoing is called 'limiting', a process which removes all amplitude modulation (including noise pulses etc.), and retains only the FM component of the signal.

In a break with tradition, this new decoder does not use a phase locked loop FM demodulator. Rather it uses a technique sometimes called a 'tachometer' or 'pulse counting' circuit — which is very simple, has inherently low distortion, and requires no adjustment.

IC1a and IC1b are configured as a 'one-shot' multivibrator, whose output pulse length is about 6us, determined by C15 and R23. For every cycle of subcarrier, C14 delivers a 0.6us trigger pulse to one input of IC1a, resulting in a 6us pulse at IC1b, pin 4. What this means is that the higher the instantaneous frequency of the subcarrier, the more 6us


### COPYRIGHT WARNING

It is our understanding that although anyone is legally permitted to demodulate and privately listen to ACS transmissions, the actual program content of most, if not all, such transmissons is protected by copyright. So **DO NOT** record these signals, or cause them to be publicly performed by feeding them into a public address system, telephone music-on-hold facility etc., without the authority of the program provider.


### PARTS LIST: BASIC ACS DECODER

***Resistors***

All 0.25W 5% unless specified:

| | |
|---|---|
| R1 | 6.8k |
| R2,24,25 | 18k |
| R3,4 | 47k |
| R5 | 2.2k 1% |
| R6,14 | 220 ohms 1% |
| R7 | 270 ohms 1% |
| R8 | 30k 1% |
| R9,18 | 100k |
| R10,19 | 2.2k |
| R11,20 | 680 ohms |
| R12,17 | 1.8k 1% |
| R13 | 120 ohms 1% |
| R15 | 200 ohms 1% |
| R16 | 24k 1% |
| R21 | 3.3M |
| R22,23 | 22k |
| R26,27 | 68k |
| R28 | 5.6k |
| R29 | 33k |
| R30 | 10k |
| VR1 | 2k trimpot (horiz. mount) |

***Capacitors***

| | |
|---|---|
| C1 | 47uF 16VW RB electrolytic |
| C2,8,13 | 0.1uF disc ceramic |
| C3 | 10uF 16VW RB electrolytic |
| C4 | 100pF disc ceramic |
| C5,6, 9,10 | 1nF 1% polystyrene (see text) |
| C7,11 | 10nF disc ceramic |
| C12,17 | 1nF metallised polyester |
| C14 | 47pF disc ceramic |
| C15 | 470pF disc ceramic |
| C16 | 2.2nF metallised polyester |
| C18,19,21 | 1uF 50VW RB electrolytic |
| C20 | 4.7nF metallised polyester |

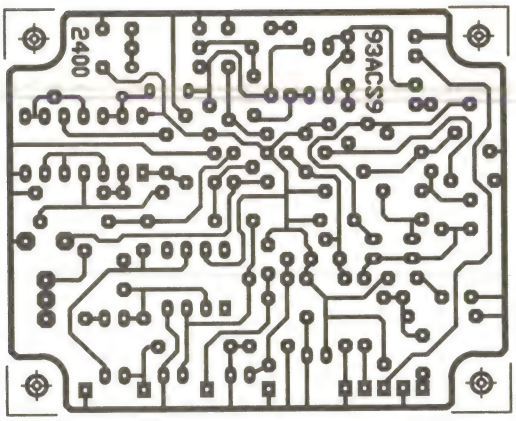
***Semiconductors***

| | |
|---|---|
| ZD1 | 6.2V 400mW zener diode |
| IC1 | 4001 CMOS quad NOR gate IC |
| IC2 | 741 op-amp |
| Q1,3,5,6, 8,9,10 | BC548 NPN transistor |
| Q2,4,7 | BC558 PNP transistor |

***Miscellaneous***

PC board, 67 x 54mm, code 93acs9; nine PCB pins; either two DPDT toggle switches, or one four-pole three position switch, as desired; four 3mm mounting screws, with nuts, spacers, etc; shielded audio cable, hookup wire etc.

*Note: Etched PC boards for this project are available from RCS Radio, of 651 Forest Road, Bexley NSW 2207. The boards are of high quality, have silk-screened component outlines and codes on the component side and solder resist masking on the copper side. They are priced at $12.40 each, plus $2.00 packing and postage within Australia if applicable.*




***As usual, this PCB pattern is reproduced here actual size, for those who wish to etch their own. It's designed to accept all common varieties of mini trimpots.***

pulses are generated per unit time — and so the higher becomes the average voltage of the pulse train waveform at pin 4 of IC1d.

R24, R25, C16, C17 and Q10 all form an active low-pass filter, with a cutoff frequency of about 5.5kHz. As a result, what went into R24 as a stream of 6us pulses appears as a frequency-proportional voltage at the top of VR1, the output level control pot.

Now all that remains to be done is to amplify and de-emphasise the audio signal present on VR1's wiper, which is IC2's job. R26 and R27 bias its output to half the supply voltage, the ratio of R29/R28 set the maximum output level of about 500mV RMS, and R29 + C20 (giving a 150us time constant) provide the gain/frequency de-emphasis curve required to restore the correct frequency response and remove most of the noise.

## Suitable FM radios

Naturally, prior to commencing this project, you'll need to select a suitable FM receiver or tuner in which to install it! For a start you'll need one in which there's enough room to comfortably mount the 67 x 54mm PC board, keeping it right away from any 240V wiring for safety.

Just about any stereo receiver should provide more than enough ACS subcarrier signal to keep this circuit happy, and so will many mono ones. It'll make things far easier if you have access to an oscilloscope, with which to search for the discriminator audio output and the ACS subcarriers superimposed thereon, and/or a circuit diagram of the receiver.

The point to connect to the 'IN' pin on the ACS board will be one around the FM discriminator transformer/diodes, or detector IC and quadrature coil, or alternately on the input pin of the stereo decoder IC, and it will contain audio plus lots of frequency components around 19 - 50kHz. If the selected FM station is transmitting ACS, small 'wiggles' should be visible on the audio waveform, in addition to the much 'longer' 19kHz pilot tone, on the CRO's 20us/division timebase position.

Next, your receiver's power supply must be capable of supplying the power requirements of this circuit: +6 to 30V DC at less than 10mA, which should include all mains-powered tuners/-receivers and many portable receivers with batteries of more than four cells.

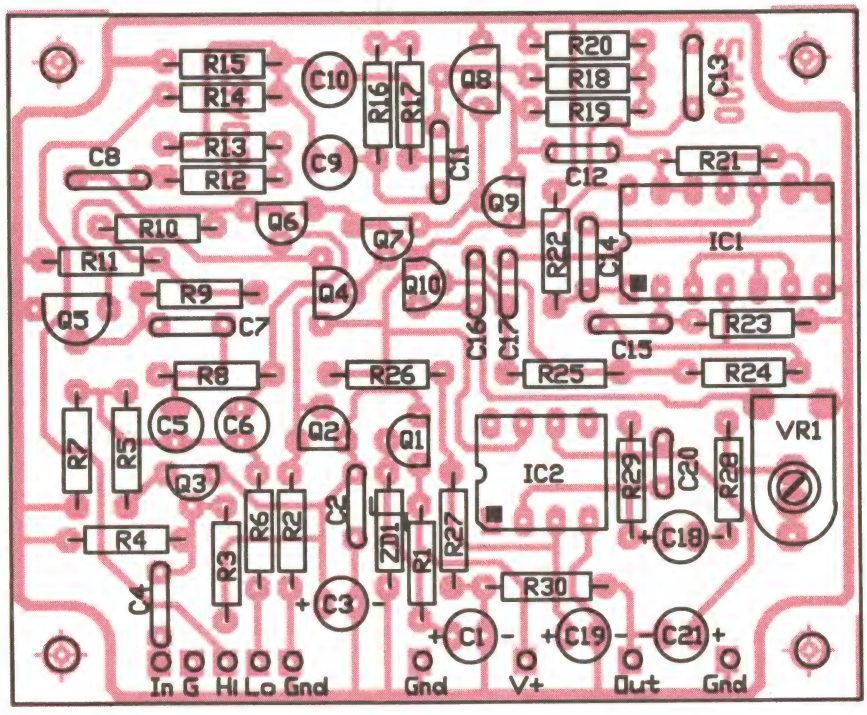
You'll also need some convenient place inside the case to mount your DPST or DPDT subcarrier selector switch, the closer to the ACS board the better.

The 'HI' and 'LO' filter switch connections are sensitive to electrical interference, so unless the subcarrier selector switch is within 50 - 60mm, connect it to the board with 'figure-8' dual shielded cable, keeping the screens separate back to the ACS board. Ensure that the switch is wired so 'HI' and 'LO' are both open or both grounded.

Due to the huge variety of receivers/-tuners in use in which this project could possibly be installed, you are going to have to work out exactly what to do with the audio coming out of the ACS board. (Although we'll give you some specific guidance, in the later articles.)

With stereo tuners, it's usually easiest to simply mount an RCA socket, connected to the ACS board output, on the back panel. Then feed the ACS audio into a spare (high level, e.g., 'auxilliary') input of your amplifier, via an RCA to two-RCA 'Y' cable.

If all your amplifier inputs are already in use, then a DPDT toggle switch, mounted somewhere on the tuner, can be used to switch the existing tuner output sockets between their existing feed points, or the ACS board output (connecting to both channels). Alternately you can use a four-pole three-position rotary switch, as I did in the 'Digitor' ghetto blaster conversion to be described in the second article.




***Use this overlay diagram, together with the photo and the schematic, as a guide when you are wiring up the decoder module. Although the board is quite densely populated, there is adequate room for all the components.***

# Improved decoder for ACS signals - 1

For mono portable radios, I've had success in breaking the signal feed to the volume control pot, then using one half of a miniature DPDT toggle switch to select between the existing signal feed or the output of the ACS board. The other half of the switch is used to control the power to the ACS board. This approach will be shown in more detail in the third article.

In all cases it's wise to use screened cable for all but very short audio interconnections, to prevent noise pickup or even instability.

## Building it

Prior to starting construction, hold the blank PC board (coded 93ACS9) up to a strong light and check for any defects such as short circuits or hairline track breaks. The fine tracks and relatively high density of this board make the risk of such problems higher than with most project PCBs.

Begin filling the board by installing the resistors first, and a little warning here: many 1% resistors have very dull colour bands and can even be easily read backwards to give a sensible but wrong value, so I suggest checking each with a multimeter prior to insertion on the board. (It saves on solder wick!)

Next install the taller components, taking care to get the orientation of the electrolytic capacitors, zener diode, transistors and ICs correct. Also be careful not to get the BC548's and BC558's mixed up! Note that the extra pads and holes around VR1 allow all known types of horizontal-mount trimpots to be installed in this position. I strongly recommend the use of PCB pins for the off-board connections.

With all the components safely on the board, hold it up to the light again and thoroughly check for any solder bridges.

To check for catastrophic problems, power the board from a DC supply of about 6 - 12V, and measure the current. If it's between 5 and 10mA then everything's probably OK; but if it's much higher or lower then start looking for wrongly-placed components, short circuits or other overlooked troubles.

## Installing it

I cannot emphasise too strongly the need to keep all the ACS circuitry right away from any 240V wiring! Apart from the safety aspect, the ACS decoder could pick up mains-borne electrical noise.

Mount the PCB in your selected location with adequate clearance beneath it, using spacers if necessary. You can get away with using only two screws on one edge in many situations, or even use double-sided adhesive foam tape if you have to! If mounting the PCB on a curved surface, as in the Digitor unit to be described in the second article, only tighten the screws up fairly loosely or you could damage the board.

Then connect a length of thin shielded cable to the set's discriminator output point, connecting the screen to a nearby earthed PCB area, and terminate the other end on the ACS board 'IN' and 'Gnd' pins.

Next deal with the power supply for the board. On mains-powered receivers, all you normally need to do is find the main positive filter capacitor and connect the 'V+' pin permanently to its positive end.

### ARE YOU EXPERIENCED?

Due to the complexity and density of both the 93ACS9 board and the equipment it will be installed in, only those experienced in delicate soldering and construction techniques should attempt this project. The potential for disaster caused by inexperience is quite significant. If you lack the experience, we suggest having the ACS Decoder assembled and installed by an experienced technician.

If the receiver is battery-powered, the best idea is to find the positive battery lead switched by the on/off switch, and power the ACS board from this — preferably via one pole of the 'Normal/ACS' switch. Now connect the ACS board audio output to the amplifier you'll be using, by whatever means you've previously decided on. Remember that the ACS board must have a ground return to the receiver ground, preferably by the cable screens or at least a wire from one of the ACS board ground pins to a receiver ground point.

## Trying it all out

Set VR1 to its fully clockwise position, connect the receiver to an antenna, select the FM mode and first make sure you're getting strong, clean reception of FM stations. Then monitor the ACS board output by whatever means; if everything's OK you'll hear a roar from the ACS board trying to demodulate noise. Then simply tune up and down the band, switching between the 67kHz and 92kHz positions until the roar disappears and is replaced by the audio of ACS transmissions.

Once you've tuned in on an ACS-carrying station, switch between the normal stereo signal and the ACS one, and adjust VR1 to give the same volume on both. Then reassemble your receiver and have fun listening to ACS signals — remembering to reposition/reorient the antenna if you're troubled by noise, primary audio breakthrough and/or distortion.

## If it doesn't work

First, are you hearing lots of noise output from the ACS board? If not, is there DC between +6V and 30V getting to the 'V+' pin? The ACS board will produce noise even with no input at all, if everything else is OK.

Is the board's audio output properly connected to an amplifier, with no shorted or open circuits? Is VR1 turned fully clockwise? If the supply is present and there's definitely no noise output, start checking the nominal voltages shown on the circuit, which should lead you to the area of the problem.

If you get noise but no ACS audio: Is the receiver connected to a suitable antenna? Are you sure you've tapped into the correct point in the FM receiver to extract the ACS signals (right at the FM detector, and before any filtering/de-emphasis)?

Did you tune through the FM band slowly and carefully? Are you sure there really *are* ACS transmissions in your area? Did you disturb, accidentally break or leave wires off some part of the FM receiver while you were working on it? Is the AM/FM switch set to FM?

If you still don't do any good, it's probably time to get hold of an oscilloscope and an experienced technician and trace the signals through from input to output. Just about all faults are traceable to wrongly-placed or wrong value components, or defective soldering. Sometimes a board defect goes unnoticed, but brand-new components are hardly ever faulty.

Finally, I'd like to acknowledge the invaluable assistance of Don Lancaster's excellent *Active-Filter Cookbook*, and also of Bob Barnes at RCS Radio, in the development and completion of this project.

In the next article, I'll describe in detail how the ACS decoder can be fitted into a low cost Digitor Portable AM/FM Stereo radio/cassette recorder, as sold by Dick Smith Electronics as Cat. No. A-5235. ❖

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# DISCOUNT COMPONENTS



## XENON/STROBE TUBES

As used in projects or as replacement.

S14050.....$3.95



## CHROME LED BEZELS

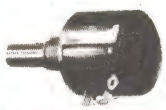
9 mm hole, available 3 colours

S14030 Red.....$1.20
S14032 Green.....$1.45
S14034 Yellow....$1.45



## GREY FLAT RIBBON CABLE

| cat no. | | $/Mtr |
|---|---|---|
| W12614 | 14way | $1.90 |
| W12616 | 16way | $2.20 |
| W12620 | 20way | $2.50 |
| W12624 | 24way | $2.90 |
| W12625 | 25way | $3.20 |
| W12626 | 26way | $3.60 |
| W12634 | 34way | $3.90 |
| W12636 | 36way | $3.90 |
| W12640 | 40way | $4.90 |
| W12650 | 50way | $5.90 |
| W12660 | 60way | $6.90 |



## 10 TURN WIRE WOUND POTENTIOMETER

Spectrol Model 5341/4" shaft. Equivalent (Bourns 3540S Beckman 7256) Dials to suit 16-1-11, 18-1-11, 21-1-11.

R14050 50R R14100 5K
R14055 100R R14110 10K
R14060 200R R14120 20K
R14070 500R R14080 1K
R14090 2K

| 1-9 | 10+ |
|---|---|
| $12.95 | $10.90 |

R14130 50K.....$16.95
R14140 100K.....$15.95



## NUMERIC KEYPAD

These are ideal for telephone dial projects or security systems. 4 x 3 encoded keypad. 10 digits with 2 utility keys. Black in colour

S13062.....$7.95



## GENERAL PURPOSE TRANSISTORS

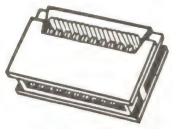
PN100: a NPN general purpose medium power amp and switch with continuous collector current up to 500mA.
PN200: a PNP general purpose amp at collector currents to 1 AMP.
Both are TO-82 plastic package.

PN100 REPLACES:
PN2221, PN2222, PN2222A, PN3585, PN3568, PN3569, PN3643, PN5133, 2N2219A, 2N2222A, 2N3414, 2N3415, 2N3416, 2N3417, 2N3700, 2N3704, 2N3904, 2N4123, 2N4124, 2N4401, 2N5088, 2N5210.

PN200 REPLACES:
PN2907, PN2907A, PN3638, PN3638A, PN3640, PN3644, PN4121, PN4143, PN4248, PN4249, PN4250, PN4355, PN4916, PN4917, PN5910, 2N2905A, 2N3467, 2N3702, 2N3906, 2N4125, 2N4126, 2N4291, 2N4402, 2N4403, 2N5086, 2N5087, 2N5447.

PN100.....T90001
PN200.....T90002

| 1-9 | 10+ | 100+ |
|---|---|---|
| $0.20 | $0.18 | $0.15 |



## CARD EDGE CONNECTORS

| .1" SPACING | 1-9 | 10+ |
|---|---|---|
| P12060 | 10pin | $3.95 | $3.50 |
| P12062 | 20pin | $4.25 | $3.75 |
| P12064 | 26pin | $4.50 | $3.95 |
| P12066 | 34pin | $4.95 | $3.95 |
| P12068 | 40pin | $5.95 | $4.95 |
| P12070 | 50pin | $6.95 | $5.95 |



## PLASTIC BOXES

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H10126 130 x 68 x 41mm.....$2.50
H10122 150 x 90 x 50mm.....$3.95
H10124 195 x 113 x 60mm..$4.95



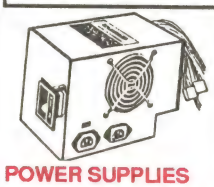
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## DIODES - BUY IN BULK & SAVE!

| Cat No. | | 10+ | 100+ | 1000+ | 10K |
|---|---|---|---|---|---|
| Z10135 | IN4148 | $0.05 | $0.04 | $0.03 | $0.02 |
| Z10105 | IN4002 | $0.06 | $0.05 | $0.04 | $0.03 |
| Z10107 | IN4004 | $0.08 | $0.06 | $0.05 | $0.04 |
| Z10110 | IN4007 | $0.10 | $0.07 | $0.06 | $0.05 |
| Z10115 | IN5404 | $0.18 | $0.14 | $0.13 | $0.11 |
| Z10119 | IN5408 | $0.20 | $0.16 | $0.15 | $0.14 |



## POWER SUPPLIES

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220W P.S.....$129.00
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200W P.S.....$79.00
BABY AT
200W P.S.....$79.00
SLIMLINE BABY AT
200W P.S.....$79.00



## COMPUTER CABLES

• Six conductor shielded computer interface cable.

W12670 • CIC6 6 con.

| 1-9M | 10M+ | 100M+ |
|---|---|---|
| $1.30M | $1.10M | $1.00M |

W12672 • CIC9 9 con.

| 1-9 M | 10M+ | 100M+ |
|---|---|---|
| $1.60M | $1.50M | $1.20M |

W12674 • CIC12 12 con.

| 1-9M | 10M+ | 100M+ |
|---|---|---|
| $2.50M | $2.20M | $1.90M |

W12676 • CIC16 16 con.

| 1-9M | 10M+ | 100M+ |
|---|---|---|
| $3.50M | $3.20M | $2.50M |

W12678 • CIC25 25 con.

| 1-9M | 10M+ | 100M+ |
|---|---|---|
| $3.90M | $3.40M | $3.00M |



## NICADS

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Size AA 450mAH

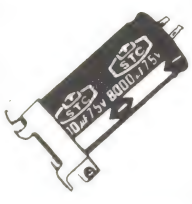
| 1-9 | 10+ | 100+ |
|---|---|---|
| $2.95 | $2.75 | $2.50 |

Size C 1 2 A H

| $9.95 | $9.50 | $8.95 |
|---|---|---|

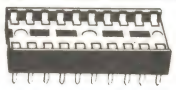
Size D 1 2 A H

| $9.95 | $9.50 | $8.95 |
|---|---|---|



## LUG MOUNTING (RG) CAPACITORS

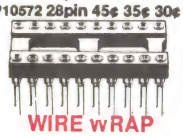
| | 1-9 | 10+ |
|---|---|---|
| R16585 | 8,000uF 75V.. | $12.95 | $10.95 |
| R16587 | 10.000uF 75V.. | $14.95 | $12.95 |



## LOW PROFILE IC SOCKETS

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| | 1-9 | 10+ | 100+ |
|---|---|---|---|
| P10550 | 8 pin | 15¢ | 12¢ | 10¢ |
| P10560 | 14pin | 20¢ | 18¢ | 15¢ |
| P10565 | 16pin | 20¢ | 18¢ | 16¢ |
| P10567 | 18pin | 30¢ | 25¢ | 22¢ |
| P10568 | 20pin | 35¢ | 30¢ | 25¢ |
| P10569 | 22pin | 35¢ | 30¢ | 26¢ |
| P10570 | 24pin | 35¢ | 30¢ | 26¢ |
| P10572 | 28pin | 45¢ | 35¢ | 30¢ |



## WIRE WRAP IC SOCKETS

These quality 3 level wire wrap sockets are tin plated phosphor bronze.

| | | 1-9 | 10+ |
|---|---|---|---|
| P10579 | 8pin | $1.50 | $1.40 |
| P10580 | 14pin | $1.85 | $1.70 |
| P10585 | 16pin | $1.95 | $1.80 |
| P10587 | 18pin | $1.95 | $1.80 |
| P10590 | 20pin | $2.95 | $2.75 |
| P10592 | 22pin | $2.95 | $2.70 |
| P10594 | 24pin | $3.95 | $3.50 |
| P10596 | 28pin | $3.95 | $3.50 |
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## IDC PLUGS AND SOCKETS FROM ONLY $2.00



## D TYPE IDC PLUGS

| | 1-9 | 10+ | 100+ |
|---|---|---|---|
| DE9P 9 pin plug | | | |
| P12166 | $2.95 | $2.50 | $2.20 |
| DA15P 15 pin plug | | | |
| P12168 | $2.95 | $2.50 | $2.20 |
| DB25P 25 pin plug | | | |
| P12170 | $4.50 | $3.95 | $3.50 |



## D TYPE IDC SOCKETS

| | 1-9 | 10+ | 100+ |
|---|---|---|---|
| DE9P 9 pin socket | | | |
| P12167 | $2.95 | $2.50 | $2.20 |
| DA15P 15 pin socket | | | |
| P12169 | $2.95 | $2.50 | $2.20 |
| DB25P 25 pin socket | | | |
| P12171 | $4.50 | $3.95 | $3.50 |



## PC BOARD HOLDER

A must for all PCB work.

T12444.....$9.95



## ECONOMY TRANSFORMERS

| | 1-9 | 10+ |
|---|---|---|
| 2155 240V 6-15V 1A | | |
| M12155 | $8.95 | $7.95 |
| 2156 240V 6-15V A2 | | |
| M12156 | $13.95 | $12.95 |
| 2851 240V 12-6V CT 250mA | | |
| M12851 | $4.95 .. | $4.50 |
| 6672 240V 15 30vc 1A tapped | | |
| M16672 | $12.95 | $11.95 |



## 12V DC FANS

80 x 80 x 25.4mm
12V DC. 1.7 Watt 0.14 Amp
T12469.....$18.95
10+ fans, only $17.95

## FANS

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115V 4 5/8" T12463..$16.95
240V 3 1/2" T12465..$16.95
115V 3 1/2" T12467..$16.95



## TOGGLE SWITCHES

| | 1-9 | 10+ |
|---|---|---|
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| S11020 | D.P.D.T | $1.30 | $1.20 |



## ICB VOLTAGE REGULATORS BARGAINS

| Description | 1-9 | 10+ | 100+ |
|---|---|---|---|
| 7805UC | $0.50 | $0.45 | $0.40 |
| 7812UC | $0.50 | $0.45 | $0.40 |
| 7815UC | $0.50 | $0.45 | $0.40 |
| 7905UC | $0.60 | $0.55 | $0.50 |
| 7912UC | $0.60 | $0.55 | $0.50 |
| 7915UC | $0.60 | $0.55 | $0.50 |
| 78L05 | $0.40 | $0.30 | $0.28 |
| 78L12 | $0.40 | $0.30 | $0.28 |
| LM324 | $1.00 | $0.90 | $0.80 |
| 555 | $0.40 | $0.38 | $0.33 |
| 741 | $0.50 | $0.45 | $0.39 |



## MINIATURE HOBBY VICE

• Lever operated suction base grip for instant mounting & portability.
• Mounts on smooth non-porous surfaces
• Ideal for holding & other small objects .

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## PCB MOUNTING SCREW TERMINALS

(INTERLOCKING ENDS)

These terminals feature interlocking ends to form any number of connections. Standard 5mm spacing pins.

P10520 2way

| 1-9 | 10_ | 100+ |
|---|---|---|
| $0.75 | $0.70 | $0.60 |

P10521 3 way

| $1.00 | $0.90 | $0.80 |
|---|---|---|



## QUALITY 3mm LEDS

| | 1-9 | 10-99 | 100+ | 1K |
|---|---|---|---|---|
| 1000+ | | | | |
| Z10140(R) | $0.15 | $0.12 | $0.10 | $0.08 |
| Z10141(G).. | $0.20 | $0.18 | $0.15 | $0.12 |
| Z10143(Y).. | $0.20 | $0.18 | $0.15 | $0.12 |
| Z10145(O).. | $0.20 | $0.18 | $0.15 | $0.12 |

## QUALITY 5mm LEDS

| | | | | |
|---|---|---|---|---|
| Z10150(R). | $0.15 | $0.12 | $0.10 | $0.08 |
| Z10151(G). | $0.25 | $0.20 | $0.18 | $0.12 |
| Z10152(Y).. | $0.25 | $0.20 | $0.18 | $0.12 |

## FLASHING LEDS

| | 1-9 | 10+ | 100+ |
|---|---|---|---|
| RED 5mm Z10159 | $1.10 | $1.00 | $0.80 |



## RECTANGULAR LEDS

| | 1-9 | 10+ | 100+ | 1K |
|---|---|---|---|---|
| RED | 20¢ | 15¢ | 12¢ | 10¢ |
| GREEN | 20¢ | 15¢ | 12¢ | 10¢ |
| YELLOW | 20¢ | 15¢ | 12¢ | 10¢ |



## DB25 CONNECTOR SPECIALS

| | 1-9 | 10+ | 100+ |
|---|---|---|---|
| P10880 DE9P | $1.00 | $0.80 | $0.60 |
| P10885 DE9S | $1.00 | $0.70 | $0.60 |
| P10891 DA15S | $1.00 | $0.70 | $0.60 |
| P10892 DA15C | $1.00 | $0.90 | $0.60 |
| P10895 DA15S | $1.00 | $0.80 | $0.60 |
| P10902 DB25C | $1.00 | $0.80 | $0.60 |
| P10904 DB25P | $1.00 | $0.80 | $0.60 |
| P10905 DB25S | $1.00 | $0.80 | $0.60 |



## DO YOU NEED A UART? "SCOOP PURCHASE" 16C450 (82450)

Features of the UART include programmable data, format parity, framing and overrun error detection etc.

U22185.....$9.95



## TRANSISTORS BUY IN BULK & SAVE!

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|---|---|---|---|
| BC 547 | $0.15 | $0.10 | $0.07 |
| BC 548 | $0.15 | $0.10 | $0.07 |
| BC 549 | $0.15 | $0.10 | $0.07 |
| BC 557 | $0.15 | $0.10 | $0.07 |
| BC 558 | $0.15 | $0.10 | $0.07 |
| BC 559 | $0.15 | $0.10 | $0.07 |
| BC 327 | $0.20 | $0.15 | $0.12 |
| BC 337 | $0.20 | $0.15 | $0.12 |
| BD 139 | $0.75 | $0.60 | $0.50 |
| BD 140 | $0.75 | $0.60 | $0.50 |



## ELECTRET MIC INSERTS

With Pins for easy board insertion.
10mm diameter,
10 mm high.
C10170

| 1-9 | 10+ | 100+ | 1000+ |
|---|---|---|---|
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MINI MIC INSERT
Omnidirctional mini mic insert, 6mm diameter.
7mm high
C10165

| 1-9 | 10+ | 100+ | 1000+ |
|---|---|---|---|
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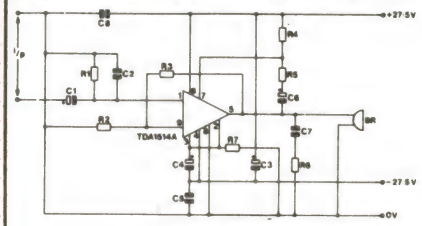
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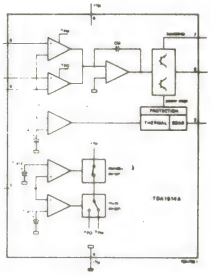
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## TDA1514A

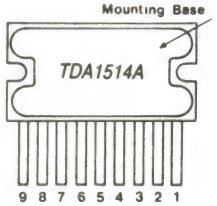
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### A HIGH QUALITY AUDIO AMP IN A 9 PIN FLAT PACK.

This amplifier will deliver up to 40W into 8ohm load with a ±27.5V power rail. The device is designed to meet the requirements of digital sound sources such as Compact Disc. The total harmonic distortion at 32W is less than 0.0032%. An output mute Circuit prevents switch-on and switch-off clicks and the device is totally protected against short circuits and thermal runaway. The device will deliver 25W into 8ohm with a ±22V supply or 12.5W into 8ohm with a ±16V supply. The metal plate on the package is connected to pin 4.



Mounting Base

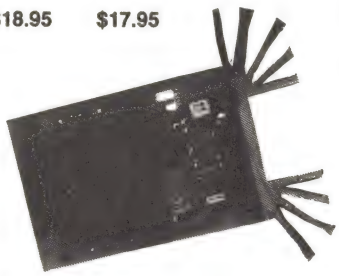



| Parts List | | Cat No. |
|---|---|---|
| R1,3 | Min Res 22kΩ | R10062 |
| R2 | Min Res 680Ω | R10044 |
| R4 | Min Res 82Ω | R10033 |
| R5 | Min Res 150Ω | R10036 |
| R6 | Min Res 3.3Ω | R10016 |
| R7 | Min Res470k | R10078 |
| C1 | PC Elect 2.2µF 100V | R15427 |
| C2 | Ceramic 220pF | R15328 |
| C3,4 | PC Elect 47µF 63V | R15525 |
| C5,8 | Green Cap 0.47µF | R15168 |
| C6 | PC Elect 220µF 35V | R15543 |
| C7 | Green Cap 0.022µF | R15152 |

**1-9** **10+**

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Complete kit including Heatsink Cat No.K10320...$49.95



Double Sided plated through fibreglass PCB. **Especially designed with large copper tracks for use in schools and the commercial environment. E10325..... $19.95**

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AS SEEN IN SILICON CHIP JULY




**K10395.....Was ~~$65.95~~ Now only $54.95**

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With strong metal end clips
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P10536.....$6.95
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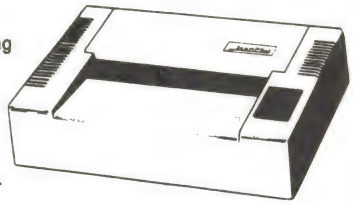
Double Isulated
Input: 240 50Hz 2 AMP
Rating: 2 min On 30 Min Off
**T12316.....$98.95**

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ScanPlus is a full-page, 24 bit colour scanner that supports up to 16.8 Million colours. The ScanPlus Colour 6000 allows you to incorperate full-colour photographs, graphics and long pages of text into your imaging, publishing and word processing system.

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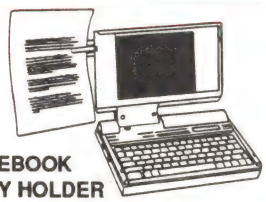
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Dimensions: 40cm x 28cm
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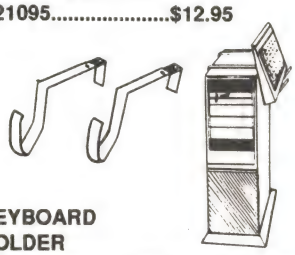
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Take control of that jungle of cables and leads under your desk with these cable managers. Hold, fix and run your cables in the location and direction you desire.
Designed to be adjustable to accommodate cables of different sizes
• Single sided tape included.
• Come in packs of five.
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Ever tried balancing your notebook on your lap while trying to type in a page of copy in a confined area. Eg: on an aeroplane or car.
Well now there is a handy little copy holder that simply sticks on to your notebook and folds out to hold your documents and folds neatly away when transporting your computer.
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### KEYBOARD HOLDER

Put your keyboard neatly out of the way when your not using it with this keyboard holder. Hooks over the top of your system. Adjustable arms allow it to fit almost any system.
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| 131M | YES | 16ms | SEA | $329 | $270 |
| 212M | YES | 16ms | SEA | $399 | $328 |
| 245M | YES | 12ms | SEA/WD | $549 | $451 |
| 345M | YES | 12ms | SEA/WD | $595 | $485 |
| 455M | YES | 10ms | SEA | $895 | $734 |
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## *Construction Project:*

# PC-controlled EPROM Programmer - 1

Experimenting with microprocessors is great fun, but it can be a lot easier and more productive with a few specialised pieces of equipment. One of these valuable extras is an EPROM programmer, and the author presents here the design for a very flexible (but low cost) programmer which is controlled from a standard PC printer port.

**by GLENN PURE**

This article and its sequel describe a programmer that is controlled via the parallel port on an IBM-compatible PC. As well as programming EPROMs, it also has a readback feature. The hardware can handle EPROMs from 2716 (2K x 8) to 27256 (32K x 8). With modifications, larger devices can also be handled. It will also program 2816 and 2864 electrically-erasable (EE) PROMs — but more about these later.

There *are* commercially available programmers, of course, but they start at around $250 — and some are a lot more expensive than this. Many experimenters might be put off by such costs, as I initially was. So my motivation in designing this project was to produce an inexpensive, but reasonably powerful and flexible programmer.

First, some background about EPROMs. For those not familiar with the jargon, the acronym stands for *erasable programmable read-only memory*.

The most common application for EPROMs is in microprocessor systems. When such a system is first started up, the microprocessor will sit there uselessly until it is instructed what to do — and you guessed it, EPROMs are a very popular and effective way of storing and delivering the necessary instructions.

EPROMs are special because they provide a *non-volatile* way to store program instructions (or any other binary information for that matter) — 'non-volatile' meaning it will not be lost once power is removed.

## Programming, erasure

Special conditions are required to erase or write data to EPROMs, so that the risk of accidental data corruption can be minimised.

The little window on the top of the device is the key to erasure. It allows UV (ultra-violet) light to reach the memory array patterned into the silicon wafer, resulting in deletion of all the data in it. UV light with a peak wavelength of 254 nanometres is usually used, and exposure times varying from only a minute or two to 30 minutes or more might be needed, depending on the UV lamp's power and the distance from it.

To minimise the time required for erasure, the window on the EPROM is made from quartz (silica) as this transmits UV light much more efficiently than glass or plastic.

**TABLE 1**
**Parallel Pin Assignments**

| Pin | I/O Address | Programmer Function |
|---|---|---|
| 2-9 | 378hex | d0-d7 data in |
| 11 | 379hex | D0, D4 out |
| 12 | 379hex | D1, D5 out |
| 13 | 379hex | D2, D6 out |
| 15 | 379hex | D3, D7 out |
| 1 | 37Ahex | Address counter advance |
| 14 | 37Ahex | Vpp off/on; Vcc = 5 or 6V |
| 16 | 37Ahex | Output enable/Program |
| 17 | 37Ahex | Chip enable |
| 1 & 16 | 37Ahex | Address counter reset |

We all know that there is a variety of sources of UV besides UV lamps, and these could potentially result in accidental erasure. Examples include the sun, and even ordinary fluorescent lights (readers of the Forum column in this magazine over recent months will be familiar with this issue). However, the emission of 254nm UV from these is relatively weak. For example, complete erasure of an EPROM in direct sunlight would take about one week, and orders of magnitude longer under a standard fluorescent light.

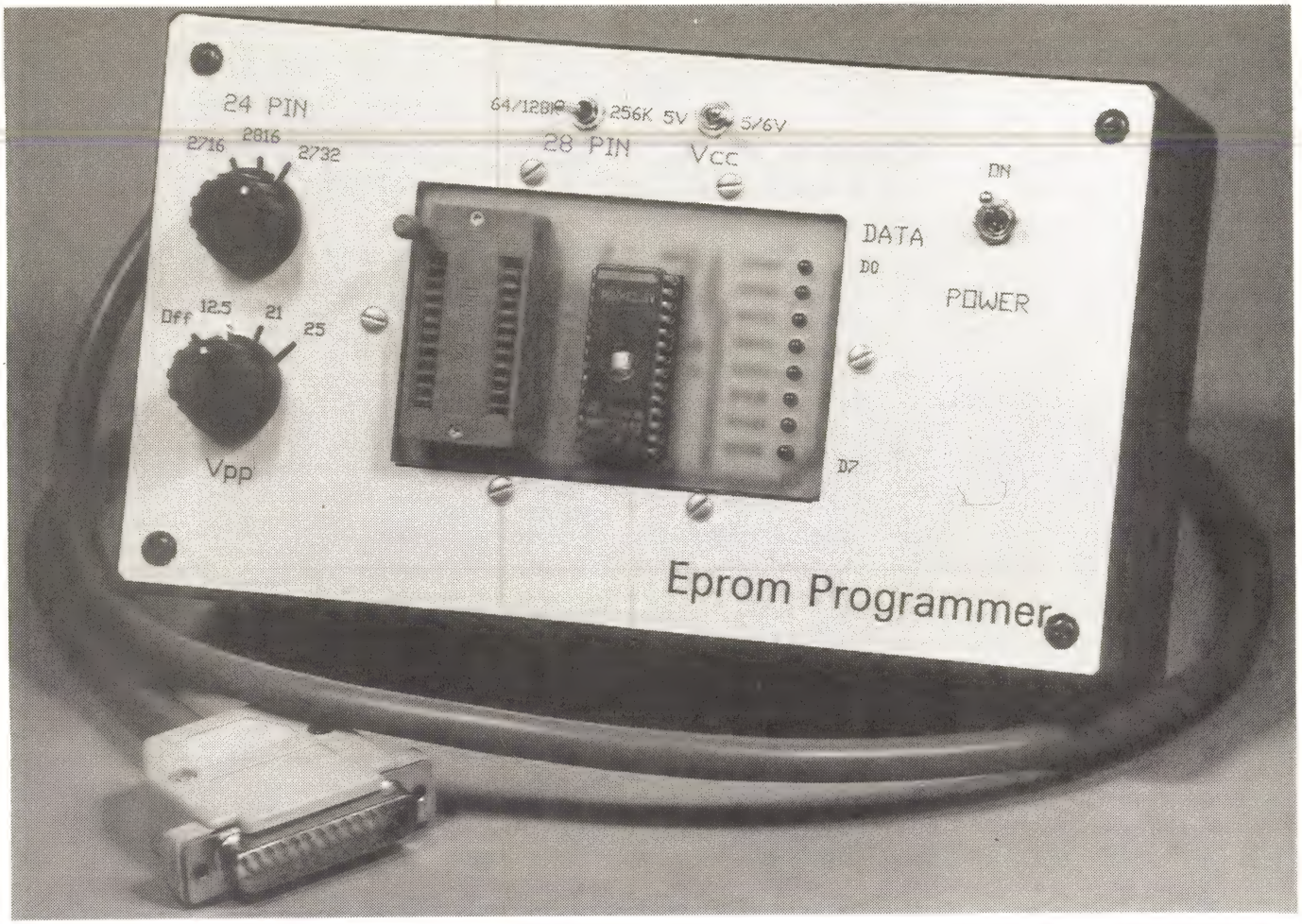
All the same, the window on the EPROM should be protected with an opaque tab if it is to be used in bright sunlight or near other UV sources for extended periods, to minimise the risk of odd bits being erased here and there.

Erasure does the opposite to what might be expected. Instead of setting all memory locations to 0, it sets them all to 1. In other words, all bytes in the EPROM are set to the hexadecimal value FF. Programming of the EPROM is carried out by selectively writing 0s to bits at desired locations. That's the job of the EPROM programmer.

The 'write' operation is only achieved when you provide a high voltage (relatively speaking) to a special pin on the EPROM — the Vpp pin. The Vpp voltage required by devices varies, and is either 25V or 21V for earlier vintage devices, or 12.5V for more recent devices.

In addition to providing the Vpp voltage, the exact programming procedure also involves presenting specified logic levels to control inputs on the EPROM (chip enable, program and output enable pins), while data is input to the required address location. The length and number of these control signals is critical and varies depending on the vintage, size and manufacturer of the EPROM. In general, there is some consistency in programming procedures with any one particular manufacturer, but considerable variations can exist between manufacturers.

Older series devices or those that specify a 21V or 25V programming voltage actually show a higher degree of standardisation and are relatively simple to program than current devices. A write signal of 50 +/- 5ms is required for each byte of data written. I gather that the 2716 and 2732 devices currently available are programmable this way. This method can




also be used for older model 2764 and larger EPROMs.

For devices with a Vpp of 12.5V, the situation is more complex. In addition to supplying 12.5V to the Vpp pin, the Vcc supply for the chip must be raised to 6V immediately prior to programming. Write signals of usually one millisecond are applied, followed by a read operation. The write pulses are repeated at each address location until the read operation verifies that the data was successfully written. Some devices also require a further write pulse at each location, the length of which is dependent on the number of one millisecond pulses applied.

In the case of some more recent EPROMs manufactured by National Semiconductor, there is an alternative programming option of one 10ms pulse while Vcc is at 6V and Vpp is at 12.5V.

I haven't attempted to check the programming procedures for all EPROMs and all manufacturers. The important point is that it is essential to check the programming protocol for the device type and manufacturer of the EPROM you are using.

At this point, I need to provide some good news and some bad news. The good news is that the programmer hardware to be described here is compatible with the variety of programming protocols that I have checked. The bad news is that because of the degree of variation, I am only providing relatively simple 'generic' software with this project — which should be sufficient to get you going, but will require modification to handle some programming protocols. Also, BASIC is not the best language for the software as it relatively slow. I hope to investigate other languages when I get a chance and will be back in touch through these pages then.

Two software listings will be provided for the project, in the second of these articles: one for EPROM/EEPROM writing and one for readback.

## EEPROMs

I mentioned EEPROMs at the start of this article, and that the programmer is capable of writing to them. At least that's true for the 2816 and 2864 devices manufactured by SEEQ that I have checked. EEPROMs are incredibly usefully and I would highly recommend experimenters trying them. Although they are substantially more expensive than EPROMs, they do not require UV erasure before new data is written to them. This makes them very quick and simple to use. Also, the write process for each address is only 10 milliseconds.

The software I have provided for writing to EEPROMs is based on the programming protocol described for SEEQ devices. These devices don't require the programmer to time the write signal, as this is handled by circuitry inside the EEPROM. It is only necessary to wait the required 10ms before attempting to write to another address location. There is a caution. Since these devices need no Vpp, this should be switched off on the programmer. I suggest this only as a precaution to minimise the risk of damage: Vpp switching is under software control anyway and is always kept off by the software for the EEPROM write program, as will be explained later.

## Circuit overview

The programmer uses all three I/O addresses that form the standard IBM-compatible parallel printer port. These latches consist of the output data bus (eight bits wide), the output control lines (four bits wide) through which the computer sends control signals to the printer (or the EPROM programmer in this case), and the input lines over which a printer normally provides status information to the PC (four out of five of these lines are used).

Bytes to be written to the EPROM are

sent through the data bus (pins 2-9) of the parallel port, before going straight to the EPROM data lines via a buffer.

Read back of data from the EPROM to the PC is achieved by multiplexing the EPROM data outputs into the four input pins of the parallel port: pins 11, 12, 13 and 15.

Read and write control over the EPROM, and control of its address counter is achieved through output port pins 1, 14, 16 and 17 — after buffering or decoding. Switching of Vpp on and off and switching of Vcc between 5V and 6V is also achieved through the latter pins and logic, although selection of the Vpp voltage between 12.5, 21 and 25V is controlled by a rotary switch on the programmer.

A summary of parallel pin assignments as they relate to this project is shown in Table 1.

Accommodation of the different packages sizes and pinouts of various EPROMs is achieved through a combination of switches and sockets in the programmer. The sockets provided are a 24-pin DIP (2716, 2816 and 2732 devices) and a 28-pin DIP (2764-27256).

## In more detail

The circuit diagram is shown in Fig.1. I'll start with the control lines from the parallel port (pins 1, 14, 16, 17), as much of the circuitry involves decoding these and doing useful things with the results.

But first, note that before any of the input or output lines enter the programmer, they encounter series resistors (R1-R16, 1k). These are provided, except on ground (pin 18 of the port), to protect from accidental shorts, contention for lines between the programmer and the computer port, etc.

Parallel pin 1 controls clocking of the address counter U3 (CMOS 4040). This line is sent high then low to advance the counter by one, and should normally be left in the low state when using the programmer. I'll explain why shortly. The signal is first inverted through U2:A (74HC04), then fed into a pullup resistor (R18) and the R-C network formed by C1 and R17.

The output of the latter goes straight to the clock pin of U3. The R-C network is important as it dampens 'ringing' from the parallel port line that would cause multiple clocking of the 4040. Such ringing is quite common I gather, from talking with a professional engineer. Before learning this, it led to much frustration when prototyping the programmer, until I figured out what was causing the problem.

The particular values chosen for the C1 and R17 produce reliable damping, but also result in a few microseconds time delay for the clocking operation. This delay has not caused any timing problems in the programmer with PCs I have tested, including my current 33MHz '386 which sends data out through the parallel port quite a bit faster than an AT.

The 12 address lines provided by one 4040 are sufficient for EPROMs up to 2732's. Larger devices require additional high-order address lines, which are provided by ganging the Q12 output of U3 to the clock input of another 4040 (U4).

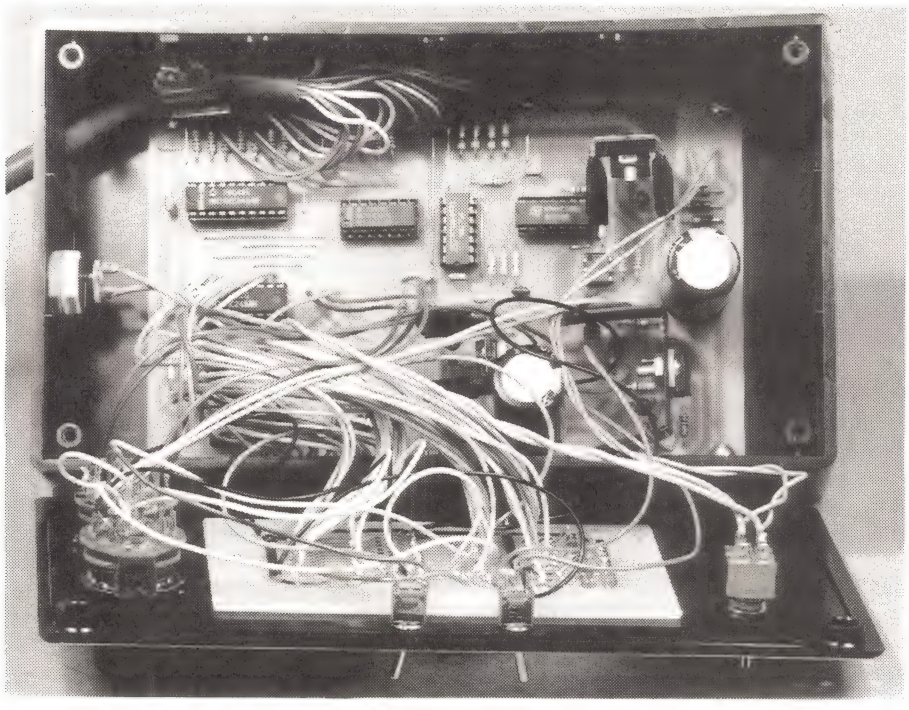
By the way, when assembling the circuit, don't be tempted to use hybrid CMOS devices (74HC series) in place of the straight CMOS 4040s — I've already tried, and they don't work. Unlike the CMOS version, the 74HC4040 doesn't have a Schmitt trigger action on the clock input. The rise and fall time produced by C1 and R17 is apparently outside the maximum allowable clock rise and fall time of the 74HC device, and results in multiple clocking.

The signal from parallel port pin 14 controls two functions simultaneously: switching of Vpp on or off, and selection of the Vcc supply for the EPROM of either 5V or 6V. Whenever Vpp is switched on, Vcc is at 6V. As noted above, some EPROMs do not require a supply (Vcc) voltage change during programming, so it has been necessary to include a manual switch (S5) to disable this feature and provide a continuous DC 5V supply when required.

Control of the Vcc voltage starts by passing the pin 14 signal through both inputs of AND gate U7:D, which simply acts as a buffer. The output of the latter goes via a protection resistor (R37, 1k) to the base of Q3, a BC337 transistor. Q3 switches 1.8k resistor R36 either in or out of a voltage divider (R34 and R35) that controls the output voltage of an LM317 regulator, U10. (This circuit is essentially the same as that used in the computer controlled power supply in *EA*, Nov 1992, p82).

When R36 is switched in to the divider, the LM317 outputs 5V; when R36 is out, the output is around 6V.

Switching of Vpp on and off is a little more complex. The pin 14 signal is first inverted through U2:C, whose output goes to an R- C network (R19 and C2). The latter is solely to add a small time delay before switching the LED side of optocoupler U5 (4N25) via a buffer formed from U7:B. The time delay is added to allow Vcc to rise to 6V shortly before Vpp is turned on. Spec sheets for some EPROMs indicate that such a delay should be provided, although the actual delay is not specified.



***Inside the author's prototype of the programmer. There are quite a large number of wires used to interconnect the smaller board on the front panel with the main board, but a neater ribbon cable system would have increased the cost significantly.***

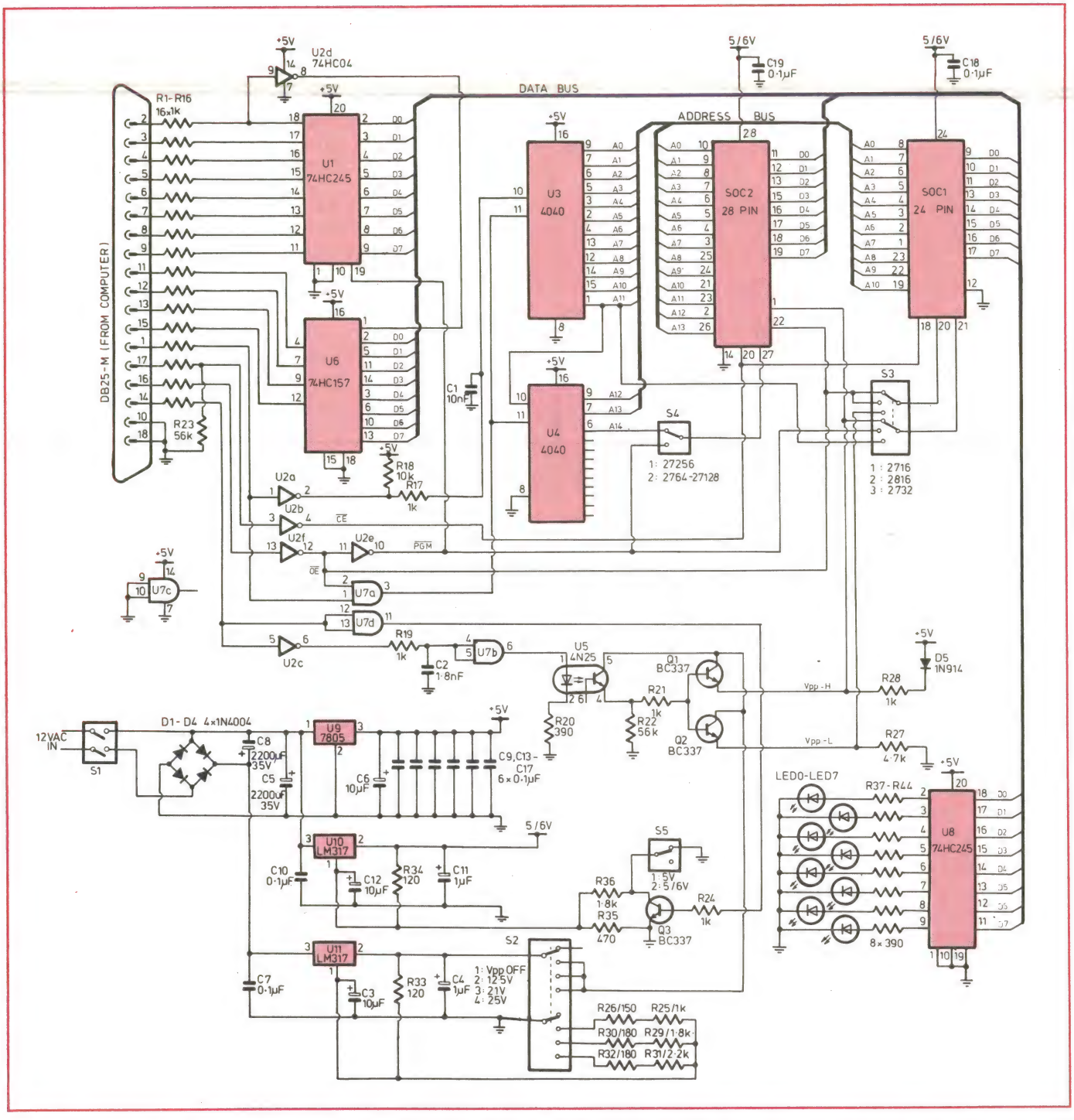



***Fig.1: The schematic diagram for the programmer, including all switches and wiring of the sockets which accept the EPROMs. The function of each switch position is also marked. Position 1 of each switch is the position closest to the top of the page. The sockets for the EPROM to be programmed are marked by a colour overlay.***

Even without the R-C network, there is a propagation delay from the LED to the transistor side of the optocoupler of a few microseconds, according to the data on 4N25's. This might normally be enough, but the additional time delay is provided to be sure.

When the LED in U5 is switched on (R20 provides current limiting), the output transistor of the coupler goes on, connecting Vpp through R21 to the bases of transistors Q1 and Q2 (also BC337's). The pull-down resistor R22 is provided to ensure Q1 and Q2 are switched off when U5 is not on. Q1 and Q2 actually achieve the switching of Vpp on or off. Two Vpp outputs are necessary, controlled by the two separate transistors, because some EPROMs require the Vpp to be held *low* when Vpp is off (2732), while others require this line to be *high* when Vpp is off (2716, 2764, etc).

Pin number 16 of the parallel port controls the EPROM's output enable (OE) and program (PGM) lines, both of which are active low. The pin 16 signal goes through two inverters in series (U2:F and E), the output of the first inverter being connected to OE and that of the second going to PGM.

The OE and PGM signals also control some of the control logic in the programmer. The PGM line controls output enable

# PC-controlled EPROM Programmer - 1

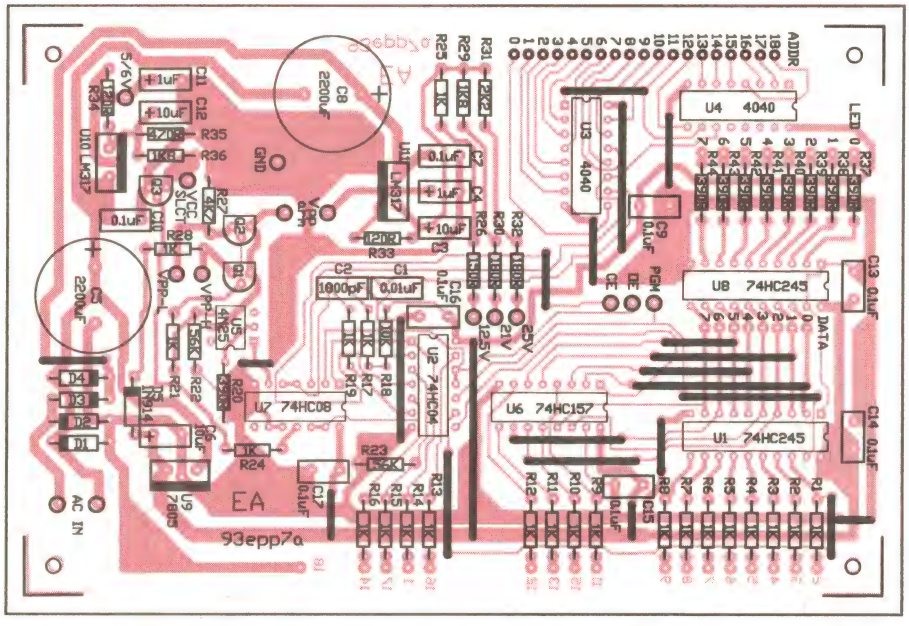



*Fig.2: The overlay for the main PCB, showing positioning and polarity of components. As this is a single-sided board, there are some links, also marked. The pad spacing for the address lines and data bus take off points is such that a pin header could be used in both of these locations if desired.*

(pin 19) on U1, which allows the computer parallel port to send data to the EPROM. Whenever a byte is being written into an EPROM, PGM is sent low by the PC and as a result U1's outputs are on, connecting the data lines of the parallel port to the data bus of the programmer. Conversely, when a read is being performed on an EPROM, PGM is high (and OE is low) and the outputs on U1 are tri-stated, allowing the EPROM sole access to the data bus of the programmer.

The OE signal line also has another function. In combination with parallel pin 1 input, OE controls the reset function on the address counters U3 and U4. This is achieved by 'ANDing' parallel pin 1 with OE through U7:A so that when both are high, the output of the AND gate goes high, resetting the two 4040's.

It would have been simpler to use a separate input line from the parallel port to control resetting of the counters, but there weren't any lines left after all the other control functions were implemented! (Only four control lines are provided from the computer to the parallel port, but there are five control functions within the programmer under software control from the computer: chip enable, output enable/program, Vpp on/off, counter advance, and counter reset.)

The final control, under software command, is chip enable. This is implemented by simply inverting parallel pin 17 input through U2:B to buffer it, and then taking it directly to the EPROM.

Input of data into the programmer has already been mentioned above. Just one additional point here: a 74HC245 (U1) two-way bus transceiver was chosen as the buffer not because two way transfer was needed — indeed, there is no point because the data lines of the parallel port can normally only output signals.

Rather the '245 was chosen because of the convenient pin configuration, with all 'A' bus pins lined up down one side of the device and all 'B' bus pins similarly down the other side.

A one-way 74HC541 could have been used as it also has such a pin arrangement, but is not as readily available as the 245 and I notice many suppliers charge more for the 541.

Output of data from the programmer to the computer is achieved through the multiplexer U6 (74HC157). The multiplexer is necessary because only five input pins are available on the parallel port (only four of which are used by the programmer — pin 10 of the port is not used in this project — but take care to ground this pin).

The 74HC157 has its outputs permanently on. The software controlling the programmer simply ignores any data presented until a readback operation is performed.

Either the upper nibble or the lower nibble of the byte being read is read by the parallel port at any one time. Determining which nibble to read is achieved with pin 1 of the multiplexer, which is connected through a buffering inverter to input data line D0 (pin 2 of the parallel port). Connection to the latter line is made before the data input buffer of the programmer (U1), because during an EPROM read operation, the outputs of U1 are switched off.

Data is read from the programmer simply by sending a '1' to pin 2 of the parallel port, then reading the input lines, followed by sending a '0' and reading again. The computer software controlling the programmer reconstitutes the full byte.

Note that all of the logic above is implemented using low power consumption 74HC series devices, except for the ad-

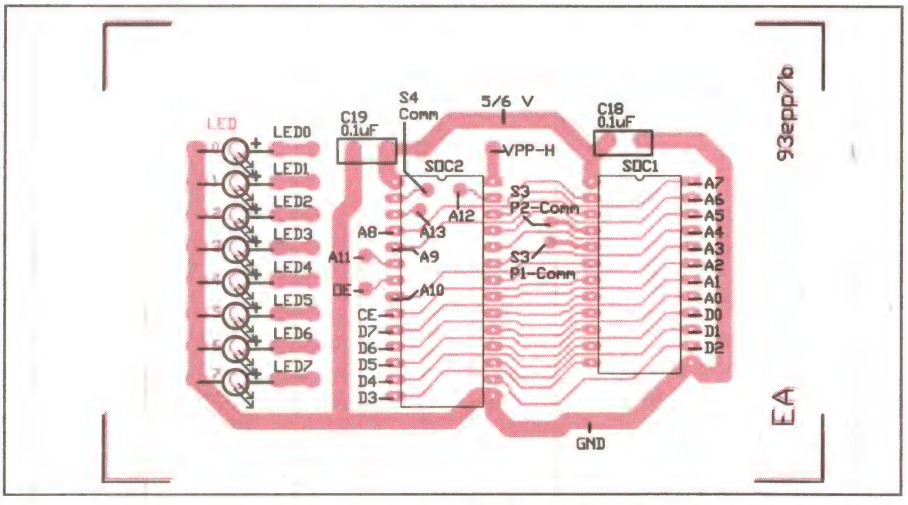



*Fig.3: The overlay for the second PCB, also single-sided, on which is mounted the sockets for the EPROMs. The view shown is from the solder side, to assist in the relatively complex task of connecting this board to the main board and front panel switches with hookup wire. Note that an extra track has been added to this PCB compared to the prototype pictured in this article.*

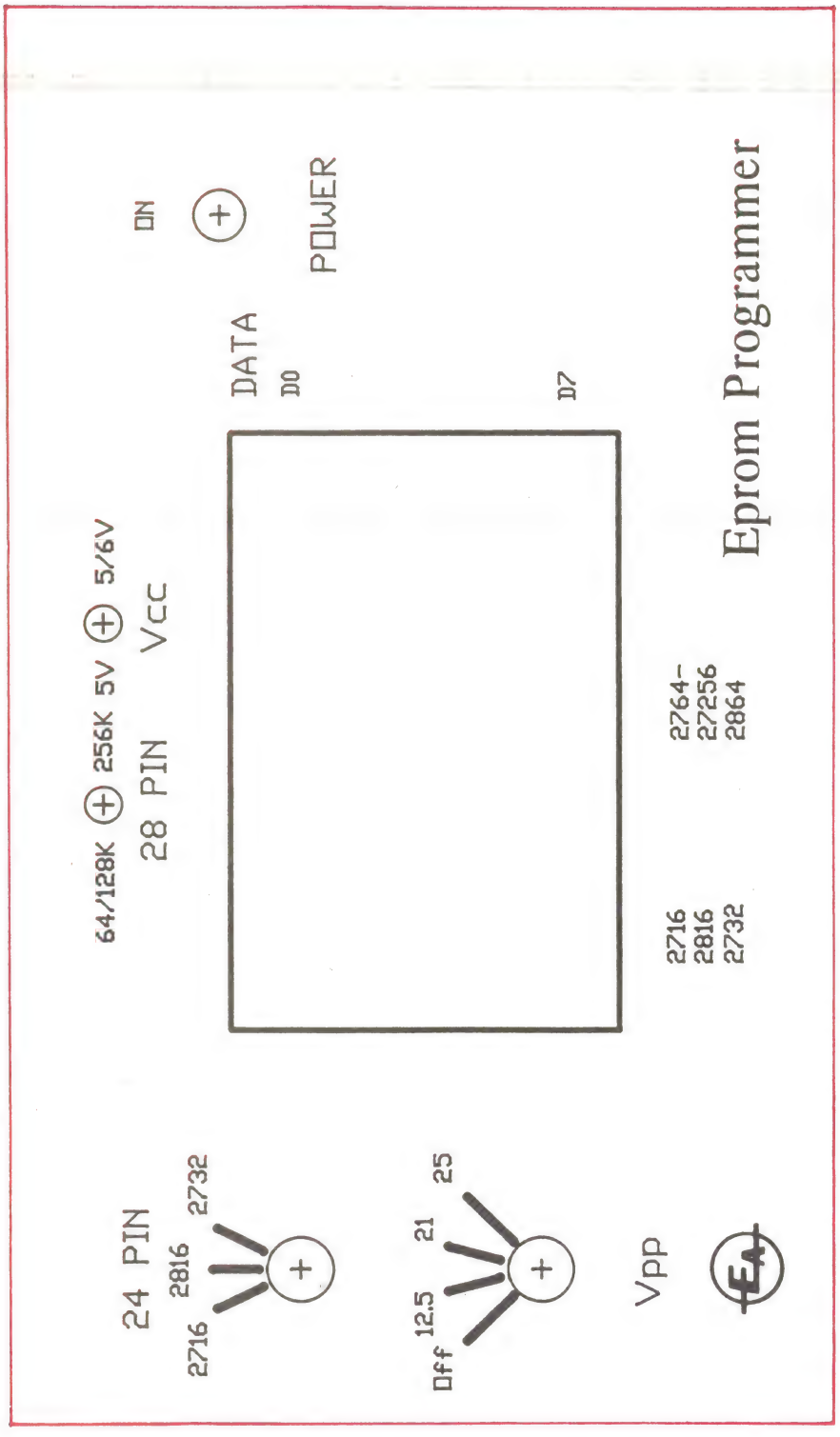



***Fig.4: The artwork for the jiffy box lid, incorporating a few minor changes from the prototype.***

dress counters as already noted. 74LS series devices will work in the circuit, but are not recommended because of the much higher power consumption and resultant risk of power supplies overheating. Total power consumption for the logic is around 80mA when all indicator LEDs are on. Consumption of the EPROM will vary significantly, and can be up to 150 - 200mA.

The remainder of the circuit is made up of the three power supplies, two IC sockets for EPROMs, indicator LEDs, and switches to control other aspects of programmer operation that could not be controlled easily with software.

The three regulated power supplies are driven from a single bridge rectifier and two smoothing electrolytic capacitors, which are connected in a standard voltage-doubling circuit.

Voltage regulators U9 and U10 are supplied from the common connection between the two capacitors C5 and C8. The voltage at this point is around 15V, with an AC input voltage of 12V going into the rectifier.

The U10 circuit, built around an LM317, has been described earlier and controls the Vcc supply for the EPROM. Metal film resistors (R34-R35) are used in the critical parts of the voltage adjust circuit of U10 for improved accuracy. The voltage drop of around 10 volts between the input of the regulator and its output can result in significant heating for the currents required by most EPROMs. A heatsink is therefore necessary on U10. I have used a segment cut from a 'universal U' heatsink, as a standard mini TO-220 heatsink may not be adequate for some high current drain EPROMs.

U9 is a 7805 regulator and provides 5V to the bulk of the circuitry, including the logic devices on the main board of the programmer. A heatsink should be fitted to this, but a mini TO-220 type should be sufficient.

Vpp is controlled by the third voltage regulator U11 (another LM317), and its associated components C3, C4, C7, R25, R26 and R29-R33. This regulator is supplied from the anode of C8, which provides around 30V when the rectifier is given 12V AC. U11 provides three Vpp voltages: 12.5, 21 and 25V. Voltage selection is achieved through the resistive divider connected to the adjust pin of the regulator.

The divider is formed on the positive side by R33 and on the ground side by one of three possible resistor pairs. A pair of resistors is necessary on the ground side of the voltage divider to achieve sufficient accuracy for generating the required Vpp voltage.

Note that all resistors are 400mW metal film types for improved accuracy. Selection of the required Vpp voltage is achieved by switching the appropriate resistor pair into the voltage divider with S2.

Two rotary switches and three toggle switches provide some key manual controls for the programmer. Both rotary switches are of the three pole, 4-position type. The other three are toggles (1 x DPST; 1 x SPST and 1 x SPDT). The DPST toggle S1 is used as the main power switch.

Rotary switch S2 controls the Vpp voltage as noted earlier, and includes a 'Vpp

off' position which can't be overridden by software control. Positions 2-4 of one pole of the switch are used to ground the end of one of three resistors which form part of the voltage-adjust circuit of regulator U11. Manual switching of Vpp on and off is achieved with the second pole of the switch, by opening or closing the Vpp connection between pin 2 of U11 and the output end of the Vpp circuit involving U5, Q1 and Q2.

The second rotary switch S3 configures the 24-pin EPROM socket (SOC1) to accept different devices: 2716, 2816 and 2732. The differences between these devices are the connections to pins 20 and 21. SPDT toggle switch S4 changes pin 27 connections on the 28-pin EPROM socket (SOC2). Connection of pin 27 to PGM is used for 2764, 2864 and 27128 devices, while connection to A14 is used for 27256's.

Toggle switch S5 controls the Vcc supply to the EPROM sockets and can be set at either 5V or 5/6V. When set to 5V, this switch permanently shorts one end of R36 to ground, ensuring that U10 continually outputs 5V.

Finally, the circuit includes indicator LEDs to show data currently on the data bus of the programmer. These are driven by another 74HC245 (U8), through current-limiting resistors R38-45 and provide a useful way of monitoring the operation of the programmer.

## Assembly

The bulk of the circuit is contained on one main single-sided PCB, including the interface with the computer parallel port and power supplies. There is also a second smaller single-sided PCB which holds the EPROM sockets, several capacitors and the eight data indicator LEDs.

Assembly of the main PCB should be straightforward, following the layout in Fig.2. As usual, take care with correct orientation of polarised components and ensure all links are installed — there are 22 of them. The connections to and from this board are numerous and are the most tedious part of assembly — and also where there is the greatest risk of making a mistake.

Care needs to be taken, in other words. The lines to the parallel port are identified with pin numbers on the solder side of the PCB, to help with these connections. Aside from the two 12V AC supply lines, all other connections to the main PCB go either to the second PCB or associated switches. I had planned to include a single large multi-pin header to simplify connections, but ended up running out of space on the PCB to do this.

Fig.3 is a plan of the second PCB which holds the EPROM sockets, as it would appear from the solder side during assembly (note that the photographs of this board may lack an extra Vcc track that was added after the prototype was built).

**TABLE 2**
**S2 Wiring**

| | Pole 1 | Pole 2 |
|---|---|---|
| Common | Vpp arm 1 | Ground |
| Position 1 (Vpp off) | NC | NC |
| Position 2 (12.5V) | Vpp arm 2 | 12.5V* (R26) |
| Position 3 (21V) | Vpp arm 2 | 21V (R30) |
| Position 4 (25V) | Vpp arm 2 | 25V (R32) |

**TABLE 3**
**S3 Wiring**

| | Pole 1 | Pole 2 |
|---|---|---|
| Common | SOC1 pin 20 | SOC1 pin 21 |
| Position 1 (2716) | OE | VPP-H |
| Position 2 (2816) | OE | PGM |
| Position 3 (2732) | VPP-L | A11 |

**TABLE 4**
**S4 and S5 Wiring**

| | S4: 28 Pin EPROM | S5: Vcc select |
|---|---|---|
| Common | SOC2, pin 27 | Ground |
| Position 1 | PGM (64-128K) | VCC SLCT (5V) |
| Position 2 | A14 (256K) | NC (5/6V) |

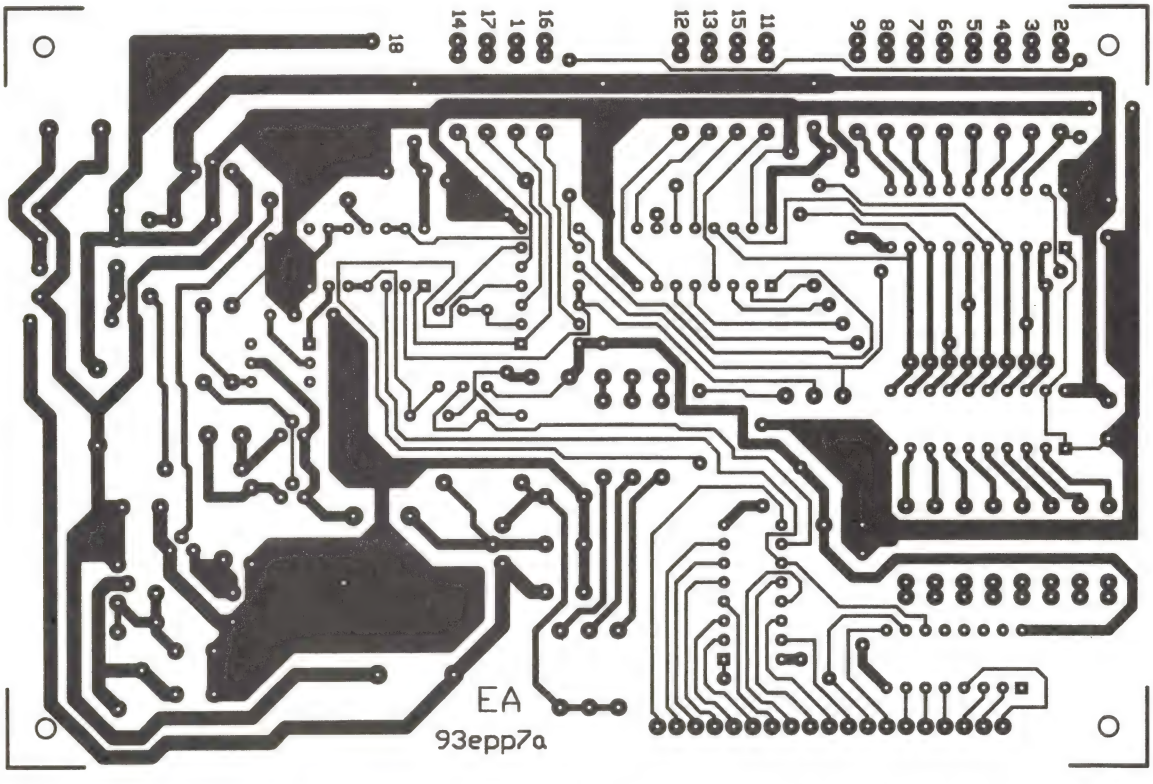



*Fig.5: The artwork for the main PCB, reproduced actual size for those who wish to etch their own boards.*

## PARTS LIST

### *Semiconductors*

4 1N4004 rectifier diode (D1-4)
1 1N914 diode (D5)
3 BC337 transistor (Q1-3)
1 4N25 optocoupler (U5)
1 74HC04 hex inverter (U2)
1 74HC08 quad AND gate (U7)
1 74HC157 quad 2:1 multiplexer (U6)
2 74HC245 octal transceiver (U1, 8)
2 4040 CMOS 12-stage counter (U3-4)
1 7805 5V/1A regulator (U9)
2 LM317 adjustable regulator (U10-11)
8 3mm red LED (LED0-7)

### *Capacitors*

**Monolithic ceramic** (0.2" pins):
10 0.1uF (C7, 9, 10, 13-19)
**Metallised polyester:**
1 10nF (C1)
1 1.8nF (C2)
**Electrolytic:**
2 2200uF 35V (C5, 8)
**Tantalum:**
2 1uF 35V (C4, 11)
2 10uF 35V (C3, 12)
1 10uF 16V (C6)

### *Resistors*

**1/4 watt 5% carbon film:**
21 1k (R1-17, 19, 21, 24, 28)
1 10k (R18)
9 390 ohms (R20, 37-44)
2 56k (R22, 23)
1 4.7k (R27)
1 1.8k (R36)
**400mW 1% metal film:**
2 120 ohms (R33, 34)
1 150 ohms (R26)
2 180 ohms (R30, 32)
1 470 ohms (R35)
1 1k (R25)
1 1.8k (R29)
1 2.2k (R31)

### *Miscellaneous*

1 UB2 (jumbo size) jiffy box
1 Main PCB, 151 x 100mm code 93epp7a
1 Smaller PCB, 111 x 70mm code 93eppb
2 3 pole 4-position rotary switches
2 Knobs to suit rotary switches
1 DPST mini toggle switch
1 SPST mini toggle switch
1 SPDT mini toggle switch
2 14-pin IC sockets
3 16-pin IC sockets
2 20-pin IC sockets
1 24-pin standard or ZIF IC socket
1 28-pin standard or ZIF IC socket
1 DB25 male in-line socket
1 2.5mm panel-mounting DC socket
2 Mini TO-220 heatsink
1 'Universal U' heatsink
Three mounting bolts and nuts for heatsinks; six 6Gx12mm self-tapping screws; four bolts, nuts and spacers for mounting main PCB; length 18-core computer cable; clamp, nut and bolt(s) for securing above cable in jiffy box; hookup wire; tinned copper wire for PCB links; four rubber feet, self-adhesive (for jiffy box base).

A wiring plan is marked on this figure, corresponding to similarly annotated connection points on the main PCB (refer Fig.2). Some connections to the second PCB come directly from the programmer's switches. You will need to refer to the section below on switch wiring for these.

There is no connection on the second PCB for the last few high level address lines on the main PCB. These additional address lines are provided for those who might wish to extend the programmer to 27512 devices and beyond, by modifying the second PCB and programmer switching.

There are two 0.1uF ceramic capacitors also mounted on the second PCB, and eight LEDs. These are mounted on the solder side of the board and their leads are 'surface' soldered directly to the appropriate pads. This avoids the need for unsightly holes and wires through the PCB, to the side that will be visible when the programmer is finally assembled. By the way, during fabrication of the second PCB, make sure you *don't* drill holes through the pads for these capacitors and LEDs.

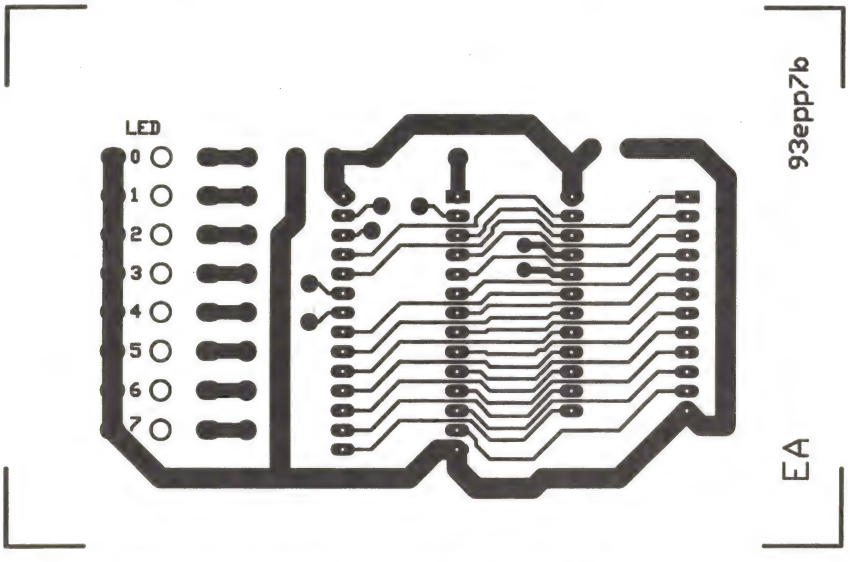



***Fig.6: The artwork for the second PCB, again actual size.***

Just a brief comment on fitting the LEDs. Holes should be drilled through the PCB at the marked middle point between the pads for each LED. These holes should be large enough to push the body of the LED through, but small enough to catch on the moulded lip at the base of the LED — if the LEDs you are using have lips. The LED is pushed through from the solder side, and the leads then trimmed and bent back onto the pads on the board so that they can be soldered. Be careful to observe correct LED polarity.

As for the EPROM sockets themselves, standard grade 24-pin and 28-pin IC sockets should be suitable. The prototype was actually built using a 'ZIF' (zero insertion force) socket for the 24-pin position, as an added extra. But these are quite expensive and although nice are not really necessary.

Wiring instructions for all switches (except the main power switch) can be found in Tables 2, 3 and 4. Rotary switch S2 controls the Vpp voltage and manual on/off for Vpp. All connections to S2 go to the main PCB. The third pole of this switch is not used. The second rotary switch, S3, controls EPROM selection for the 24-pin EPROM socket between 2716, 2816 and 2732. Only two poles and three positions of this switch are used.

A jumbo-sized jiffy box (UB2) has been used to house the hardware. The second PCB containing the EPROM sockets is exposed for access to the EPROM sockets behind a large hole cut into the top of the box, and secured with self tapping screws or bolts. The two rotary switches and three toggle switches are also mounted on the top panel. Artwork for the lid is shown in Fig.4.

Connection to the PC parallel port is achieved by running an 18-core cable directly from the main PCB through a suitably-sized hole in the side of the jiffy box and soldering a male DB25 plug to the other end. The cable should be secured to the inside of the jiffy box with a suitable clamp.

A panel mounting 2.5mm DC socket is used for the AC input. A 500mA/12V AC plug pack should provide a suitable power source. For those who wish, it may be possible to squeeze a small 240V transformer in at the power switch end of the box — provided the main PCB is positioned with the large power supply capacitors at the other end of the box.

For those who wish to fabricate their own PCB's, final scale artwork is shown in Figs.5 and 6.

*(To be continued)* ❖

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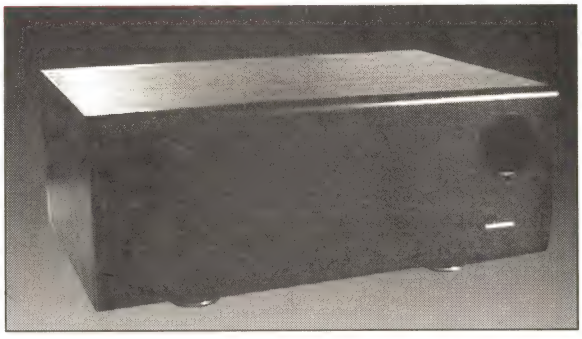
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# RE/SPONSE STEREO MINI SUBWOOFER

NEW

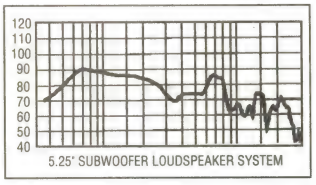
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Ideal for use with: • small bookshelf type Hi Fi speakers • rear speakers for AV surround sound • car Hi Fi systems.
The Re/Sponse subwoofer connects in line with your normal speakers, so you don't have to buy expensive subwoofer amplifiers, cabinets, crossovers, etc.
It is housed in a very smart black cabinet measuring 437(W) x 180(H) x 300(D)mm. There are two high quality drivers in each cabinet - one for each channel. The speaker impedance is 4 ohms, which is ideally suited to both car Hi Fi and Home systems. The subwoofer is connected in-line to the normal speakers via push terminals on the back of the box - in/out for each channel. Simply place the subwoofer on the floor at home, it can even be hidden behind a chair. Ideal for increasing the bass response in rear channels for surround sound systems.



**Specifications**

| | |
|---|---|
| **Drivers** | 5 1/4" high compliance |
| **Max Power** | 100 watts |
| **RMS Power** | 50 watts |
| **Impedance** | 4 ohms |
| **Frequency Response** | 36 - 200Hz |
| **Crossover Network** | 6dB/octave roll off |
| **Dimensions** | 437(W) x 180(H) x 300(D)mm |
| **Sensitivity** | 88dB ±2dB @ 50cm |

Cat. CS-2500



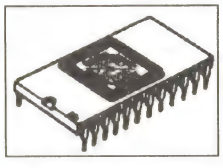
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Cat. ZZ-8470

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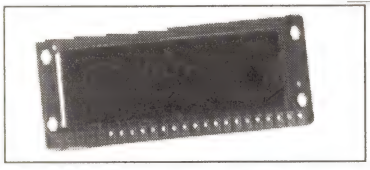


Ref: Silicon Chip 8/93
Forget those messy edits on your VCR! This kit accepts a composite PAL video signal and can fade it down smoothly to a black screen and back up again. You can also wipe the screen to black from left to right and back again. Give your home movies a tower of class! The kit includes case, labels, PCB and all electronic components. Plugpack is not included - use MP-3006.

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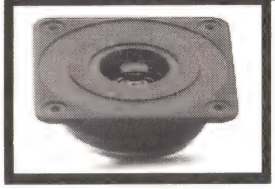
**Features:** •1/2" (12.7mm) red height character •flexible to select both 12/24 hours and full feature •continuous uniform segments •wide angle, long distance viewing •low power requirements •high reliability and long life
**Specifications:** •average forward current - 25mA •peak forward current - 200mA •com forward current - 30mA •reverse voltage - 5v •luminous intensity - typ 350uCd @ 10mA •forward voltage - 2.1v @ 20mA •reverse current - 2.1v @ 20mA •size PCB 64(W) x 25(H)mm, display 52(L) x 17(H) x 5.5(D)mm •data sheet available on request

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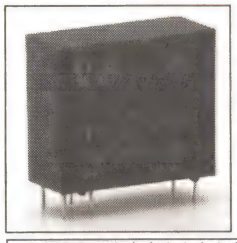
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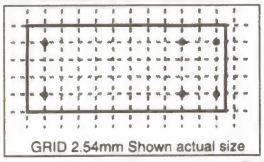
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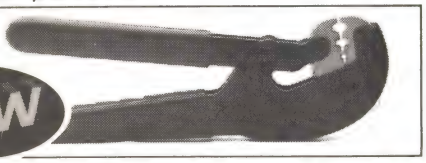
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## ANSWERING MACHINE

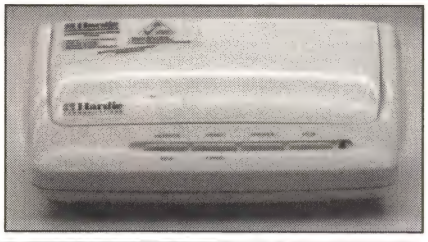
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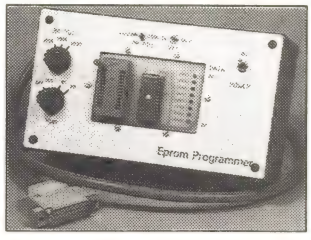
## PC CONTROLLED EPROM PROGRAMMER

Ref E.A. Sept 93.
This programmer is controlled via the parallel port on an IBM compatible PC. As well as programming EPROMs, it also has a readback feature. The hardware can handle EPROMs from 2716 (2k x 8) to 27256 (32k x 8). With modifications larger devices can be handled. It will also programme 2816 and 2864.
The kit includes 2 x PCBs, box, scotched panel, 2 x ZIF sockets and all specified components. KIT AVAILABLE EARLY OCTOBER.

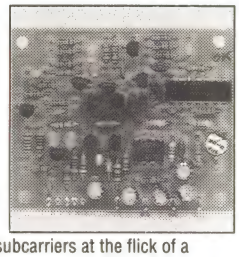
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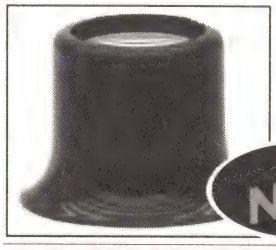

## IMPROVED DECODER FOR ACS SIGNALS



Ref E.A. Sept 93.
Many of Australia's FM broadcasters are now radiating either one or two "piggyback" ACS (Ancillary Communication Service) subcarrier signals in addition to their main programme. All you need to listen to these "hidden signals" is a FM receiver fitted with an ACS decoder. The ACS decoder can receive either of the standard subcarriers at the flick of a switch. Kit includes PCB and all components.

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# AUTOMOTIVE ELECTRONICS



with MAJOR AL YOUNGER (USAR, Ret.)

## SPX Automotive Group's Churchill diagnostic monitors

In previous articles we've looked at diagnostic scanners in general, and the way they work. Now we're going to take a more in-depth look at popular scanners available on the Australian market — starting with those marketed by SPX.

You might recall that OTC (the Owatonna Tool Company) is one of the oldest tool manufacturers in North America. The firm entered the automotive scanner business when they purchased the rights from Superior Electric, one of the oldest electric meter manufacturers in North America.

Nowadays OTC is itself owned by Sealed Power, of piston ring fame. All are under the new banner of 'SPX'. In Australia it's called SPX Churchill Tools (an Australian company).

OTC first introduced the Monitor System 2000, on the modular or add-on concept. The basic Monitor 2000 is a stand-alone scanner, with plug-in firmware. Additional 'System' equipment is added for optional features. This allows for recording, printing, terminal and PC operations.

In 1989, OTC introduced the Monitor 4000 with these additional features built in — including a true *record* function, in contrast with the 'snapshot' approach used by others. With a normal 'snapshot', data is lost when the power is removed.

In 1992, SPX Automotive Group introduced the Churchill Tools Diagnostic Monitor, for the Australian market. The Monitor comes as a complete kit (EM 9101) with connector cables and firmware, for vehicles manufactured or marketed in Australia. The kit offers the same features as the Monitor 4000, but the Aussie software makes it easier to use. Additional firmware is available for North American imports.

### Firmware history

The above preamble might make it seem as if using this kind of scanner would be a 'snack', with no problems, but it isn't quite that straightforward.

The number of vehicles and competing scanners in North America put extreme pressure on programmers to get the initial product on the market. Although it was the most versatile scanner on the market, the software could have been a lot better.

Just before the introduction of the Monitor 4000, the software became very 'user friendly'. If you could read the display, you could run the machine. (I like to think they had been listening to me — I always said "the industry needs a scanner that does not require a book when operating it, or extensive training".)

Of course the systems fitted to certain vehicles require a specific procedure to extract the correct data. But with the right firmware in the scanner, there's no reason why it shouldn't be able to guide you through the correct procedure — just by following the 'readout' instructions. (NOTE: In the auto industry, firmware is often referred to as 'software'.)




*The SPX Churchill Diagnostic Monitor.*

As it turns out, the latest Aussie firmware is very easy to use. You just power-up the Monitor and answer the questions. There are two firmware cartridges available: the '4 in 1' and the '11 in 1.' The first covers the four main OEM systems: GM/Holden, Ford (including F Series trucks), Toyota Lexcen and Nissan Pulsar. The '11 in 1' cartridge covers eleven different Japanese brands: Toyota, Nissan, Mazda, Subaru, Mitsubishi, Hyundai, Holden Isuzu, Suzuki, Lexis, Daihatsu and Honda.

### Using it

A few precautions must be taken before using. The firmware cartridge or 'chip' must be plugged in with the Monitor's power turned OFF, and the ignition must also be switched OFF during hook-up to the vehicle.

It's also important to make sure the cigarette lighter socket has power with ignition OFF — if not, the Monitor must be powered directly from the battery. Some lighter sockets switch OFF during cranking, and this will reset the Monitor.

To illustrate how the Monitor is used, we're going to hook it up to a Holden VN. So first we locate the ALDL connector — it's behind the left kick panel. Try fishing it out from the top; if it won't come out, you need to remove the panel.

I use an optional extension cable, from the Monitor to the ALDL connector cable. Check that all connectors and the 'chip' are firmly in place, then plug the power lead into the cigarette lighter socket or directly to the battery. The eight LEDs will light and you will hear a 'beep'. The display will rapidly show a screen identifying the firmware chip in use, and then display a message rather like that shown in Fig.1 (the exact message shown will depend on the last vehicle that was tested, of course).




Fig.1

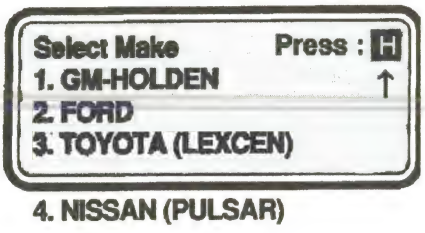



Fig.2

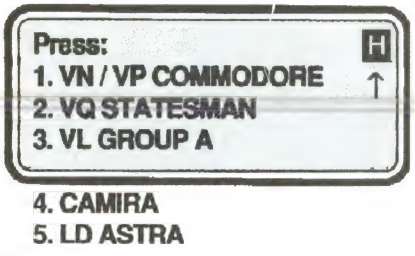



Fig.3

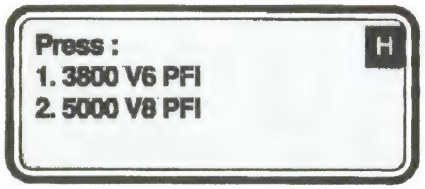



Fig.4




Fig.5




Fig.6

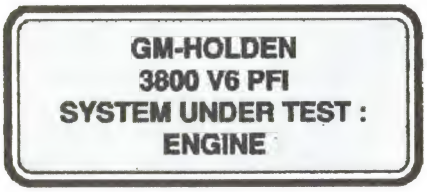



Fig.7




Fig.8

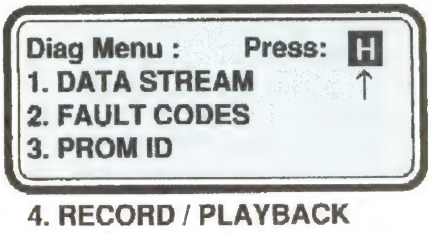



Fig.9

Since in this case we want to check another model, we press #2 and get the display shown in Fig.2. (Note that the 'H' appears in the top right of the display when 'Help' information is available. The 'up arrow' (↑) appears as well, if the menu is actually longer than the items displayed. Fig.2 shows that in this case there is in fact a fourth choice available.)

Here we want another model Holden, so we press the #1 key. The display briefly shows 'HOLDEN 1984-1991', and then changes to that shown in Fig.3. Since we want to test a VN, we obviously need to press #1 again — which gives us a further choice of engines, as shown in Fig.4.

Our model has the six cylinder engine so we again press #1. We now get a further choice, as shown in Fig.5. Let's say we have an auto transmission, so we now press #2. This switches the display to that shown in Fig.6, where we have to indicate whether our vehicle has air conditioning or not. We'll assume it has, so we press #1.

Once we have fully specified our model and configuration, the display briefly shows vehicle identification (Fig.7) and the correct connector/adaptor part number (Fig.8). Then (phew!) we get the main Diagnostic Menu, shown in Fig.9.

At this point some would say that the foregoing represents a lot of button pushing. To this I must agree; but it also allows you to set-up the scanner without reading a reference manual or book.

In other parts of the world, vehicles use a VIN (vehicle identification number). Just entering the VIN information answers most of the questions. But there are no VIN's as yet on Aussie cars — so we must push the buttons.

(In the recent New York bombing, the bombers' vehicle VIN tag was found. This allowed the 'Feds' to locate the culprits within three hours, using a VIN trace. So VINs have other worthwhile uses, as well.)

Before the next step, make sure the ignition is ON. If not, we will receive a '+NO DATA AT ALCL CONNECTOR' message, on the display. So, let's make it simple and start the engine; then we can continue.

Press the #1 key. This brings up a display like that shown in Fig.10. It shows eight readings, in what we call 'Live Data'. This is the actual data from the ECU. The Monitor's eight LEDs also indicate various functions, like 'OPEN/CLOSED'(loop).

By pressing the arrow keys, you can 'scan' all of the available data. All of the data is presented — it's now up to the auto technician to determine the validity. As I have said many times, it's still up to the autotech to find the faults and fix the car. The Monitor only presents data and performs tests, as a tool to assist in diagnosing the vehicle.

As noted earlier, any time the 'H' appears on the display, pressing the HELP key provides additional information. The information will vary, depending upon which stage of the procedure you're up to. The arrow signs indicate more display data is available; just press the corresponding arrow to see it. Also the Monitor indicates units of measurement with an 'm' for metric and an 'e' for English (Imperial).

## Recording

I tried out the Monitor's Record function, and found you can do quite a bit of testing in the one minute it gives you. I hooked up to a warm VN 3800, with a user complaint that it consumed too much fuel, and recorded as follows:

1. Ignition On (15 seconds)
2. Crank Engine & Run (15 sec)
3. Idle at 2000rpm (15 sec)
4. Remaining time with:
   a. Wide Open Throttle
   b. Engine Off-Ignition On

During the tests, I noticed the LED indicators showed that the system was always LEAN and that it never entered the CLOSED Loop ($O^2$ control).

It was a typical beautiful day in NSW, just slightly on the warm side. So, I gathered up the Monitor and returned to my flat. I poured a cup of coffee and entered my computer room. Then I hooked up the Monitor to my PC, ran the *ZSTEM* program (discussed shortly) and moni-

tored the data. There it was: an easy one, a code 13 — $O^2$ Sensor Open. (No, the Check Engine Lamp did not come on...)

I returned to the VN and checked the $O^2$ sensor connector, which was slightly corroded. So I cleaned the connector and again hooked-up the Monitor to display data stream. Then I set the engine idling at 2000rpm, and watched the Closed Loop LED and the $O^2$ sensor voltage to check for any sign of 'hunting' (swinging continually between high and low volts). The ECU certainly went into Closed Loop, but both the $O^2$ reading and the 'Rich/Lean' LEDs also indicated slow hunting.

Well, I had found it: a 'lazy' sensor. So let's fix it...

An engine running too RICH will 'carbon up' the $O^2$ sensor, so the obvious thing to try is cleaning it. I set the idle at 2000rpm and made the engine 'super lean'. This makes the exhaust gases super hot, and this will clean the sensor.

How did I make it super lean? I forgot to tell you. I had previously hooked-up my 'black box' in the coolant temperature circuit, so I just switched it to Lean (Short).

**CAUTION: Do not attempt to do this yourself without adequate knowledge and test equipment. Running an engine too lean, for too long, can easily damage engine components — including catalytic converters, which are very expensive.**

As it happens, there's other data stream information available to find this problem. (Note that the GM/Holden VN systems also have a test mode that will test the $O^2$ sensor operation.) But this particular test showed the versatility of the Monitor's record function. I like to record and print the data for future reference, and also provide a copy for the customer. Of course, the customer pays for this additional service...

## Terminal setup

It takes very little time for you to learn the Monitor's function keys, F1 and F2. For instance, if you're using a terminal display, after power-up you just press 2, F2, F2, 2 and 2. All the OEM vehicles appear on the screen, waiting for you to choose the one you need.

## Learning feature

This is not an advertised feature of the Monitor, but it should be. In the Toyota section of the '11 in 1' firmware, there's an example of data stream. Just hook-up the Monitor to any 12 volt source. Select Toyota, press Help (H), then choose Demonstration (#1) and start practising set-ups or retrieving data. (With the '4 in 1' firmware you can record a GM-Holden and practice away.) This allows learning anywhere you have access to a 12 volt source.

## Available options

Among the optional hardware and firmware items available for the Monitor are the following:

**Communicator/Anticipator**: This records and stores four events of data stream information. A built-in 'super cap' (high value capacitor) retains memory for 72 hours. You can recall the data for viewing on the Monitor or on a terminal or PC (requires software). The Communicator also features a built-in Hayes-compatible modem.

**Personal computer software**: The optional *ZSTEM* software is used to allow an IBM-compatible PC to communicate with the Monitor. This allows live or 'replay' viewing on a PC screen, which

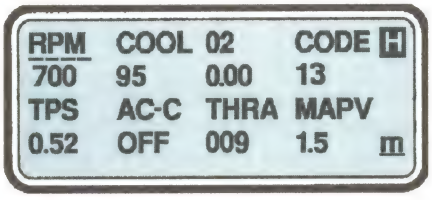



***Fig.10: An example of the 'data stream' indication obtained from an ECU.***

can be not only an aid in diagnostics, but also a 'show item' for customers.

Also available is *EZEVENT*, a software package for graphing which allows an autotech to view sensor operation for diagnostics. This is a fine tool for teaching or learning the interaction of sensors.

**Printer**: The WeighTronix is a DC-operated serial printer, with output 40 characters wide. The driver software is supplied in a plug-in firmware cartridge.

**Terminal**: For communication with a VT-100 compatible data terminal such as the Wyse WY-60 or others, software is again available in the form of a plug-in firmware cartridge.

## Special features

An important 'special feature' of the SPX Monitor is its RS-232 serial I/O port. I'm sure most *EA* readers will know the benefits of an I/O port. This allows 'talking to the world' via a modem, printing out data and communicating with a terminal or PC. As noted above, optional software and hardware are available for the Monitor so you can take advantage of this feature.

What's so important about being able to print out data from the Monitor? If you have ever worked in the retail trade, you'll probably know the value of printed information. Have you ever gone back to a store to complain about some missing part, or item that was faulty, only to receive that "Oh yeah — that's what YOU say!" look? I've even had customers say it to me.

With a printout of the crucial data, there can be no arguments. This is especially useful on vehicles with data stream, which is ECU serial data. Not only can you show it to the customer, to show that there *was* a fault and you've now fixed it, but it's an aid to diagnostics anyway.

Another very important feature of the Monitor is its RECORD function. The hardest faults to find, in any field, are those that are *intermittent* — and especially in electronics. The record feature allows you to capture data. When the fault occurs, just press the Record key. It will capture up to 30 events, before and after the key is pressed. Simply play it back or print out the events for further diagnosis of the fault.

The Monitor offers the ability to make two recordings, each of one minute duration. The data remains in memory until deliberately erased.

If I have to list the main features of the SPX Churchill Monitor, here they are:

- Its display panel, showing four lines of data or instructions.
- It is menu driven, for easy step-by-step test procedures.
- A has a 'HELP' key to guide you though usage.
- It has that 'RECORD' key, allowing capture of active data.
- It has a serial interface for communicating with a printer, terminal, modem or personal computer.
- It comes with firmware containing vehicle data.
- It also comes with a 'Code Library' which gives a brief description of stored ECU codes.

Above all, what I like about the Monitor is that it is a 'stand-alone' scanner, and manuals are not required for most operations. In addition it can be hooked up to many Engine Diagnostic machines. This allows display on their terminal screen.

By the way, the Churchill Monitor has a 'big brother' called the 'HD Monitor'. This works on heavy duty trucks such as Caterpillar, Cummins, Detroit Diesel and Mack; or any truck that's fitted with the Cummins Pace, PT Pacer or Celect systems. *Continued on page 91*

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READER INFO NO. 12

# SHORTWAVE LISTENING

by Arthur Cushen, MBE



## *Australian Navy transmitters serve overseas forces*

Since early in the year, for personnel serving overseas in areas like Somalia and Cambodia, the Australian Armed Forces Radio has been broadcasting recorded greetings from their families. For several months this was done with a special transmission from the Darwin transmitter of Radio Australia, at 0300 - 0400UTC on 17,900kHz. However, the service is now being provided by the Navy's own transmitters, each with a power of 40kW and broadcasting in the upper side band.

The Royal Australian Navy is now providing the facilities to send a signal to Somalia, Cambodia and other areas in which Australian Forces are stationed, according to Hugh McKenzie in a broadcast on Radio Nederland. The programmes are produced at the studios in the Russell Complex, which is the main Defence Administration Complex in Canberra. The Australian Armed Forces programme service is a one hour programme in which wives and relatives send greetings to Australian servicemen in various parts of the world.

Several transmitter sites are now being used, to ensure good reception in the target area. These include Exmouth in north western Australia, a former US/Australian base but now run by the Australian Defence Forces. Another site near Canberra, the Belconnen transmitting station beams its signal into Cambodia, and this transmission is also heard in Afghanistan and Pakistan — areas in which Australian troops are also based.

The transmission schedule shows that all of the frequencies are in the upper sideband and that each broadcast lasts one hour. The schedule is: to Somalia at 0300 on 19,037kHz: 0900 on 25,322kHz and 1400 on 13,508kHz; and to Cambodia at 0300 on 23,678kHz; 0900 on 20,418kHz and at 1200 on 12,070kHz. The transmission at 0300 is live, while the repeat broadcasts have been recorded.

The Australian Armed Forces Radio is interested in reception reports from listeners anywhere in the world. The address is: Mr Hugh McKenzie, Department of Defence, EMU Anzac Park West, APW 1-B-07, Reid, ACT 2601, Australia.

The transmissions are now on a more permanent basis and have been scheduled for a year, operating towards the various areas in which Australian Froces are serving. The Chiefs of Staff Committee was impressed with the service originally broadcast to Somalia and has agreed to the new system of operation. The Australian Armed Forces will continue its attempt to supply a service to Australian Forces no matter where they are located.




### Paraguay on the air

Most readers of this feature would never have heard signals from Paraguay, because it is one of the world's most isolated and poorest countries, with its radio services in the same category. In my 56 years of listening I have only heard five signals from Paraguay; so the announcement that a new 10kW shortwave transmitter is to come into operation shortly will be welcomed by listeners throughout the world.

The name of the station is Radio La Voz del Chaco Paraguayo, and it is located in Filadelfia, some 500km north of the capital of Paraguay, Asuncion. The station has the callsign ZP30 and already operates on mediumwave 610kHz with 10kW. The listening area comprises a cross section of languages including Spanish, Portugese and German. The plans for shortwave are being introduced following a survey which showed that one of the popular areas which the station is trying to serve on AM is outside the range of 610kHz.

Following the purchase of a new 10kW mediumwave transmitter, the old transmitter has been refurbished and will be put into operation on shortwave. It will operate in the 60m band and will allow ZP30 to cover Eastern Paraguay and Southern Bolivia.

The fact that the station is using an old Gates 10kW transmitter is no assurance that this will be the output power, but it should range between 5kW and 10kW once operating, reports DX Party-line.

The mail service in Paraguay is not good, and mail is seldom received from listeners to ZP30. Most contact is from the listening public who call into the studio to express their interest in the broadcasts, but the station has established outposts where mail can be left for forwarding to ZP30.

The station will be keen to hear from shortwave listeners once the transmitter is activated, which is expected to occur by September. It will have a verification letter or card. In the early stages, the shortwave signal will be a relay of the one from 610kHz which operates from 0930 - 0215. The address of the station is: ZP30, PO Box 984, Filadelfia, Paraguay.

### Expanding German station

Last month we reported reception of Radio Ropa Info on 5980kHz, heard between 0300 - 0500 — although the schedule actually runs through to 2300. This test broadcast is using a Czech transmitter to gauge the shortwave audience, which will be compared with its longstanding outlets on longwave and FM.

A letter in English was received from the

***This item was contributed by Arthur Cushen, 212 Earn St. Invercargill, New Zealand who would be pleased to supply additional information on medium and shortwave listening. All times are quoted in UTC (GMT) which is 10 hours behind Australian Eastern Standard Time and 12 hours behind NZ Standard Time.***

## AROUND THE WORLD

**CHINA:** China Radio International Beijing reports a record incoming mail of 328,610 letters received in 1992, from listeners in more than 170 countries and regions. This represents a 15% increase over the peak year of 1965 which registered 286,000 letters. The station claims that based on analysts' projections, the number of CRI's overseas listeners in 1992 represents an estimated total of 160 million. China Radio International has a service to Australia and New Zealand from 0900 - 1100 daily on three frequencies, 11,755, 15,440 and 17,710kHz.

**FRANCE:** Radio France International has English to Asia and Oceania from 1400 - 1500 on 11,910, 17,650 and 17,695kHz. Other broadcasts are from 1200 - 1300 to Europe on 15,155 and 15,195kHz; and to Africa from 1600 - 1700 on 11,705, 12,015, 17,620 and 17,850kHz.

**ITALY:** Italian Radio Relay Service is heard on 7125kHz at 2030 with popular English music, while at 2100 there is a transcribed programme from the United National Radio.

**JAPAN:** The Japanese Gospel organisation, Radio Aum Shinrikyo, which uses the facilities of Radio Moscow, broadcasts in English to this area at 0430 and lists 43 frequencies. The best channels in this area are 11,690, 11,765, 15,230, 15,375 and 17,560kHz. It is interesting to note that the ferquency list for transmissions to Asia cover 59 channels, but many of these are duplicated with the service to Australia and New Zealand.

**SAUDI ARABIA:** Riyadh, which has the mailing address of PO Box 61718 for the Ministry of Information, Kingdom of Saudi Arabia, shows a change in the frequencies used for English, with broadcasts now on 9705kHz from 1600 - 2100.

**SRI LANKA:** The Voice of America has announced that it has accepted a tender from the Marconi Company for the installation of three transmitters at the VOA site in Sri Lanka. This is the first turnkey station ordered by VOA as part of its ongoing modernisation programme, and includes all civil work — buildings, feeders, matrices, antennas, audio and control systems. The completion of this $35m contract is expected early next year.

Marconi Communications is already installing shortwave and mediumwave broadcast transmitters and antennas for VOA in Morocco, Thailand, Greece and Botswana.

station confirming reception and offering to supply additional information. The verification card shows frequencies in use as 261kHz and 105.2MHz, with transmissions also being carried by satellite. Included with the verification were two books (one concerning Radio Ropa Info and the other the new Digital Super radio), and five stickers showing both the longwave and FM frequencies. The address for the station is: PO Box 549, W-5568 Daun, Germany.

### VOA expands in Thailand

The Voice of America announcement that it was to construct seven 500kW transmitters in northern Thailand is gradually taking shape, with two transmitters already on the air. The services are mainly directed to China.

In the initial broadcast on 11,785kHz at 1100 jamming was evident, but a re-arrangement of the scheduling seems to have overcome this problem. The broadcasts from Thailand are backed up by transmitters in the Philippines, which are carrying basically the same programmes, with a service in Mandarin from 1100. This is received on 6160 and 12,040kHz, as well as other frequencies. The present schedule valid to September 25, includes the following transmissions which are suitable for reception in the South Pacific: 6045kHz at 2100 - 0100; 6070kHz at 2200 - 2400; 9560kHz at 1130 - 1400; and 11,820kHz at 1100 - 1300.

The Voice of America is keen to receive reception reports, and recently has been providing listeners with a sample report form and background information on how to report signals. An excellent booklet on the Voice of America is also sent to listeners, as well as the latest programme schedule. Reports should be addressed to Irene R. Greene, QSL Desk, Room G759, Voice of America, Washington DC 20547 USA.


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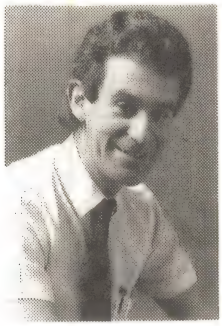
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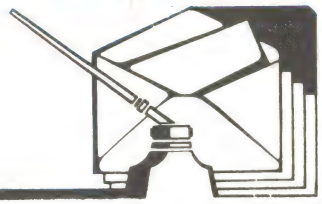
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READER INFO NO. 13



# Information centre



Conducted by Peter Phillips

## The 'sparks' are flying...

There's a lot of reference to the 240V mains this month, with some of the discussion getting rather heated. RMS power is also defined by an audio expert, while a reader explains a simple way of discharging NiCad cells.

Even TV technicians, who regularly deal with 25kV or more, admit to being very apprehensive when confronted with 240V AC mains wiring. And for good reason. Most deaths due to electrocution are from the mains, not from an isolated supply inside an appliance.

One of the reasons for this is the MEN system where the neutral wire is connected to earth at the fuse box. This system ensures that we are almost always in contact with one of the conductors (ground), and all you have to do is touch the other (active) wire, to receive a shock.

Proponents of the MEN system argue that this is better than having accidental earths through faulty appliances, which could make an otherwise isolated system relative to earth. A case of 'better the devil you know!

### Various licences

Why am I saying all this? I'm prompted by our first letter, as I think it's time we demystified some of the thinking around mains wiring. The notion that only qualified, licensed electricians can work on fixed wiring is being increasingly challenged. There are now a number of restricted electrical licences available, which allow otherwise unskilled people to do certain 'connect and reconnect' tasks on single-phase and even three-phase wiring.

And let's face it, how many readers do some or all of their own mains wiring? Quite a lot, I'd say. In NSW (and possibly other states) self-testing is now in place, where the installer takes full responsibility for the installation. Previously it was tested by an inspector.

So this month, I'm starting with a letter from a reader who, to say the least is quite horrified...

In July, my opening remarks made the point that quite a few electricians now read *EA*. Here's a letter from a licensed electrician who is concerned about the answer given to the May What?? question. To help you understand the concerns, the circuit given as the answer is shown in Fig.1.

*Being somewhat safety minded, and I would think better qualified than your contributor (who is obviously not a licensed electrician), I am, to say the least, horrified at the circuit given as the answer. I am also horrified with your suggestion, by default that it is safe and legal wiring practice. You also seem to endorse your approval by supplying the catalog number and price of the switch.*

*Here's what is wrong with the installation...*

*There is no isolation between the 240V AC and the rectified 240V DC. The whole system is floating above earth because the neutral is no longer MEN. Of course if you ground it (as the negative line should be), you no longer have a circuit that can operate as a two-way switching system.*

*There will also be a time when the red wire is negative and the black wire positive, which is totally against AS 3000 wiring rules (3.2.4.1 Fixed wiring). Finally, the switch is rated at 240V AC and must be derated for DC operation.*

*This type of modification in domestic premises is definitely very dangerous apart from the legalities it infringes. However, apart from all the above, it is an ingenious way to overcome the original problem.*

*Maybe if your writer had thought more about safety, he could have dropped the voltage to say 12V DC and saved me writing this letter. He could have even used one of the 12V fluorescent light designs from EA!* (J.B., Campbelltown NSW).

What we have here is a circuit that doesn't conform, but does that automatically makes it dangerous or even illegal? To me a circuit or installation is unsafe if an unwary person is likely to be electrocuted. It's also unsafe if its poor design is likely to result in damage to other property. Let's look at J.B's points in turn:

There are many appliances that derive their DC directly from the AC mains, without isolation between the two. Ask any TV technician. The difference here is that the wiring is not inside an appliance, it's running under the ground and happens to look like mains wiring.

Regarding the rating of the switch, I discussed this in August. Here I made the point that a 10A 240V AC switch should be able to switch a current of say 1A at 240V DC, which is all it's being asked to do. I'd also like to see what DC rating Clipsal give the switch.

### Wary of both...

The fact that both wires after the rectifier are now above earth is potentially more dangerous than having only one wire above earth. But who among us happily touches the neutral wire in a live installation?

I always regard both wires as potential hazards, in case the wires have been reversed somewhere, making the black wire the active. And if the wiring has been done properly, it should not be possible to contact a termination anyway.

As for the colours, I'll make the obvious point that the contributor didn't specify or even suggest any colours. As far as I recall, the AS 3000 rules don't state that red must be the active and black the neutral, rather they say you must be *consistent* in your use of colours. To conform to the rules all you need to do is use say, blue and white wires.

Having said all that, I take the point that unusual circuits directly connected to the mains are more likely to be dangerous than those that are isolated. However, that's not an admission that the circuit is dangerous, as I don't believe it is.

Whether it's something I'd do in my house is another matter, but I don't think it's incumbent on us (or me) to describe such a circuit as unsafe or illegal when there are no real grounds to do so. But I agree that making it 12V (or even 32V) would have saved all this discussion.

So to our next topic, which also involves the mains.

## Mains filters

A mains noise filter is something we rarely get to see working. You can put the unit through all kinds of tests, but when overvoltage surges appear on the mains all you can do is hope that the manufacturer's data is right.

The following letter not only describes an instance where a mains filter saved the day, but also asks a few questions about their design:

*It's probably not often you get reports about mains filters. I'm talking about the type with a commercial EMI filter and a MOV — like those you described in EA, October 1989. About a year ago I built three of these for a relative, using EMI modules I bought from Truscotts Electronics in Croydon, Victoria.*

*These were then used as mains protection units for (1) a TV and VCR, (2) a hifi system and (3) a computer, VDU and printer. The modem connected to the computer was powered directly from the mains and was therefore not protected.*

*We recently had very stormy weather along with a mains failure of about 10 minutes. When power was restored, all equipment worked perfectly.*

*After the storm, my relative went out, returning several hours later to find the neon indicators on each filter unit extinguished. He found that the 5A fuses in each unit had blown and that the MOVs had been destroyed, with bits blown off and lying in the case housing the filter.*

*It turned out that all the equipment protected by the mains filters still worked perfectly, except the modem, which no longer worked. Obviously the mains filters had carried out their protection role.*

*However this experience raises a few questions. Because the MOVs were connected before the EMI filter, I'm assuming the filters were not stressed by the fault condition that caused the demise of the MOVs. It would therefore seem to be bad practice to connect a MOV after the filter, as the surge current could then possibly burn out the filter. Do you agree?*

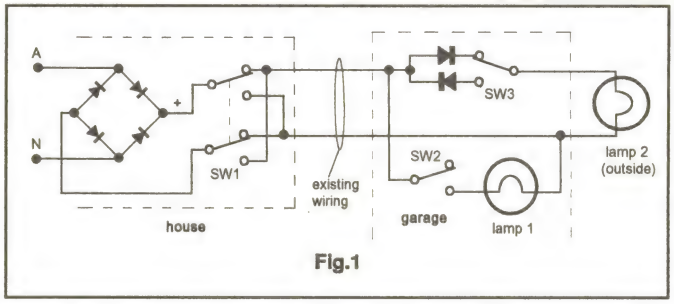


Fig.1

*Obviously a key protection feature is the fuse, which blows when the MOV conducts. The fuses used in the units are 5A 3AG fast-blow types, with a fusible element consisting of a flat metal strip incorporating an S-shaped centre.*

*In trying to find replacement fuses, I've discovered that some are marked 250V, others have no voltage rating and the latest DSE catalog has 32V rated glass fuses. Are some of these rated for DC use only and others for 240V AC use? Is there a difference in fuse applications for 240V AC, 12V automotive, 32V DC and so on?*

*Finally, from this experience it would seem the fuse rating should be less than 5A. This might prevent the MOVs from self-destructing!* (B.H., Heathmont Vic).

You're right B.H., not many people tell us about something that works — it's usually when it doesn't work! Regarding your questions, I'll start with the fuses.

Fuses are usually given three ratings: current, voltage and a third called the *category of duty*. This latter rating is an indication of the amount of energy the fuse can contain without damage. Most re-wireable household fuses are rated AC1 or AC2 and HRC fuses are much higher at AC5. However the humble automotive glass (AG) fuse has no such rating, as (I suggest) it's also a function of how the fuse is housed.

Voltage rating is the maximum voltage at which the fuse can safely interrupt a fault current without undue arcing. Current rating is, of course the current that will cause the fuse to blow.

While I can't find any information about this, I suggest that for a 3AG glass fuse, the only rating you can rely on is the current rating; the others depend on the fuse holder. If you look in the DSE catalog you'll see that only some 3AG fuse holders are rated at 240V. One is even specified as 12V only.

I further suggest that all 3AG fuses can be used safely with 240V AC, providing you have the right type of holder. I would however caution against using glass fuses with a current rating of more than 5A in a 240V circuit. This comes down to the category of duty, which is again a function of the housing as well as the type of fuse. The 32V fuses you mention are 5AG types, although I notice the fuse holder for these is rated at 600V. Again, providing the fusing current is 5A or less, I suggest you could use 5AG fuses on 240V.

The current rating for a fuse in a mains protection filter is always difficult to judge, as you want maximum protection without nuisance fuse blows. I've found 3A seems to be suitable for most applications protecting electronic equipment.

As to where the MOV should be connected, I agree that if you have one only, let it be on the mains side of the EMI filter. However, I doubt if a MOV connected after the filter unit will cause problems, as a fault current likely to damage the filter will surely blow the fuse first.

We'll return to mains filters in a moment, but first a short diversion about yellow LEDs...

## Yellow LEDs, noise

*I'm writing in response to two of the letters in the June 93 edition. Concerning yellow LEDs, I've found those from Tandy to be the closest to yellow. I paid $2 for a packet of two, but even though they are slightly green, they're well worth a look.*

*I also have a problem with mains noise. It comes in the form of beeps, with a relatively high pitch which lasts up to a minute.*

*I get the sound in my hifi and it seems others in the neighbourhood have the same problem. I thought it might be due to a piece of machinery somewhere nearby, but after reading your column I wonder if a line filter/conditioner would be a wise investment.* (J.G., Jannali NSW).

Thanks for the information about the Tandy LEDs. Regarding the mains noise, it sounds like the switching tones used to operate off-peak appliances. These tones are sometimes audible in different types of equipment, but especially sound equipment. A mains filter would probably help, although it may not get rid of all the interference.

If it is still a problem, I suggest you call the supply authority, which in your case is Sydney Electricity.

# INFORMATION CENTRE

## Motor speed control

You might remember a discussion in April when I advised a reader to take a much simpler approach to the problem of a speed control system for a billy cart motor. Well, I'm at it again, this time with telescopes...

*I have two astronomical telescopes, and I'd like to be able to use a 12V windscreen wiper motor to drive them. Unfortunately I don't have a variable speed control system to do this. I don't even have the basic knowledge to design a system, and I wonder if you have anything in kit form.*

*I've built a number of your kits, but there seems to be nothing to suit this task.* (F.M., Borden WA).

First F.M., let me say that *EA* doesn't sell kits. Instead electronic parts suppliers make up and sell kits for the various projects we design and publish. Somehow a lot of people seem to get confused about this.

I don't know the type of load a telescope puts on a motor, but I imagine it's reasonably constant. If so, then I think you can get away with a quite simple arrangement. Years ago I designed a motor speed control system for a 12V Volkswagen windscreen wiper motor, for use as the roll drive in a player piano.

Here the motor speed has to be adjustable over a wide range of speeds, and yet maintain the preset speed regardless of the load. I went to extraordinary lengths to do this, with a tacho generator connected to the motor, a stable reference voltage and a complex control circuit.

Because of its success, other player piano owners wanted one. I subsequently found that the VW wiper motor was able to hold its speed quite well regardless of the load, and I then designed a much simpler system which was basically just a regulated adjustable power supply.

So I think you'll find a regulated power supply, able to deliver up to 2A over a voltage range of 3V to 12V will work quite well, assuming you use a permanent magnet motor.

There's quite a few pianola owners out there who would agree. To prove it, you might be able to borrow a suitable DC power supply from a friend and try it out. If it works, visit your nearest parts supplier and see what he has to offer in the way of a kit.

## Scanners and SW

I included several letters in June from readers asking about listings of various radio frequencies. The next letter offers yet another source for this information:

*In regard to the enquiries about scanning frequencies in the June edition, there is a magazine called CB Action (Australian) that should help your readers. The magazine has columns dedicated to scanning and shortwave listening as well as CB radio. They also review SW receivers and scanners.* (B.S., Annandale NSW).

## NiCad discharger

Having designed and described a NiCad discharger (September '89) I was therefore quite interested in the following letter. The author explains how to use a regulated power supply as the means of discharging a NiCad pack:

*I have recently become amazed at the variety of NiCad battery discharging devices which are appearing in magazines in kit form. These kits cost between $20 to $45 and it appears to me they would be a valuable addition to we amateurs or anyone who regularly uses NiCad batteries.*

*BUT — there is a much easier way to flatten NiCads to one volt per cell. You only need what most of us have anyway, a variable bench power supply capable of delivering slightly more current than the discharge current of the battery pack.*

*The procedure is: discharge the battery on the device you are using (radio TXR etc), to about half charge or a little less. You then preset your bench supply to the 'flat' terminal voltage required. In the case of my Icom BP8 battery, this voltage is 7V as there are seven cells. Now attach your 7V supply to the BP8 battery, which will have a surface voltage of about 8.4V. The voltmeter on the supply will read 8.4V, but ignore it.*

*Now attach a suitable load resistor in parallel with the battery. A typical load specified by Yuasa is C/0.2, which for the 800mA BP8 is 160mA. I used two 18-ohm 5W resistors in series, giving me 213mA drain. When the load resistor drags the battery voltage down to the supply preset of 7V, the ammeter on the supply will read 213mA. You now have your NiCad sitting discharged on 7V, for a month if necessary.* (R.T., Brisbane Qld).

Thanks R.T., this sounds like a good way to discharge NiCads, providing of course you don't need the supply in the meantime. It also has the advantage of being able to handle just about every battery pack, as the user has complete control on the voltage and current settings.

## RMS power

The next letter is from a reader who wants to justify the use of the term RMS power. He's from the audio industry, the main body of people who use this seemingly tautological term...

*I am writing in answer to the question of RMS power. At face value it would appear to be an interesting dilemma that doesn't make sense, because in linear circuit theory there is no such thing as RMS power. As I'm in the audio industry, I beg time to explain away our apparent stupidity.*

*If the world was perfect, apparent power would be the only type of power and I would be out of a job due to a lack of imaginary tricky things running around spoiling a perfectly good circuit. However instead we have real power, reactive power and apparent power.*

*Like any industry, we need internationally accepted standards which involve their own jargon, to keep strangers out of the conversation. But because we don't want to go mad trying to measure these standards, we adopt methods of measurement that are easily reproduced and consistent. In this case, RMS refers to the fact that the power is calculated by measuring the RMS voltage.*

*We have to do this because loudspeaker impedance curves couldn't lay straight in bed. Just take a look at any of Louis Challis's reports on speakers. So what we do is nominate the impedance of the speaker and quote to the consumer the amount of voltage that can be applied to a device of X nominal impedance without destroying it.*

*That is, quoted power RMS = (Vrms squared)/nominal impedance (Most people would know that the international standard for our one watt is*

## NOTES AND ERRATA

**REGENERATION - REFLEX RADIO** (May 1993): The parts list for this 'Experimenting with Electronics' project should have included L1 and L2, two 2.5mH radio frequency chokes.

**PC INTERFACE FOR DSE'S TELETEXT DECODER** (June 1993): The pin numbering of the IC shown in Fig.2 has pin numbers 8 to 14 reversed. Pin 8 should be at the bottom at pin 14 at the top.

**DOLBY SURROUND SOUND DECODER** (January 1992): It's been pointed out by a reader that R20 and R21 on the PCB should be swapped. The circuit diagram is correct. Also there is no earth connection on the PCB for position 1 of SW1.

*2.8284...Vrms for a nominal eight ohm speaker)*

*If we decided to use the average impedance, rather than the nominal impedance, we would have to involve calculus and Fourier analysis in the calculations. So in the interest of simplicity we use a nominal impedance and RMS voltage to convey power specifications.*

*Amplifier manufacturers also rate the power output of their amplifiers in the same way. They do this by swapping a speaker for a dummy load with the perfect nominal impedance. They then measure the RMS voltage. Yes, you guessed it, they use the same nominal impedance we speaker manufacturers use in our calculations.*

*I hope you will now believe we are not the electronic heathens that it would first appear. Maybe there is a thread of logic to our madness.* (H.L., Ballina NSW).

From what you say H.L., the term RMS power is used to identify the use of a nominal impedance for a loudspeaker rather than its average impedance. I have to admit some difficulty with that, as whether it's average impedance or a nominal impedance, it's still in ohms. To me, the fact that the measurement is made with an RMS voltage (not average or peak-to-peak) would be a better reason to justify the term RMS power.

I reckon the term has come about not from any rational mathematical reasoning, but from common usage. For instance it contrasts continuous power output with instantaneous power output. It also sounds better in the specifications than straight out, boring old power. Sorry H.L., I'm not convinced that the audio industry has actually defined this term in the way you describe.

## Bio-feedback

In June I included a letter from a reader seeking information about bio-feedback, or the measurement of brainwaves. Several readers have since responded by sending information not only to me, but also to the reader seeking the information. That's service!

In case others are interested, the *ETI* article I referred to was published in September 1987 and November 1987. It describes an EEG (electro-encephalogram). The circuit uses basic components (op-amps and so on) and describes how to make the necessary electrodes.

Another more sophisticated EEG is also described in the June and July 1988 issues of *Byte*, in an article called *Computers on the Brain* by Steve Ciarcia. This article was reprinted in *Ciarcia's Circuit Cellar Volume VII* (1990), published by McGraw-Hill.

The project, HAL (Hemispheric Activation Level detector), is a 'relatively sophisticated, low cost, stand-alone, isolated four channel electroencephalogram brain-wave monitor' and comprises a free-standing unit for data collection and software for an IBM PC compatible computer, which analyses the data using a fast Fourier transform (FFT) and displays the 'energy levels by frequency of brain-wave signals for both sides of the brain'. The PC and the data collection unit are connected via an RS232 link. The HAL can reportedly identify and monitor Alpha, Beta, Theta and Delta signals.

While the original copies of *Byte* may be difficult to obtain, a book of reprints can be ordered through any good technical book store, such as Dymocks.

As with all popular Circuit Cellar kits (and this one seems to be one of the most popular) an enormous amount of information and software is available on the Circuit Cellar bulletin board system (BBS). Unfortunately it's in the USA, but easily accessible and free to download.

The May issue of *Circuit Cellar INK - The Computer Applications Journal* lists the HAL-4 at US$179 plus shipping. Their telephone number is 0011-1-203-875-2751 and fax is 203-872-2204. (My thanks to P.B., Lindfield NSW for this information)

## Satellites

Perhaps someone can help this reader, as we don't have any information:

*I am writing to you for information on the satellites in the Pacific/Asia region, especially Aussat.*

*I have just bought a 12-foot satellite dish for sport and entertainment and although I find Aussat is easy to find, I am wondering if there are any other satellites I could go for. I am right on the West Coast of the South Island (NZ) and I have been told this is probably the best place for Pacific TV.*

*I am also interested in what will be the future of Aussat and what programs will be coming up. I hope to see more European TV and I watch the French transmission to Polynesia and New Caledonia, but will there be more European channels? I understand there is a magazine that has Aussat news, but is it available in New Zealand?* (Carl Hansen, Ngakawau Store, Ngakawau, Buller, West Coast NZ).

## CTOAN

I've had a number of enquiries about the whereabouts of CTOAN, who are the copyright owners and kit suppliers for a number of *EA* projects. I've been advised by CTOAN that they have recently moved premises and are now in a position to support all previous kits. Their new address is: CTOAN Electronics, PO Box 211, Jimboomba Qld 4280. You can phone them on (07) 297-5421.

## What??

The question this month comes from John Zervos (Five Dock, NSW). It's not really about electronics, although we've adapted it to give it an electronic 'feel':

You buy a TV set for $300, purely for the parts. A friend offers to buy the cabinet from you and asks how much to pay you. You reply (being the cryptic person you are) 'the TV parts are worth $250 more than the cabinet'. How much does your friend pay you? It's obviously not $50!

## Answer to August's What??

The answer is the sidebands are produced while the sinewave carrier is actually changing shape. This happens when it's changing amplitude, so the energy within the sidebands depends on the amount of change and the rate of change. ❖

## AUTO ELECTRONICS

*Continued from page 84*

The HD Monitor has all the features of the Churchill Monitor and can use its firmware — but the Monitor can't use its firmware.

## Conclusion

Feature for feature and considering its ease of operation, the SPX Churchill Monitor is a first class unit. Advanced users, tired of pressing keys, expressed a desire for user definable 'hot' keys. SPX's immediate solution has been to add the opening menu option 'Last Vehicle Setup' (Fig.1), which can certainly eliminate much key crunching if you're doing repeated testing of one vehicle or mainly servicing the same model.

By the way, somewhere in my files of reference information I have an article by a 'bean counter' which stated *...only 10% of automotive faults are considered very difficult, but only 7% of the auto technician force have the equipment are are knowledgeable enough to fix these.* Well, Mr Bean Counter may be right, but I have another one I know is true: that 75% of all cars in the world will soon be fixed using a scanner. Why? Simple — they are affordable, and soon they're going to be the cheapest way to fix many of the faults in today's complex vehicle systems. ❖

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# Altronics Commitment to Quality



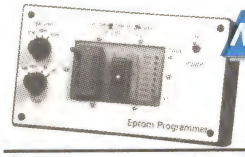
Our customers throughout Australia are constantly amazed of our efficiency and quality products. With services like a minimum 6 month warranty on all products, overnight jet courier service (to capital cities and suburbs) and the recent installation of a computerised mail order system, *ALTRONICS* is setting standards for others to follow. I invite you to try our fast mail-order service. Just phone your order on 008 999 007 by 4.00pm EST and in most cases we can deliver to your door step the next working day!
Regards Jack O'Donnell

## PC Based EPROM Programmer Kit

This is a great new kit for programming EPROMs from 2716 to 27256. Compares favourably against commercial units costing $$$ more. This kit puts you in the driving seat for under $ 100. It is flexible enough to be able to cope with 12.5, 21 and 25 programming voltages.

A must for Every PC Owner!

K 9525 **$97.50**




NEW

## Signal Comparator Kit

Have you ever had a faulty circuit that you have wanted to compare to an operational unit but been put off doing so because it is complex to do so. Well, this is a neat little kit that will allow you to compare the two units and give a differential voltage between them.



K 2563 **$39.95**

NEW

## Single Chip Message Recorder Kit

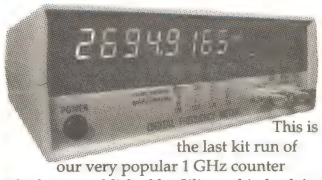
NEW

Here is a simple kit capable of storing a audio signal of up to 16 seconds on a single IC. Features a 10 year memory. Simple to construct, and even simpler to operate, only controls are two buttons, one to record and one to playback. Great kit for memo taking, message announcing etc.




K 9560 **$69.95**

## 1 GHz Frequency Counter Kit

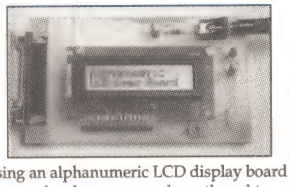


This is the last kit run of our very popular 1 GHz counter which was published by Silicon chip back in '87. Grab your kit whilst there are still stock left. Features professional screen printed perspex front panel, bright 7 segment LED displays, electronic switch latching etc. etc. Stocks limited.

K 2515 Normally $299.00

**This Month Only $240.00**

## Alphanumeric LCD Module Kit



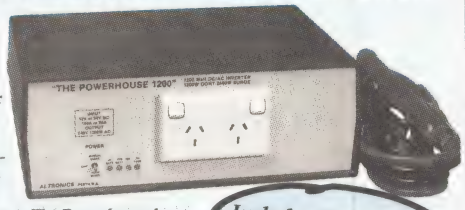
Using an alphanumeric LCD display board is not as hard as you may have thought. This kit is certainly the easiest way of learning about these devices. It connects straight up to your printer port of your P.C. N.B. requires software.

Great Kit for Your PC

K 2825 **$39.95**
K 2826 5.25" PC Software Disk
K 2827 3.5" PC Software Disk **$14.00**

## The Powerhouse 600W & 1200W Inverters

**(EA Feb '92)**




These Power Inverters will provide all your power requirements from a heavy duty 12 or 24V battery. Using the latest Mosfet output stage and toroidal transformer the inverters are both efficient and will deliver high surge currents. The Powerhouse has been designed not only for rugged operation but for ease of construction. The kits comes to you in a fully drilled, pre punched chassis complete with silk screened front panel. Assembly of the kit is simplified as the majority of components mount on a single PCB. Thus virtually eliminating all external terminations. Suitable for use in camping, boating, fishing, mining, farming, remote settlements etc.

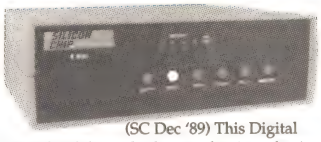
Includes Heavy Duty Battery Leads!

K 6770 600W Kit Version **$535.00**
K 6774 600W Fully Built & Tested 12V Input
K 6775 600W Fully Built & Tested 24V Input **$699.00**

K 6790 1200W Kit Version **$799.00**
K 6792 1200W Fully Built & Tested 12V Input
K 6793 1200W Fully Built & Tested 24V Input **$999.00**

Ideal for Camping, Boating, Farming etc.

## Digital Voice Recorder Kits



(SC Dec '89) This Digital Recorder delivers high reproduction of voice and/or music without any moving parts. It can store 4 different messages/recordings of up to 30 seconds each or one continuous recording of of up to 2 minutes. The Digital Recorder uses a dedicated recorder/playback IC and separate 256K ram chips. Features 4 trigger inputs so that a message can be stored when a certain condition occurs. Battery backup is provided so that the messages are retained when the power is turned off. Ideal for • Alarm system messages • Telephone 'on-hold' messages • Door station announcer • Emergency warning message announcement • Countless other applications where voice or music is required. K 9555 pictured.

K 9550 PCB Only Format **$129.00**

K 9555 Complete with Case **$149.00**

## Impedance Meter

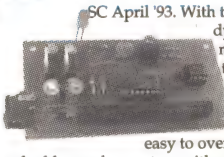
Have you ever wondered if a transformers has a shorted turn and not been able to prove it. Or is that speaker transformer on the correct tapping. Well this little meter can now do that with digital reliability.



K 2550 Kit Version **$79.95**
K 2551 Fully Built-Up Version **$119.95**

NEW

## Audio Power Meter Kit



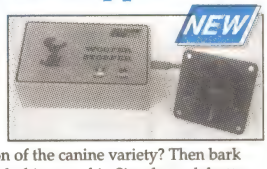
SC April '93. With the wide dynamic range of today's CD's and CD players, it is all too easy to over drive your valuable speaker system without being aware that anything is a miss. By using this low cost project, you can monitor power levels from 200 mW to 100 W RMS using a LED Bargraph display.

K 5415 **$24.95**

NEW

Save Those Expensive Hi-Fi Speakers

## Woofer Stopper Kit



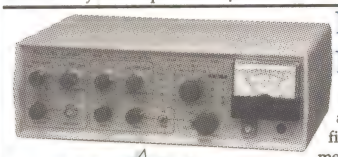
NEW

SC May '93. Do you have a noise pollution of the canine variety? Then bark back with this great kit. Simple push button operation emits a harmless 20kHz signal (beyond human hearing) which irritates the dog and in most cases takes out the temptation for barking.

Stop that annoying Midnight Bark

K 1165 **$59.95**

## Low Cost Noise and Distortion Meter Kit



If you design, service, or experiment with audio equipment, this new instrument will fill a gap in your range of test gear. It can measure distortion levels down to less than 0.01% at spot frequencies of 100Hz, 1KHz and 10KHz, as well as providing a built-in low distortion oscillator and AC milli-voltmeter. Best of all, it costs a fraction of commercial equivalents!

An Obsolute Must for Serious Hobbyists & Technicians

K 2542 **$129.95**

NEW

# PHONE ORDER - FREECALL 008 999 007

Protect your Home or Business from Intruders With One of These "State of the Art" Burglar Alarm Security Systems

## Economy 3 Sector Alarm Panel



**Features:**
• 3 Independent Protection Sectors • All Sectors are Compatible with N.O. and N.C. Switches • All Sectors are Sealed with End of Line Resistors • Adjustable Timers for Entry Delay and Siren Duration • Built-in Siren Driver • Output Relay is Selectable for 'Latch' or 'Timing' Operation • Remote Arming and Disarming Control Possible • Remote and Local Alarm Status Indication • Key operated arm and disarm • Requires 16 Volts AC M 9025 Plugpack, and Battery Backup S 5065-7 (Not Supplied)

*Ideal for Homes & Small Commercial Premises!*

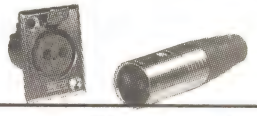
**S 5480** Normally $159.00,

## Alcatel/Cannon Plugs & Sockets



Yes! We have extended our range of genuine Alcatel connectors to cover not only 3 & 5 Pin audio connectors but 240 Volt rated cannons as well.

| | |
|---|---|
| **P 0900** 3 Pin Line Female | $5.95 |
| **P 0902** 3 Pin Line Male | $5.50 |
| **P 0904** 3 Pin Chassis Female | $6.95 |
| **P 0906** 3 Pin Chassis Male | $4.50 |
| **P 0920** 5 Pin Line Female | $14.25 |
| **P 0922** 5 Pin Line Male | $9.25 |
| **P 0924** 5 Pin Chassis Female | $13.95 |
| **P 0926** 5 Pin Chassis Male | $7.75 |
| **P 0930** 240V Mains Line Female | $12.95 |
| **P 0932** 240V Mains Line Male | $13.35 |
| **P 0934** 240V Mains Chassis Female | $9.95 |
| **P 0936** 240V Mains Chassis Male | $9.25 |



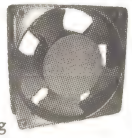
## 4 Channel Economy Mixer



This compact mixer has inputs suitable for microphone, record players, camera audio, CD, Tape, and Tuner etc. Ideal for amateur cinematographers who would like to add their own background music and/or voice overs. Includes inputs for microphone, phono (with magnetic or ceramic cartridge), camera audio and an auxiliary (CD, tape, tuner etc). Features headphone output and master volume control. Requires M 9004 9V DC 300mA plug pack.

**A 2520** $119.00

NEW



Fantastic computer type fans for replacement or additions for extra cooling of power supplies, amps etc.

**F 1020** 240V 80mm² $25.50
**F 1030** 240V 120mm² $25.95
**F 1040** 24V DC 120mm² $25.95
**F 1050** 12V DC 80mm² $17.50

## Electronic FET Multimeter



*Centre zero pointer setting allows + and - readings.*
This meter has the advantage of digital multimeters ie. insignificant circuit loading, high accuracy etc. without the misleading and erroneous readings that DVM's are famous for. Includes AC and DC volts, resistance, AC and DC current (up to 12 amps), testleads etc etc.

**Q 1050** Normally $99.50
**This Month Only** $89.00

## Digital Multimeter & LCR Meter



This digital meter tests in addition to standard multimeter ranges, capacitance and inductance, enabling you to test a wide variety of components. Indispensable for the design engineer, technician and enthusiast alike.

**Q 1062** $149.00

*Includes Carry Case*

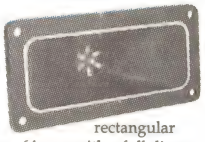
## Universal Multimeter Carry Case Q 1052



**Excellent padded vinyl case with zipper. Suitable for all meters advertised this month.**

Free With Each Multimeter Ordered this Month

## Piezo Tweeters



We are clearing a large quantity of piezo tweeters out at half price. These rectangular horns 144.8mm x 64 mm with a full dispersion angle of 90° are a bargain price. Frequency response 3 K to 40 Khz. Sensitivity 110 Db @ 2.8 V. Only while stocks last.

**C 6120** Normally $19.50
**This Month Only** $10.00

## Multi-Purpose Electrical Tester



This fantastic gadget will test a myriad of electrical and electronic components. It is simple to operate and is sure to amaze you with it's uses. Best of all, it's priced to make it a must for every technician, electrician and enthusiast. Tests continuity/resistance (100MΩ, 50MΩ and 5MΩ ranges), with buzzer and/or LED indication. Dead easy to use. Will check fuses, light bulbs, wiring, elements, speakers, diodes/LEDS, transistors, transformers and the list is endless.

**Q 1250** Amazing Low Price $17.95

## PECC Speaker Bargains



These speakers feature Poly Emmulsion Coated Cone (PECC) and barium ferrite magnets offer quite remarkable performance and extremely low distortion.

*Update those Old Hi-Fi Speakers*

**C 3022** 6.5" PECC Normally $49.95
**This Month Only** $38.00
Rated Input Power.....30 Watts
Freq Response.....f0 - 5 kHz

**C3030** 12" PECC Normally $155.00
**This Month Only** $135.00
Rated Input Power.....80 Watts
Freq Response.....f0 - 3 kHz

## 24 Range Digital Multimeter



**Features 1% Accuracy and Massive 20A Current Check.** 3.5 digit. Ranges include AC & DC voltage, AC & DC current, resistance, diode check, transistor check etc. this meter would have to be one of the best value multimeters available today.

**Q 1030** $99.00

NEW

**Q 1040** Protective Holster to Suit $15.95

## 24 Range Digital Multimeter



**With Frequency Measurement and Capacitance Meter.** Includes frequency and capacitance ranges. With the addition of a built in logic probe and screen hold button it would have to one of the most useful DMM's available today.

**Q 1035** $169.00

NEW

**Q 1040** Protective Holster to Suit $15.95

## Auto Ranging 3.75 Digit Digital Multimeter



**Triple LCD Display Includes 2 Digital & 1 Bar Graph.**
This incredible multimeter would have to be one of the most comprehensive on the market today. It is capable of doing all the normal voltage, current and resistance readings, as well as capacitance, frequency, minimum and maximum sampling, relating measurements, storing previous readings, limit setting, signal transistor gain checking and is full auto-ranging.

**Q 1038** $199.00

NEW

**Q 1040** Protective Holster to Suit $15.95

## Pin Point Ultra Sonic Cleaner

*Gently cleans Computer Connectors, PCB's, Switches, Relays, Jewellry, Glasses, Watches, Fuel Injectors and other Very Fine Parts.*

The Pin Point Ultrasonic Cleaner uses a transducer generator to produce millions of activated microscopic cleansing bubbles which blow dirt, grease and grime off surfaces, and penetrate deep into cracks and holes. This personal ultrasonic cleaner won't scratch precious jewellry or glass. Tank size 150 x 90 x 55mm approx.



**A 0100** Normallyt $229.00
**This Month Only** $209.00

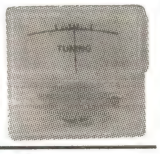
ALTRONIC COMPONENTS

PHONE ORDER - FREECALL 008 999 007

ALTRONIC COMPONENTS

## Tuning Meter with Centre Zero

We have a limited quantity of tuning meters. Their sensitivity is 250µA half scale. You will need to be quick at this price. Ideal for project radios etc. Hurry stocks limited.



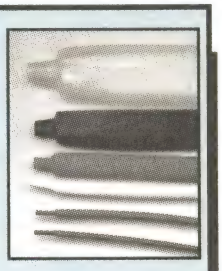
**Q 0600**
Normally $5.95
**This Month**
**$3.00**

## Heatshrink Tubing

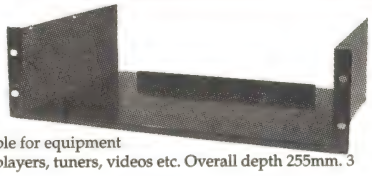
With the arrival of a new supplier on the scene, we have dramatically increased our range of heatshrink and have encompassed a full range of colours too. Each length is 1.2 M long.

| SIZE | BLACK | RED | CLEAR | BLUE | WHITE | GREEN | PRICE/ 1.2m strip |
|---|---|---|---|---|---|---|---|
| 1.6mm 1/16" | W 0810 | W 0820 | W 0850 | W 0830 | W 0840 | W 0860 | $2.95 |
| 3.2mm 1/8" | W 0812 | W 0822 | W 0852 | W 0832 | W 0842 | W 0862 | $3.45 |
| 4.8mm 3/16" | W 0813 | W 0823 | W 0853 | W 0833 | W 0843 | W 0863 | $4.50 |
| 6.4mm 1/4" | W 0814 | W 0824 | W 0854 | W 0834 | W 0844 | W 0864 | $5.10 |
| 9.5mm 3/8" | W 0815 | W 0825 | W 0855 | | | | $5.75 |
| 12.7mm 1/2" | W 0816 | W 0826 | W 0856 | | | | $6.45 |
| 19mm 3/4" | W 0817 | W 0827 | W 0857 | | | | $8.85 |

NEW



## Rack Shelves



In some cases heavy equipment, eg. large amplifiers, tend to sag at the rear when installed in racks. With the addition of one of these shelves this tendency is eliminated. Simply screws to the rack frame. Also suitable for equipment that does not rack mount, e.g. C.D. players, tuners, videos etc. Overall depth 255mm. 3 sizes to choose from. Black only.

H 5352 2 Unit **$49.95** H 5353 3 Unit **$49.95** H 5354 4 Unit **$55.95**

## Hand Held De–Soldering Pump/Iron

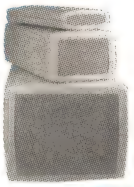
These great units are a fully self contained de-soldering tool. Includes an inbuilt soldering iron to heat the joint and simple push button operation enabling easy removal of solder from PCB's. Limited stock. Sorry not available from Altronic dealers.



A Must for the Hobbyist!

T 1250 **$45.00**

## Deluxe Utility Enclosures

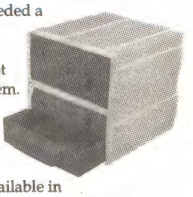


This professional series features solid ABS screw-together constructions, internal PCB guides and an attractive rounded finish. Larger sizes include stick on rubber feet and brass screw inserts. Light grey case, with dark grey front panel, all with a textured finished, they make excellent boxes for your new projects.

NEW

| | |
|---|---|
| H 0212 50w x 90d x 16h mm | $2.95 |
| H 0214 50w x 90d x 24h mm | $3.95 |
| H 0216 60w x 120d x 30h mm | $5.95 |
| H 0217 60w x 120d x 40h mm | $5.95 |
| H 0218 80w x 150d x 30h mm | $7.95 |
| H 0219 80w x 150d x 45h mm | $7.95 |
| H 0220 100w x 190d x 40h mm | $11.95 |
| H 0222 100w x 190d x 80h mm | $14.95 |

## Storage Tray Units



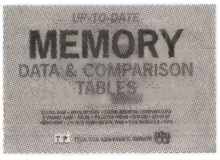
Have you ever needed a part but not been able to locate it because you forgot where you put them. Well, now is the time to get organised with this months special of storage boxes. Available in either large single tray or smaller double tray configurations. Features tongue and groove on all sides for easy stacking and wall mounting.

H 0235 Single Tray **$4.95**

H 0236 Double Tray **$5.50**

*ALTRONICS 1993 RETAIL CATALOGUE*
*If you haven't received yours call us on 008 999 007 for your free copy!*

## Up-to-Date Memory Data & Comparison Tables

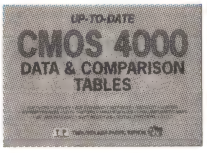



This TECH publication covers a wide range of RAM, ROM, EPROM, EEPROM, and PROM ic's. It documents the packages used, pin configuration and other basic details such as speed. It is not intended as a full data book but for comparison of memory technology

B 1285 **$19.95**

NEW

## Up-to-Date CMOS 4000 Data & Comparison Tables

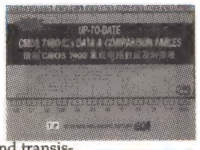



Finally a book has been published to cover the CMOS 4000 Series ic's. This is a well laid out book and gives all the useful details on this range such as pin configuration, voltage ranges, truth tables, transistion times, and high and low switching voltages. It also covers connecting TTL to CMOS and CMOS to TTL.

B 1290 **$19.95**

NEW

## Up-to-date CMOS 7400 Data & Comparison Tables



This is a book which covers the CMOS 74Cxx, 74ACxx and 74HCxx range of IC's. It gives truth tables, pin configurations, and transistion times. A great companion book to the CMOS

B 1295 **$19.95**

NEW

## MIDI Survival guide.

Whether you're a beginner or a seasoned pro, the MIDI Survival Guide shows you the way. No maths, no MIDI theory, just practical advice on starting up, setting up and ending up with a working MIDI system.

B 2221




NEW

## ALTRONICS

174 Roe St. Perth W.A. 6000
**Phone** (09) 328 1599, **Fax** (09) 328 4459
MAIL ORDERS C/- P.O. Box 8350
Stirling Street, PERTH W.A. 6849

STANDARD DELIVERY & PACKING CHARGE $3.50 to 500gms, $5.50 500gms -1 kg, $8 1kg-5kg **AUSTRALIA WIDE**-We process your order the day received and despatch via. Australia Post. Allow approx 9 days from day you post order to when you receive goods.

OVERNIGHT JETSERVICE Up to 3kg is $10.00, 3kg to 5kg is $23.00—We try to process your order the day received and despatch via. **Overnight Jetservice Courier** for delivery next day Country areas please allow additional 24-48 hours.

HEAVY HEAVY SERVICE-All orders of 10kgs or more must travel Express Road—Please allow 7 days for delivery. $12.00 to 10kgs. $15.00 over 10kgs.

INSURANCE-As with virtually every other Australian supplier, we send goods at consignee's risk. Should you require comprehensive insurance cover against loss or damage please add $1.00 per $100 of order value (minimum charge $1). When phone ordering please request "Insurance".

TOLL FREE PHONE ORDER-Bankcard, Visa, Mastercard Holders can phone order toll free up to 4pm Eastern Standard Time. Remember with our Overnight Jetservice we deliver next day.

ALTRONICS RESELLERS Chances are there is an Altronic Reseller right near you—check this list or phone us for details of the nearest dealer. Blue Ribbon Dealers are highlighted with a ● These dealers generally carry a comprehensive range of Altronic products and kits or will order any required item for you.

### WA - COUNTRY

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| ALBANY | BP Electronics ● | (098) 412681 |
| | Micro Electronics | (098) 412077 |
| BUNBURY | Micro Electronics | (097) 216222 |
| ESPERANCE | Esperance Comm. | (090) 713344 |
| MANDURAH | Forum Electronics | (09) 5813466 |
| PORT HEDLAND | Ivan Tomek Electronics | (091) 732531 |
| ROCKINGHAM | TV Joe's | (09) 5271806 |

### NT

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| ALICE SPRINGS | Farmer Electronics | (089) 522388 |
| DARWIN | Ventronics | (089) 853 622 |

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| | All Electronic Comp. | (03) 6623506 |
| | TECS | (03) 6706474 |
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| CHELTENHAM | Talking Electronics | (03) 5842386 |
| COLLINGWOOD | Truscott Electronics ● | (03) 4198208 |
| CROYDON | Truscott Electronics ● | (03) 7233860 |
| FOOTSCRAY | G.B. Telespares | (03) 3266035 |
| PRESTON | Preston Electronics ● | (03) 4840191 |

### COUNTRY

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| BAIRNSDALE | LH & LM Crawford | (051) 525677 |
| BALLARAT | Ballarat Electronics | (053) 311947 |
| BENDIGO | Sumner Electronics | (054) 431977 |
| MILDURA | Pullman Auto | (050) 232882 |
| SHEPPARTON | Andrew Guyatt Elect. | (058) 219497 |
| WARRNAMBOOL | Koroit Electronics | (055) 627 417 |

### QLD - CITY

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| | Delsound PL● | (07) 8396155 |
| NEWSTEAD | E.C.Q. | (07) 2541153 |
| WEST END | B.A.S. Audiotronics | (07) 8447566 |
| WOODRIDGE | David Hall Elect.● | (07) 8082777 |

### COUNTRY

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| GLADSTONE | Gladstone Elect. Services | (079) 724459 |
| | Electronic Enterprises | (079) 726660 |
| MAROOCHYDORE | Mals Electronics ● | (074) 436119 |
| TOWNSVILLE | Super Solex ● | (077) 724466 |

### SA - CITY

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| | Force Electronics ● | (08) 2125505 |
| BRIGHTON | Force Electronics ● | (08) 3770512 |
| CHRISTIES BEACH | Force Electronics ● | (08) 3823366 |
| FINDON | Force Electronics ● | (08) 3471188 |
| HOLDEN HILL | Force Electronics ● | (08) 2617088 |
| LONSDALE | Force Electronics ● | (08) 3260901 |
| ENFIELD | Aztronics ● | (08) 3496340 |

### COUNTRY

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|---|---|---|
| WHYALLA | Eyre Electronics | (086) 454764 |

### TAS

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|---|---|---|
| HOBART | George Harvey ● | (002) 342233 |
| LAUNCESTON | George Harvey ● | (003) 316533 |

### NSW - CITY

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|---|---|---|
| | A-One Electronics | (02) 2674819 |
| | David Reid Elect. ● | (02) 2671385 |
| | Chantronics | (02) 6097218 |
| SMITHFIELD | | |

### COUNTRY

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| COFFS HARBOUR | Coffs Habour Elect. | (066) 525684 |
| NEWCASTLE | Novocastrian Elect.Supplies | (049) 621358 |
| WARNERS BAY | Vilec Distributors | (049) 566792 |
| WINDSOR | M & E Elect. and Comm. | (045) 775935 |
| WOLLONGONG | Newtek Electronics ● | (042) 271620 |
| | Vimcom Electronics | (042) 284400 |
| WOY WOY | Alphatran Electronics | (043) 434919 |

# PHONE ORDER - FREECALL 008 999 007

ALTRONIC COMPONENTS

# Experimenting with Electronics

by PETER MURTAGH

## Ultrasonic messages — 1

Sound-on-sound is this month's project. Find out how to use an ultrasonic transducer to produce a 40kHz carrier sound wave, and then amplitude-modulate it with the output from a small microphone. To recover the voice signal, you will also need to build a receiver with a radio-like detector circuit.

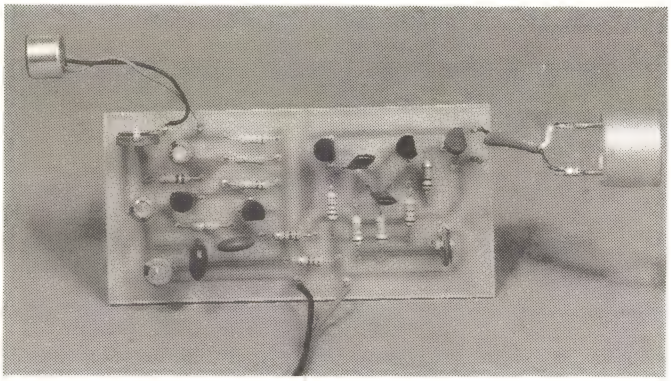


*Photo 1: The ultrasonic transmitter is joined to the PCB with a short length of shielded cable. This allows it to be pointed directly at the receiver in order to increase the signal being received.*

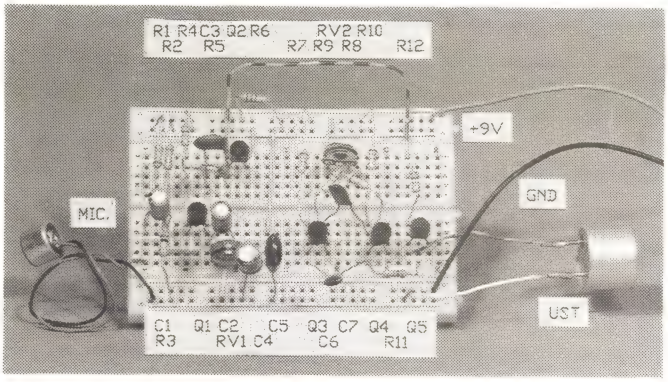
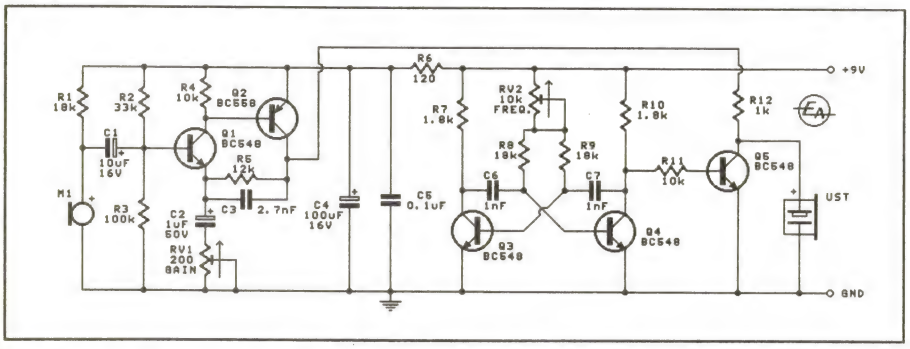



*Photo 2: Here's the layout for breadboard construction. (Refer to the schematic for more details if all connections are not clear.) Remember that you will need a second board to build the receiver half of this project, next month.*

Following on our last two projects (medium-wave and short-wave radio receivers), you should now be familiar with the use of amplitude-modulated waves to transmit an audio signal. However, this AM technique is not limited to *radio* waves, but can be used also with sound and light waves. After all, any high frequency wave can act as a *carrier* for a signal. So for this project we are using a sound wave carrier. This month's circuit shows how to alter (modulate) the 40kHz output of an ultrasonic transmitter with your voice signal, while next month's circuit will show how to build a simple receiver circuit to remove the carrier and recover the audio signal.

The transmitter circuit consists of two sections: a 40kHz oscillator built around transistors Q3 and Q4 to provide the carrier frequency, and a two-transistor amplifier, using Q1 and Q2, to boost the signal from the microphone. Both these circuits should look familiar — the amplifier was used in the 'Sound switch' (March, 1992), while a similar transducer-driver appeared in the 'Ultrasonic doorminder' (November, 1992).




*The schematic shows the two sections of the amplitude-modulated (AM) transmitting circuit: on the right is the 40kHz oscillator which provides the carrier wave; while at left is the audio amplifier which provides the modulating signal.*

When the two sections are linked together via transistor Q5, the oscillator provides a constant 40kHz drive for the transducer, while the audio signal is used to alter the magnitude of the supply voltage. This provides amplitude modulation, because the end effect of a rise or fall in the audio signal is simply a rise or fall in the intensity (amplitude) of the transducer output.

It is interesting to look at the conversions which occur in these circuits: both the *input* and *output* of transmitter and receiver alike are sound waves. In the transmitter, the microphone changes your voice (sound) into an electrical signal, which is first amplified and then used to vary the drive to the first transducer — producing high frequency sound waves. The receiver converts these sound waves back into an electrical signal via the second transducer, amplifies and detects the signal, then feeds it to a loudspeaker where — you've guessed it — it again becomes sound!

Because the microphone input goes to a high gain amplifier, it is important to keep the input and output of the circuit as separated as possible. Hence the ground from the amplifier and oscillator should

also be kept separate and only be linked to one common spot (this can be seen in Fig.1). This means that currents flowing in the ground track caused by the operation of the oscillator are less likely to become amplified by the microphone section of the circuit. Feedback is also reduced by decoupling the power supply to the two sections via resistor R6.

To further reduce such type of interaction, when next month's receiver is built, we will recommend that you use separate batteries for transmitter and receiver.

The ultrasonic transducers which we used for this project came from Dick Smith Electronics (Cat. numbers for the transmitter and receiver are L-7050 and L-7052, respectively). Other suppliers also stock suitable units.

## Construction

Begin your construction with the more rugged components, working your way through resistors, capacitors, and transistors. Refer to Fig.3 for the orientation of the polarised components. When you come to mounting the ultrasonic transmitter (UST), either connect it directly to pins on the PCB, or use a short length of shielded cable, if more flexibility is required. Remember that the transmitter transducer must be able to point directly at the receiver transducer, to transfer maximum signal. So think about how you intend to mount the two PCBs (transmitter and receiver) before deciding how to fix the transducers to these boards. Once this decision is made, the construction of this month's project is quite straightforward.

Note that both the microphone and transducer are polarised components. The red lead on the mic goes to the '+' connection on the circuit (and the black lead to GND), while the transducer terminal, which is insulated from the metal casing, is its '+' side (and the casing is connected to GND).

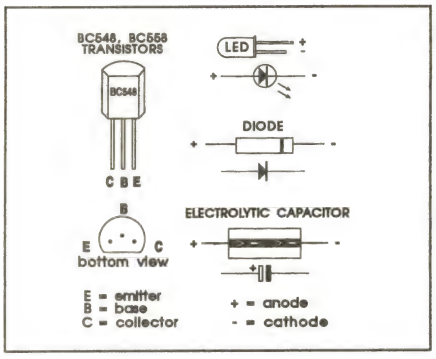



***Fig.3: Refer to this diagram to identify the various leads of the polarised components which you will use in this circuit.***

## Tuning

Trimpot RV2 is used to maximise the output of the transmitter. It adjusts the oscillator frequency so that its output is at exactly the resonant frequency of the nominal 40kHz transducer (the DSE model is quoted at 40.0±1.0kHz).

However, there really isn't much point in talking about tuning the transmitter until we have built both our transmitter and receiver — we are assuming that you don't have access to a Cathode Ray Oscilloscope (CRO) to allow you to view the output waveform. So (next month), we will use the signal picked up by our receiver to maximise the output of our transmitter.

### PARTS LIST

***Miscellaneous***

PCB 83 x 41mm, coded 93ust7
9V battery
electret microphone insert
ultrasonic transmitter
hookup wire, solder, etc.

***Resistors***

All 1/4W, 5%

| | | |
|---|---|---|
| 3 | 18k R1,R8,R9 | brown-grey-orange |
| 1 | 33k R2 | orange-orange-orange |
| 1 | 100k R3 | brown-black-yellow |
| 2 | 10k R4,R11 | brown-black-orange |
| 1 | 12k R5 | brown-red-orange |
| 1 | 120 R6 | brown-red-brown |
| 2 | 1.8k R7,R10 | brown-grey-red |
| 1 | 1k R12 | brown-black-red |
| 1 | 200 ohm 5mm vert.trimpot | RV1 |
| 1 | 10k 5mm vert.trimpot | RV2 |

***Capacitors PC-mount electrolytics***

| | | |
|---|---|---|
| 1 | 10uF,16V | C1 |
| 1 | 1uF,50V | C2 |
| 1 | 100uF,16V | C4 |

***Capacitors polyester (greencap)***

| | | |
|---|---|---|
| 1 | 2.7uF | C3 |
| 1 | 0.1uF | C5 |
| 2 | 1nF | C6,C7 |

***Semiconductors***

| | | |
|---|---|---|
| 4 | BC548 NPN transistors | Q1,Q3,Q4,Q5 |
| 1 | BC558 PNP transistor | Q2 |

## Changes

There aren't a lot of changes that you can make to this circuit. Its power output is limited, so you can't move the receiver too far from the transmitter. It is really designed to show how one sound frequency can become the carrier for another frequency, rather than as a permanent communicating system.

## How it works

We will look first at producing the 40kHz carrier frequency. This is done by the astable multivibrator built around transistors Q3 and Q4. The frequency at which transistor Q3 turns on and off is determined by the time constant of capacitor C7 and resistor R9+RV2. Similarly, C6 and R8+RV2 determine Q4's turning off and on. The values shown on the schematic, with trimpot RV2 roughly set to half way, gives somewhere around the desired 40kHz frequency. RV2 can be adjusted to make it correspond exactly with the resonant frequency of the ultrasonic transmitter.

The working of such a multivibrator was described in detail back in September 1992. But here's a brief refresher..

When power is first applied, leakage currents through the base-emitter junctions of Q3 and Q4 allow capacitors C7 and C6 to charge. Both continue to charge until one of the transistors turns on. At this point both C6 and C7 will have charged up to around +5V on their positive sides (the ends connected directly to the collectors of

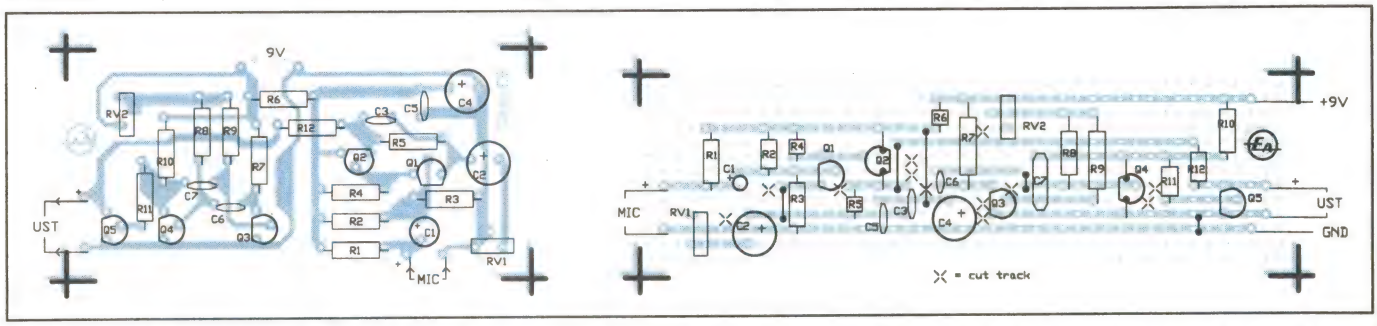
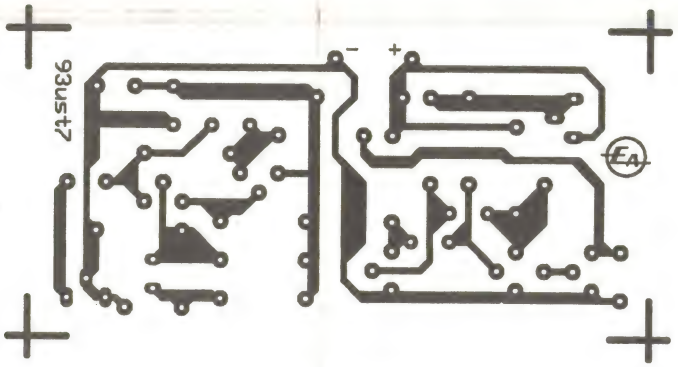



***Fig.1 (left): The component layout for the PCB. Note how the amplifier and oscillator sections are kept completely separate to avoid interference — even to the extent of not sharing a common earth track. Fig.2 (right): The stripboard version also attempts to keep the same isolation between the amplifier and oscillator. And remember to break the copper tracks at all points marked with an 'X' — otherwise the circuit definitely won't work.***




***If you wish to etch your own board, then make use of this full size PCB pattern. Using a PCB design will give a far more stable circuit for high gain amplifiers than either the stripboard or breadboard construction.***

transistors Q3 and Q4) and about 0V on their negative ends (connected to the bases of Q4 and Q3).

Let's assume that Q3 has a slightly higher gain than Q4 and so is the first transistor to turn on. Once this happens, the voltage at the positive end of C6 drops suddenly from +5V to about +1V, forcing its negative end to drop immediately from 0V to -4V (to maintain the 5V differential). This -4V turns transistor Q4 hard off.

Capacitor C6 now begins to discharge, via R8 and RV2, making the voltage at its negative end begin to rise. Eventually, this voltage becomes high enough to provide sufficient base current to turn on Q4. When transistor Q4 turns on, it forces Q3 off — and so the alternating on-off cycle continues in turn for each transistor.

The square wave output from the collector of Q4 switches transistor Q5 on and off, and this drives the ultrasonic transmitter (UST). The 40kHz electrical signal becomes a 40kHz sound wave. The DC voltage at Q5's collector (provided by the microphone circuit, with the mic shorted out) is around 6V. This means that the amplitude of the modulating signal derived from the microphone must be kept under 3V peak, to avoid running out of voltage swing (the maximum voltage output is the 9V of the supply rail).

Since the microphone output is amplified by transistors Q1 and Q2, we have provided our two-stage amplifier with variable AC gain to keep the amount of modulation as large as possible without distorting. Resistor R5 provides 100% DC negative feedback to help stabilise the amplifier (against current variations caused by temperature alterations or component tolerances, etc.). In AC terms, because capacitor C2 blocks DC but not AC, the amount of negative feedback is determined by the potential divider formed by R5, C2 and RV1. As the trimpot resistance decreases, so does the amount of AC feedback — resulting in an increase in amplifier gain.

Because the amplifier can operate at quite high gain, high frequency interference (RF) can become a problem. This is controlled by adding capacitor C3 to the circuit, which provides a low impedance path for RF. This greatly reduces the gain of the amplifier at these frequencies, since the amount of negative feedback is substantially increased.

As mentioned earlier, the positive supply rail is decoupled (isolated) via resistor R6, so that variations caused by the current fluctuations of the multivibrator have less effect on the supply voltage for the microphone amplifier. Capacitors C4 and C5 also help stabilise that voltage — the large electrolytic capacitor (C4) acts as a surge reservoir to supply large, but brief current demand, without lowering the supply voltage; while the polyester type (C5) also helps to keep a constant voltage by bypassing unwanted RF fluctuations.

So, there's our transmitter circuit: the multivibrator provides a constant 40kHz carrier, and the microphone signal provides amplitude modulation, by altering the magnitude of the transducer output. Next month we'll describe the receiver half of this ultrasonic project.

## Transparencies

As usual, a high contrast, actual size transparency (negative) for the PCB used in this circuit is available for only $2. This will allow you to etch your own printed circuit board. This special price applies for transparencies for all projects in this series only. Write to *EA*'s reader services division.

Happy experimenting — and please send us your comments on the circuits we have published, as well as ideas for future projects. ❖

# FORUM

*Continued from page 43*

want to respond to them, and I'll be happy to print his response when he does. Actually you may not realise it, but your criticism is probably directed more at myself than at Louis, because I'm the one that he expects will edit out any rough edges in his copy.

Louis has told me on many occasions that he has no pretentions to be a great author — apart from anything else, he is kept extremely busy with his consulting and acoustical testing work. Of necessity his reviewing of products for *EA* has to be squeezed into his 'spare time', and he understandably spends most of his effort on the actual product testing and analysis. As far as the 'writing' is concerned, this is often dictated verbally into a pocket recorder, while he's on a plane or waiting in an airport terminal, and typed into a word processor later by his secretary. Then the file is sent to me on a floppy disk, and it's my job to prepare it for publication.

But Louis is a very practical man, when it comes to his copy, and has often said to me "You're the Editor — edit it!"

So if you find the reviews a bit flowery at times, Mr Grant, I guess that's really my fault. In my efforts to leave as much of the Challis 'sizzle' in the reviews, perhaps I've also been a bit remiss at times as an Editor. As you say, this is probably doing Louis a dis-service, so I'll have to lift my game. Sorry, folks (including Louis).

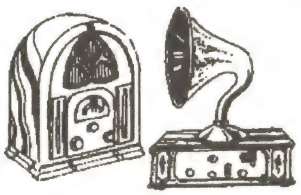
By the way, I believe what Louis was trying to say, with regard to the Pioneer 'Legato Link' CD player, was that he suspected their *real agenda* had been to reduce the slope of the player's anti-aliasing filter, to achieve a better compromise with regard to transient response and ringing — which actually turned out to be quite worthwhile, in terms of the sonic performance. But because this would inevitably result in a small increase in the level of alias components in the player's output, as well (which they perhaps sensed might worry the purists), they apparently sought to justify their action by dressing it up with that rather weird explanation about 'recovering signal components that were normally lost in the digital encoding and decoding processes'...

Anyway, I *think* that's what he meant; hopefully Louis will correct me if I'm wrong.

And that's it for another month. I hope you'll join me again next time. ❖

# Vintage Radio

by PETER LANKSHEAR



## Some popular output triodes — 1

A special group of valves has always been held in high regard by high quality audio enthusiasts. These are the big output triodes, some of which are still in production. This month we look at the first generation of these valves.

Before 1923 and the advent of broadcasting, the concept of fidelity of audio reproduction hardly existed. Headphones were in universal use, and they were judged mainly by their sensitivity. Transmissions were practically all in Morse code, and the prime requirement was audibility. Often receiver audio transformers were tuned to around 1kHz, to improve intelligibility of telegraph signals. In 1920, the only service where audio quality had any meaning was not in radio, but the rapidly expanding telephone repeater technology.

America's Western Electric Bell Laboratories had taken Lee de Forest's erratic Audion triode and by 1915 had tamed it, to become a practical commercial device capable of factory production to close standards. In Europe valve development was accelerated by wartime demands, one very significant result being the famous 'R' valve.

The advent of broadcasting soon created a demand for loudspeakers and, to drive them, valves capable of more than the few milliwatts required by headphones. In Britain, Marconi-Osram had developed from the R valve their type 25, a large valve used by the British Post Office for telephone service. From the type 25, Marconi-Osram produced a family of large triodes, their 'LS' series for loudspeaker work. The LS5A, introduced in 1924, was used by the newly established BBC and became popular with affluent amateurs interested in improving sound quality.

Meanwhile Western Electric had taken one of their wartime valves, the VT2 and in 1917 further refined it to become the 205A, a 'miniature' transmitting valve, capable of handling 300 anode volts. The 205 series underwent several developments, and by 1924 the 205D was in full production.

Western Electric with its research organisation, the Bell Telephone Laboratories, was and still is a remarkable organisation. Their prime purpose was to provide the vast Bell Telephone network with its equipment. As well, they are involved in outside commercial undertakings. In Britain and Australasia, they are represented by their affiliates Standard Telephones and Cables (now Alcatel Australia), an organisation I imagine with which most readers are familiar.

### Reliability paramount

Not being concerned so much with high volume, low initial cost equipment as with extreme reliability, Western Electric's philosophy for valves has always been very different from the domestic consumer market.

To put this into perspective, in 1978 it was estimated that replacement of a valve in a submarine repeater could cost $40,000. Obviously, low initial cost was not significant if it compromised quality and reliability!

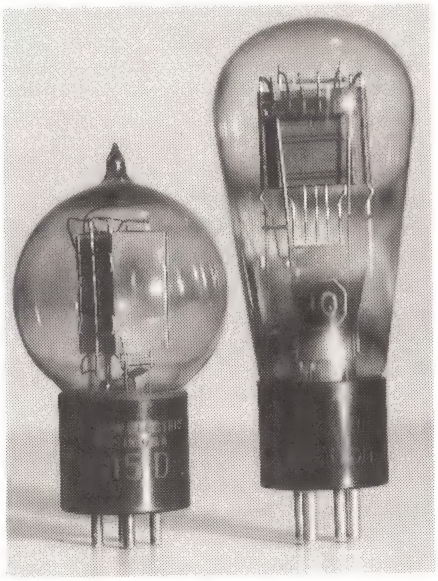


*Fig.1: Although the spherical Western Electric 205S and the S-bulb RCA UX210 were very different in construction, their characteristics were comparable. Globular envelopes were a distinctive feature of many WE valves, which had oxide-coated filaments or cathodes.*

It is on record that every one of the 306 Western Electric type 175HQ valves used for the first trans-Atlantic telephone cable operated continuously for 22 years, without a single failure. The later type 455A-F valves were equally reliable. By 1978 there were 5674 of these valves in use, each with an average continuous service of nearly 15 years. There had been only two probable failures and in any event, redundancy of amplifier design meant that service was not affected. Even premium semiconductors would find it hard to beat that sort of record.

This then is the background to the type of organisation that in 1924 produced the 205D. I guess that few readers have handled a 205D, but as we shall see, many will have encountered the 205D in operation.

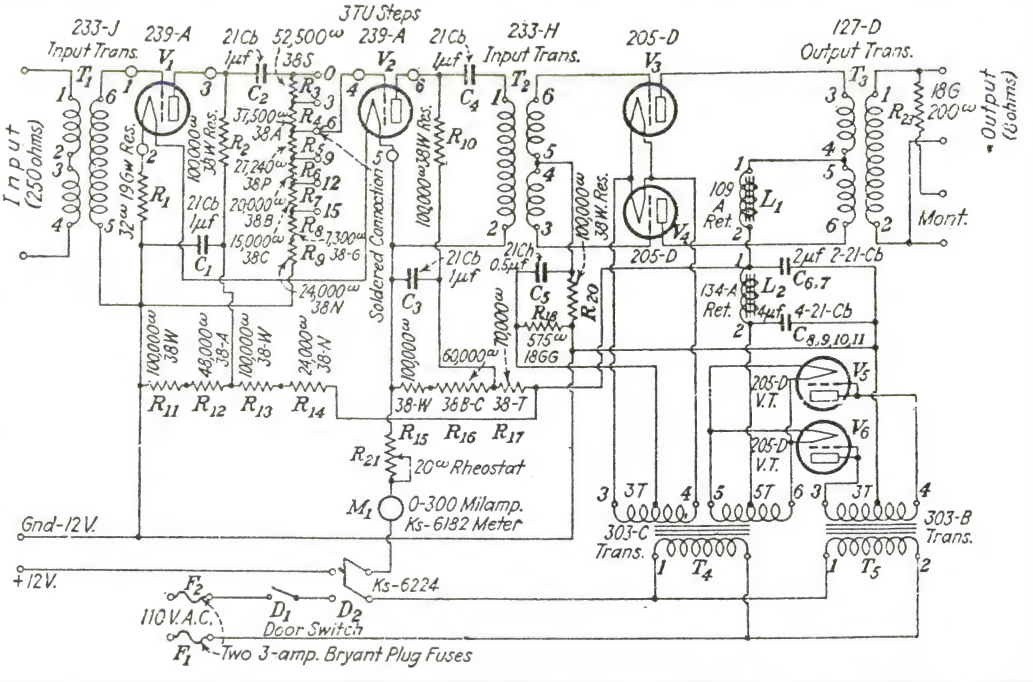
### Favoured by hams

Meanwhile, American General Electric and Westinghouse were developing valves and equipment for RCA. As we related in this column for May 1990, the production of the first practical moving coil loudspeaker depended on the availability of an audio amplifier capable of producing a genuine one watt. This became possible when, in 1924, RCA's UV210, essentially a scaled up UV201A valve, became available. The following year it received the new long-pin base, to become the UX210 and proved to be popular for audio amplifiers and especially with radio amateurs as an oscillator and RF amplifier.

Transmitting versions, the 10Y and 801 were produced. Only with the advent of the equally ubiquitous 807, immediately prior to World War II was the UX210 superseded.

At this stage I would remind readers

***State of the art audio in the late 1920's: Western Electric 46A amplifiers using 205D triodes as rectifiers, as well as output valves, were used in thousands of cinemas for early 'talkie' sound installations. As WE had not developed an indirectly heated valve, low microphony type 239A and later the 264 series with 1.5V/300mA filaments were used for the voltage amplifiers. The 46A could produce only about four watts, but this was adequate for horn-loaded speaker drivers such as the WE555.***




that the original RCA numbering system for valves was clumsy. The prefix UV, UX and UY referred to the base, and the first digit identified the supplier — 1 for Arcturus, 2 for RCA and 3 for Cunningham etc. Only the second and third digits had any real significance, and before long the rest was dropped. Thus the UX210 was known as the 10, the UX250 as the 50 and the UX245 became the 45. This abbreviation did not apply to Western Electric valves, which generally had their own system of identification.

Two major developments influenced high quality sound research in the mid 1920's. These were electrical gramophone recording and sound movies, both of which set new standards in reproduction and sound generation. Both the Western Electric and RCA organisations were major players, and good use was made of both the 205D and the 210.

## 50 years of service

Western Electric designed new amplifiers, including the 42A and 46A, for the 'talkies'. Both used a push-pull pair of 205D valves in the final stage, and were capable of producing three to four watts of audio power. Used with WE 555 horn-loaded speaker drivers, this was sufficient power for small movie theatres. But for larger auditoriums, additional power was provided by the type 43A amplifier, which used a push-pull pair of 211 transmitting valves coasting at a modest 12 watts output!

Many thousands of the 42A and 46A amplifiers were in use world wide, and such was the quality of their design and construction that some were still in service in the early 1980's! There can be few other types of electronic equipment with continuous service spanning more than half a century, and there must be few readers who have not at some time attended a WE-equipped theatre and heard one of these amplifiers in operation.

By 1928, moving coil speakers were beginning to be widely used, in many cases installed in console cabinets with their improved baffling. More audio power could be used, and in February RCA announced the Westinghouse developed UX250. With the biggest envelope ever used on an American



***Fig 2: For the best part of three years, the UX245 practically monopolised American receiver output stages.***



***Fig.3: With the largest bulb ever used for American non-transmitting valves, the impressive UX250 was used in some 'top of the line' receivers.***

non-transmitting valve, the mighty 50 could develop nearly three times the power output of the 10. Some were used in prestige receivers, but the 50 really belonged in public address and theatre sound systems.

For some years, the 50 was unrivalled in sound systems, but it was really too large and over-powered for most domestic service. A much more suitable valve appeared in 1929. In many respects the junior brother of the 50, the UX245 was an immediate success. Almost always used in push-pull, a pair of 45's could produce up to five watts with only 275 anode volts.

## Rule of the 45

Although in Europe and Britain, Philips had introduced the pentode output valve in 1927, the 45 dominated American receiver output stage design for the best part of three years. Not until 1931 did America have a really acceptable output pentode. Even then the 45 continued to be used occasionally, in receivers made for the quality conscious.

By the end of the decade, valve design had progressed considerably. Some significant characteristics are listed in the table. Anode voltage and current are an indication of power handling ability, and being less stressful on capacitors and safer, low voltage operation was an advantage. The 45 could produce as much power as the earlier 205D and 10, but with a worthwhile reduction in anode voltage. The remaining parameters are inter-related.

VALVE CHARACTERISTICS

| VALVE TYPE | AMPL FCTR | ANODE RESIS | MUTUAL CONDUCT | ANODE VOLTS | ANODE mA | POWER WATTS |
|---|---|---|---|---|---|---|
| LS5A | 2.5 | 2750 | 1.0 | 400 | 33 | 2.6 |
| 205D | 7.3 | 3800 | 1.9 | 350 | 30 | 1.8 |
| 10 | 8.0 | 5000 | 1.6 | 425 | 18 | 1.6 |
| 50 | 3.8 | 1800 | 2.1 | 450 | 55 | 4.6 |
| 45 | 3.5 | 1700 | 2.0 | 275 | 35 | 2.0 |

***The characteristics of the valves described, in typical single-ended operation. Two in push-pull would produce something more than twice the power output.***

Amplification factor or mu (μ) provides an indication of the amount of grid signal voltage required to drive a triode valve to full output. In practice, the mu of power triodes is less than 10 and in some cases less than four.

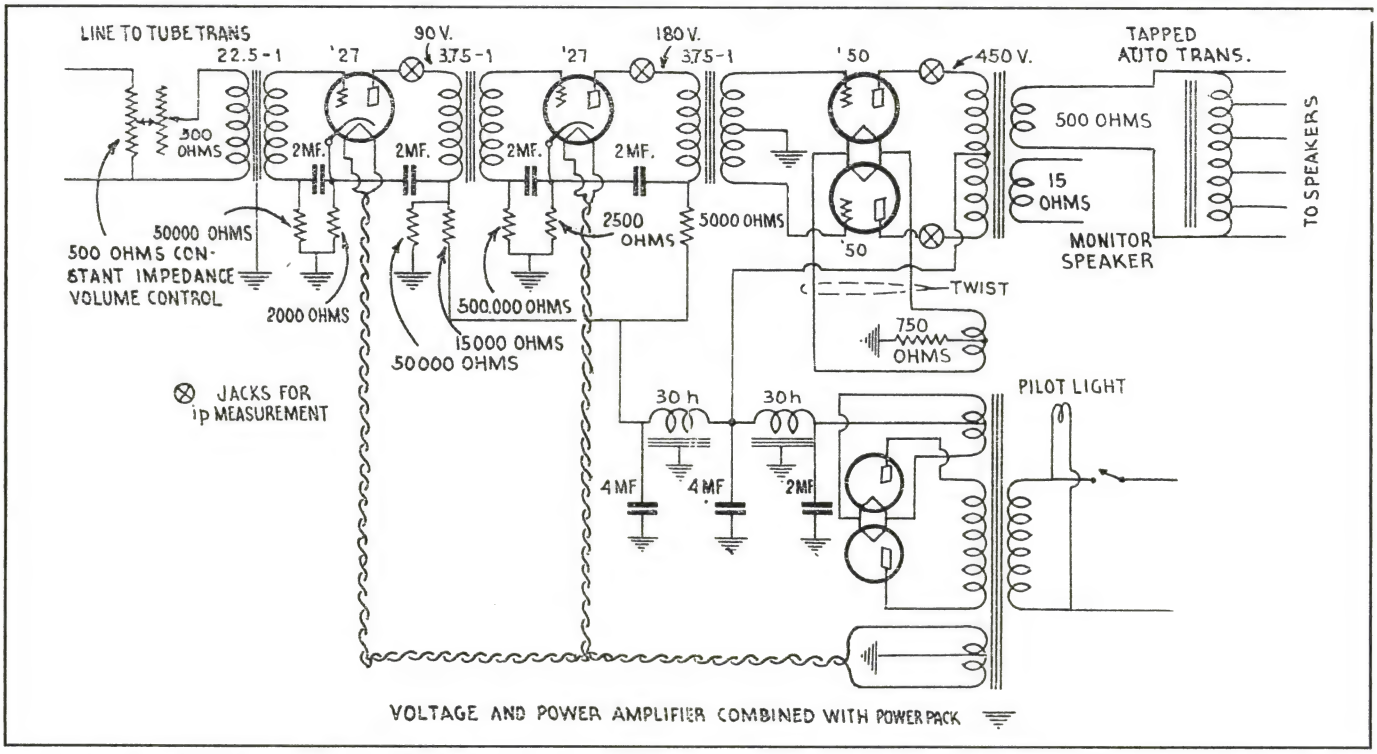
Anode resistance is a measure of the ability of a valve to deliver power to varying loads. This can be illustrated by the differing behaviour of carbon/zinc and NiCad cells.

The terminal voltage of a standard dry cell connected to a low resistance falls significantly under load, whereas the much lower internal resistance of a NiCad cell has little effect on voltage under quite heavy loads. A low plate resistance enables a triode to more readily cope with the extremely variable load presented by a moving coil loudspeaker.

## Transformer inductance

Another factor is transformer requirements. For a given low frequency performance, output transformer primary winding inductance requirements are proportional to anode resistance. Referring to the operating conditions given in the table, for the same frequency response, a transformer for a type 10 valve would require 5000/1700 or nearly three times the inductance required for a type 45.

The ideal power triode would therefore have a low anode impedance and a




***A typical high powered audio amplifier using a pair of 50's. Transformer coupling was universal, and frequently the limiting factor in reproduction quality. It was commonly thought that grid blocking made R-C coupling of output stages impractical.***

high amplification factor; but unfortunately, the two are in conflict. For a given valve geometry, raising the amplification factor increases the anode resistance. The ratio of these two parameters is a constant called, in the American system, the *transconductance* and is measured in micromhos (the same as the modern microsiemens, or uS).

In British terms the same ratio is known as the *mutual conductance* and is expressed in mA/V — the change in anode current, in milliamps, for a change of one grid volt.

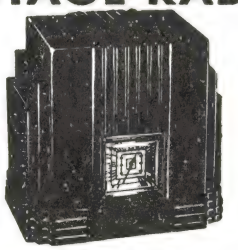
## Clearer terminology

In my opinion the British terminology provides a clearer concept. Fortunately, regardless of the system used, the result is the same, but it would have helped if the Americans had chosen millimhos (millisiemens, or mS) for the unit, as then the figures in the two systems would have been identical. As it is, in American terms the 45 has a transconductance of 2000 micromhos, whereas the British would quote the mutual conductance as 2mA/V. Despite the apparent difference the two are identical.

I have written at length about transconductance or mutual conductance, because it is the characteristic that can be regarded as a figure of merit for output valves. In 1929, the limit had been reached at around 2.0mA/V, and only by raising this could the output triode be improved.

How Marconi-Osram advanced valve design, leading to the second generation of output triodes, and prevented their complete eclipsing by the pentode will have to wait until the second of these articles. ❖


VINTAGE RADIO



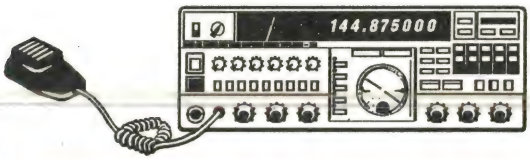
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# Amateur Radio News




## US auctions UHF spectrum

The WIA's Bill Roper, VK3ARZ reports that the US government plans to auction two large segments of the radio spectrum between 1.8 and 2.2GHz. The scheme is apparently part of a plan to cut the government's budget deficit.

The auctions have been approved by a committee of the Congress, while companion plans are passing through the US Senate. President Clinton apparently approves of the auctions scheme, which practically guarantees they will be passed.

The auctions are forecast to return some US$7 billion to the US government.

## Report on VK2DIK's balloon contacts

From Al Pearson, VK2CU came a first-hand report of contacts made with Dick Smith VK2DIK on June 17-18, during his recent successful baloon flight from Carnarvon in WA to Tabulam on the east coast. VK2CU was operating HF portable at Angledale, 430km south of Sydney, and at 0845 EAST on June 17 received very strong and clear signals from VK2DIK operating on 14.150MHz. At the time the balloon was at an altitude of 16,000ft and Dick was quite uncomfortable, having had to remove his oxygen mask to speak into the microphone.

VK2CU reports that VK4ABJ and VK6ABS were also being received very well, with the signals from the flight control centre VK2AWI in Terrey Hills, Sydney rather weak at the time. Dick had begun to experience problems with his generator, and only battery power was available. However he made reference to good wishes being received from Phil Kavanaugh, the competing balloonist.

At 1120 EAST signals were heard from VK2DIK reporting flight progress and giving their position as over Mee Katharra, still at an altitude of 16,000ft but preparing to switch on the burner.

Next day at 0952 EAST, VK2DIK was received on 7.070MHz and gave their position as south-east of Broken Hill, at 20,200ft. VK2BRG from Coff's Harbour was heard calling VK2DIK at 1157, while at 1430 VK2DK was heard reporting to VK2AWI that he had a visual sighting of the balloon at Narrabri. Then at 1450 a report of another visual sighting was made by VK2AUK, south-east of Bingara. When the balloon began its descent at 1630 EAST, VK2ATS at Inverell and VK2WT at Tenterfield were monitoring the frequency, and apparently heard VK2DIK report a perfect touchdown at Tabulam at 1704.

Our thanks for this report to VK2CU, who says that monitoring the historic balloon trip was one of the most interesting and satisfying experiences of his many years in amateur radio.

## New amateur radio society

The Australian Naval Amateur Radio Society (ANARS) has been formed to bring together all radio amateurs and interested shortwave listeners in Australia who have a professional naval or maritime background. Honorary secretary Terry Clark VK2ALG reports that it is a national society, fully structured and with administration facilities now in place.

Membership is open to all persons who are either serving in, or are retired from, the Royal Australian Navy, WRANS, Naval Reserves or the Australian Merchant Navy. Membership is also open to those who have served in *any* foreign navy or merchant navy, and who are now Australian citizens or permanent residents.

The ANARS was officially launched on August 9 by its headquarters station in Canberra, using its special callsign VI1RAN. This date was chosen because it is the anniversary of the WW2 Battle of Savo Island, in which Australia's heavy cruiser *HMAS Canberra* was sunk. Those interested in joining the ANARS are invited to contact the honorary secretary at 467 McKenzie Street, Lavington 2641 for further details.

## Australia tops 35th JOTA participation

With 18.8% of Scouts in the country taking part in the 35th Jamboree of the Air last October, Australia is reported to have scored the highest participation rate among the 32 countries who submitted reports to the World Organisation of the Scout Movement.

The Netherlands were close behind, with 14.2% of their Scouts participating. However, 17.9% of the Guides in the Netherlands took part in last year's JOTA, while 9.9% of Australia's Guides participated. A total of over 400,000 Scouts and Guides from around the world took part. (From the *International JOTA Report for 1992*, supplied to the WIA by Peter Hughes VK6HU) ❖

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## FOR THIS PAGE

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# 68705 Microcomputer

*Continued from page 52*

minimum functions the routines must perform are:

Control Write: (refer to Listing 4)
Initialise port A as outputs
Set up DB0-DB7 with the desired control code
Set the R/W line to a logic zero (WRITE)
Set the RS line to a logic zero
Strobe the ENABLE line
Data Write: (refer to Listing 5)
Initialise port A as output
Set up DB0-DB7 with the desired character code
Set the R/W line to logic zero (WRITE)
Set the RS line to a logic one
Strobe the ENABLE line

Listing 3 defines the control codes commonly used with the LCD module. Table 2 describes the available control options for the module.

Using the ACIA is similar to the LCD module except the ACIA needs a clock. Normally this would be provided by the system clock of a computer, but it can be simulated by toggling PB6 with a timer interrupt routine to create a square wave of around 1kHz. All data transfers to and from the ACIA must be synchronised to the leading edge of the clock pulse.

The ACIA contains a Transmit Data Register (TDR), Receive Data Register (RDR), Control Register and Status Register. Refer to the example in Listing 6 for a simple control register read routine and Table 3 for a definition of the ACIA register contents.

As you can see from the listings, one of the many powerful features of the 68705 instruction set is the inclusion of bit manipulation and branching instructions. And as you can also see, the routines for controlling the microcomputer are quite simple. The kit comes with a disk containing many programs to get you started. So even if you're not a seasoned 68705 programmer there will be plenty of routines (with documentation) to get you started.

Some of these programs include a basic digital function generator, LCD module routines, keypad routines and serial data transfer routines. These can also be used as subroutines in your pro grams. If you're not sure what you might be able to make the microcomputer do, how about programming it to be an alarm system, a voltmeter, a programmable logic controller (PLC), a calculator, music generator, successive approximation A-D converter or... The list is endless.

Finally, we are developing an update for the 68705 Development System to allow it to program the 68HC705C8 series. Keep watching... ❖

# 50 and 25 years ago...

*'Electronics Australia' is one of the longest running technical publications in the world. We started as 'Wireless Weekly' in August 1922 and became 'Radio and Hobbies in Australia' in April 1939. The title was changed to 'Radio, Television and Hobbies' in February 1955 and finally, to 'Electronics Australia' in April 1965. Below we feature some items from past issues.*

## September 1943

**Faster than sound:** Lt.Col. C.S. Hough, a 36-year-old American airman, power-dived a Lightning fighter in Britain from 43,000 feet for nearly five miles at a speed of over 780mph (faster than the speed of sound).

Granted the DFC for independent flight research, his citation says: "His flight took him knowingly and deliberately into unexplored scientific fields and unknown conditions of compressibility, furnishing invaluable technical data covering the entire range of dive phenomena."

**Military goggles:** New military goggles are being manufactured, which enable gunners to follow the path of tracer bullets in daylight. They will simplify the gunner's job and enable him to score more direct hits on enemy targets.

Fliers wearing the goggles can work under full illumination, thus eliminating the 30-minute period previously spent in a dark room to condition the eyes for night flight.

## September 1968

**Man or machine?:** In Britain, members of the 'International Society for the Abolition of Data Processing Machines' are allegedly being encouraged to defeat data processing equipment by demagnetising magnetically coded cheques and making extra holes in punched cards.

The society is symptomatic of the negative attitude to data processing, which can be evident all the way from management to the office boy. The computer is accorded the role of a monster, inaccessible to all but its white-frocked attendants, inflexible, unsympathetic, given to sending out repetitious demands to deceased defaulters and, above all, proving a ready-made excuse for not giving matters individual attention.

**Gun-practice without shells:** A new type of gunnery simulator has been developed, which is intended to be used with guided weapons, tanks, helicopters and infantry, to provide a high degree of realism on tactical exercises, without using live ammunition.

Weapon aiming is simulated by directing a narrow beam of infra-red light from a low-powered laser to illuminate the target. Information relating to accuracy is relayed back to the attacker by telemetry link. The simulator indicates whether a direct hit has been scored, or where the 'round' has landed. It also signals the armour thickness of the target, and simulates the precise shell trajectories.

**RF soldering:** RF soldering is being used at the ICT factory in the UK in the production of its new range of IC computers. The pin to be soldered and a preformed solder washer are heated by a rapidly alternating magnetic field. As the joint does not come into contract with the heating element, a clean joint is ensured. The heating element is a water-cooled copper coil (which does not itself get hot) through which an RF current is passed for a short period. ❖

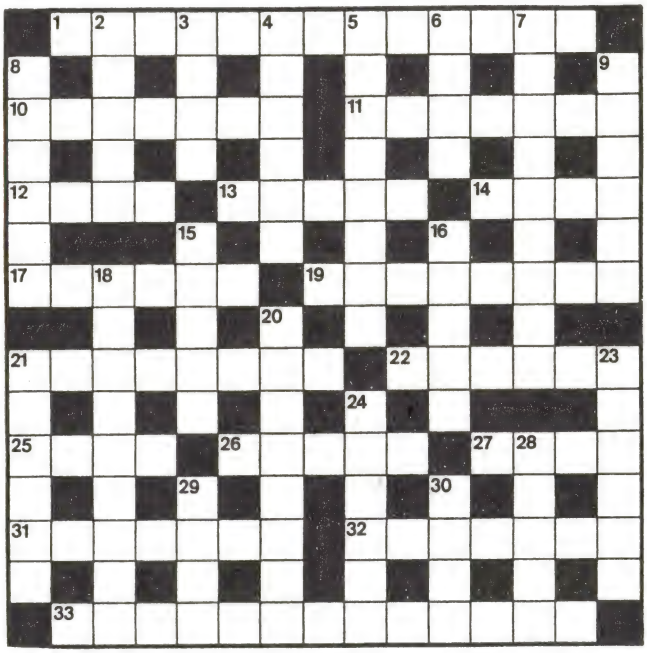
# EA CROSSWORD

### ACROSS

1. Bifurcating device. (6,7)
10. Planned undertaking. (7)
11. First name of Wien famous for his radiation law. (7)
12. Mental inspiration. (4)
13. Robert ——, 17th century scientist. (5)
14. Transfer data to a computer memory. (4)
17. Domestic electrical appliance. (6)
19. Apply potential. (8)
21. Physical property of a moving mass. (8)
22. Sent a ranging signal. (6)
25. Non-corroding metal. (4)
26. Concerned with the most dense metal. (5)
27. Artificial satellite. (4)
31. Powerful orchestral piece by Beethoven, —— Concerto. (7)
32. Form a picture using 16 down. (7)
33. EA's technical consultant. (5,8)

### DOWN

2. Protective atmospheric layer. (5)
3. What a spent fuse did. (4)
4. Form of an electronic financial transaction. (6)
5. Patch for satellite's signal. (8)
6. Early battery, the voltaic ——. (4)
7. Functioning. (9)
8. Path for signal to satellite. (6)
9. French physicist famous for fundamental formulae. (6)
15. Said of flying relying on avionics. (5)
16. Convoluted nervous mass. (5)
18. Intermittent exposures, or —— photography. (4-5)
20. Clearly perform better at preparing wires. (8)
21. Lodestone is a natural ——. (6)
23. Unidirectional electronic devices. (6)
24. Site of atomic testing in Pacific Ocean, —— Atoll. (6)
28. Secure by crushing. (5)
29. Said of mobile electrons. (4)
30. Name of effect that produces electric field in conductors. (4)



### SOLUTION FOR AUGUST 1993

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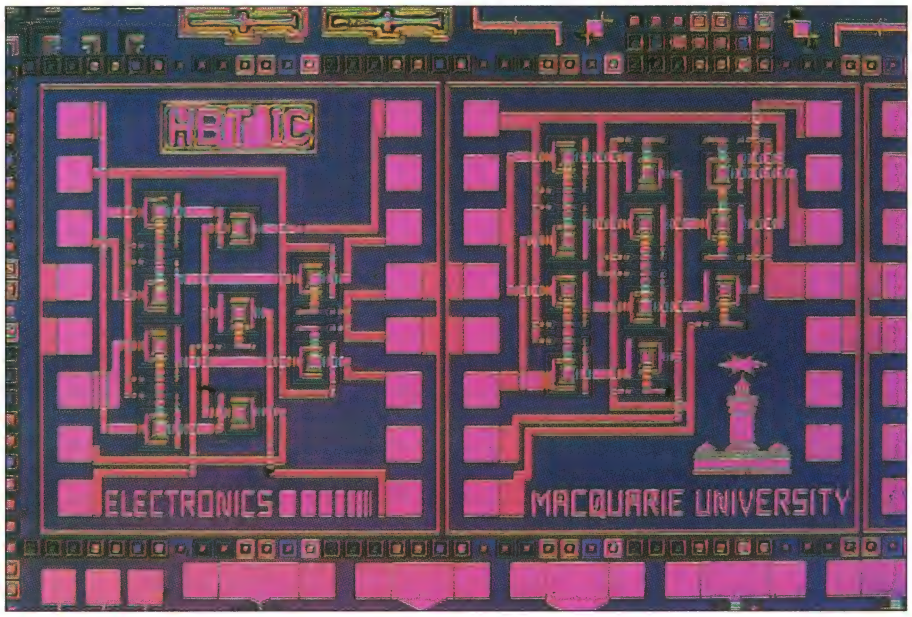



**ADVANTECH'S PCL-816 MODULAR DA&C CARD: SIXTEEN 16-BIT DIFFERENTIAL ANALOG INPUT CHANNELS, WITH SAMPLING AT 100kHz — PLUS HIGH ACCURACY...**

*(Courtesy Priority Electronics)*

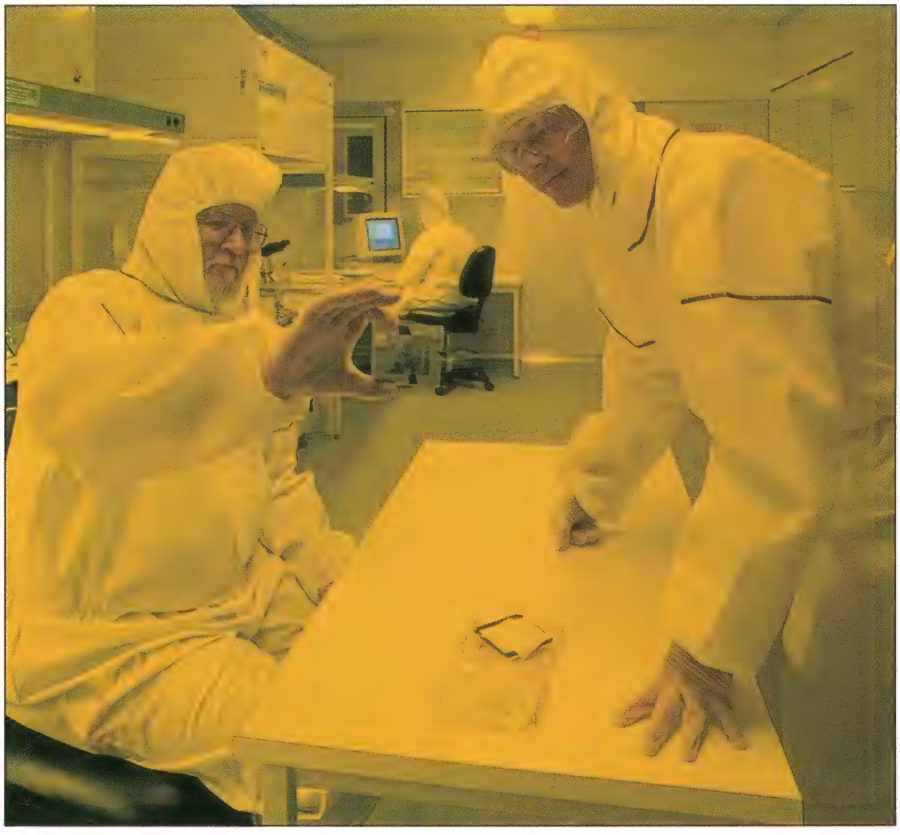
# NEWS HIGHLIGHTS

## CLASS 35 CLEAN ROOM AT MACQUARIE




Macquarie University, at North Ryde in Sydney, has set up a Class 35 clean room facility for research into compound semiconductor devices and circuits. The facility is a joint project between the university's schools of Electronics and Physics, and in particular the Electronics Research Group headed by Professor David Skellern, and the Semiconductor Science and Technology Laboratory, headed by Associate Professor Trevor Tansley. Manager of the clean room is Mark Parilla, who has himself conducted considerable research into compound semiconductor devices.

The new facility meets Australian Standard AS 1386.1, which specifies that there are at least 20 changes of room air every hour, and that any litre of air contains fewer than 35 particles of 0.5um or larger. This involves the use of high efficiency particulate air filters and maintaining the air pressure within the room at 60 pascals above the surrounding ambient. A changing room maintained at 30 pascals above ambient is provided for personnel to don and remove the required suits, caps and overboots.



Equipment in the new room includes a wet-chemical bench for etching, Wentworth hotplates for wafer baking, a vacuum deposition system for metal application, a Karl Suss MJB3 mask aligner, Dektak Profileometer, Cascade Microwave Probe Station and HP Semiconductor Parameter Analyser. The 'raw materials' used to fabricate devices in the facility are custom-designed Indium Phosphide/Indium Gallium Arsenide heterostructure epitaxial wafers produced by Epitaxial Products International, of the UK.

Among other devices the facility will be used to conduct research into are those using heterojunction bipolar transistors (HBTs), double heterojunction bipolar transistors (DHBTs) and resonant tunneling diodes (RTDs). HBT devices use a structure similar to that of silicon BJTs, but employ a wide energy bandgap material such as Indium Phosphide for emitter, and a narrow energy bandgap material such as Indium Gallium Arsenide for the base. This gives a 'heterojunction' for the base-emitter junction, whose high injection gain allows the doping profile to be manipulated for optimum high-frequency performance. HBTs already fabricated by researchers at Macquarie have demonstrated a unity gain frequency response of 70GHz, without requiring sub-micron processing — the emitter size was 9 x 9um.

## NEWTON LANDS IN SYDNEY

Recently a hushed crowd of Sydney journalists allowed themselves to be hypnotised for three hours by a pair of evangelists from Cupertino in California, at a press conference in Darling Harbour. The gospel concerned was strictly and fervently according to Newton — Apple Computer's Newton, that is.

We've read and hypothesised about this new 'PDA' or personal digital assistant, for three years, and Apple claims it has been under development for six. The full colour advertising brochure is dated 9/92, while the specs sheet carried the legend 'July 1993'. The official global launch was August 2. Obviously, the 190 x 190 x 110mm gadget's external contours had been set a long time ago, but the internals had apparently undergone major changes on their way to finality.

If you view Newton as a mere 'electronic note pad', you will severely underestimate the extent of Apple's strategy. According to evangelists Michael Tchao and James Joaquin, Apple intends to position itself at the crossroads of the computer/communications/electronics industries — with, down the track, a tilt at the video industry. As they explained, anyone who thinks of Apple as a hardware company should realise that its products are 'but thinly skinned boxes of software'.

The company intends the Newton to be a true personal digital assistant — enabling you to maintain contact with friends and colleagues, organise your life more efficiently, keep track of your ideas, take notes, make quick sketches, format and print letters, share and synchronise information with your PC, send a fax, receive pages and messages or E-mail. Around 1500 developers are reputed to be waiting to produce software specifically for the Newton. Among them will be applications for shorthand recognition as well as sound, motion and colour.

Chao and Joaquin enthralled the crowd by showing how scribbles could be written onto the resistive glass panel and, within a fifth of a second, be replaced by clear text; the device allows you to teach Newton your individual writing characteristics. Further, rough sketches of geometric objects — squares, circles and so on — will reformat into perfect bit-mapped graphics. Want to erase a drawing? Simply rub it out with the stylus and a puff of smoke erupts. Cute! Text to be deleted? Simply cross it out and the words are torn into fragments and tossed into the 'trash can'.

According to the Newton spec sheet, it's powered by four AAA batteries plus a lithium backup. The ARM 610 processor and its custom ASIC run at 20MHz, with 4MB of ROM and 640KB of RAM. It has a PCMCIA card slot for data storage, and can interface — via accessories — to both Mac and Windows computers, printers and Group 3 fax machines.

The price is expected to be under US$1000 on launch. (B.S.)




RTDs have a thin 'quantum well', approximately 5nm thick, sandwiched between two barriers of similar thickness. The confinement of electrons between the barriers causes a quantisation of their energy, producing resonant states. This causes the I-V characteristic to exhibit negative resistance regions, similar to those of P-N tunnel diodes. RTDs are reasonably low power devices with speeds comparable to Josephson junctions (oscillation to 1THz, switching as fast as 2ps), but without requiring cryogenics. Macquarie's new clean room will be able to fabricate RTDs down to 3um in diameter, using the custom epitaxial material.

## MAKERS PLAN HDTV DIGITAL VCR

Ten major manufacturers of video cassette recorders, having agreed on a standard for consumer digital VCRs, are to set up a conference in September to develop a common set of specifications for HDTV digital VCRs. When finished, the conference will submit the specifications to the IEC, with the hope of having it established as the worldwide format.

The manufacturers involved are Philips, Hitachi, Matsushita, Mitsubishi, Sanyo, Sharp, Sony, Thomson, Toshiba and JVC. The standard-definition digital VCR specification already agreed upon involves digital component recording on metal evaporated tape 6.35mm (0.25"), with 8-bit video samples taken at a rate of 13.5MHz and recorded at 25Mbps. Discrete cosine transformation (DCT) is used for video bit rate reduction. For 50Hz countries the tape will move at a linear speed of 18.831mm/s, with a corresponding speed of 18.812mm/s for 60Hz countries.

It is expected that for HDTV, the video recording rate after bit rate reduction will be 50Mbps, with the linear tape speed increased to 37.662/37.625mm/s.

## SBS, WOLLONGONG UNI TV INITIATIVE

Wollongong University and the Special Broadcasting Service have launched an educational TV network, claimed to herald a new era in professional and postgraduate education. The network will provide access to the teaching expertise of 17 Australian universities, from the home or office.

The three initial courses being offered over the network are Health Management, Total Quality Management and Electronic Data Interchange. Next year there will also be University of Wollongong graduate courses in Telecommunications Engineering, Journalism and Multicultural Studies, and it is expected that graduate courses from the 16 other universities will be added progressively.

## NEW STANDARDS

Standards Australia has recently published the following standards and drafts, of potential interest to the electronics industry:

AS 1284 Electricity Metering: various parts, concerning electronic watt-hour meters, data exchange for meter reading, direct local data exchange with a handheld unit using both the IEC standard interface (IEC 1107:1992) and ANSI standard interface.

## NEWS HIGHLIGHTS

AS 3912 Quality Assurance Requirements for Measuring Equipment: Part 1, specifying a metrological confirmation system for measuring equipment.

Standards Australia also has handbook HB45 available, providing a guide to standards, practices and regulations relating to the broad subjects of electromagnetic compatibility and interference.

These standards and materials may be purchased from any office of Standards Australia, or by contacting the National Sales Centre; phone (02) 746 4600, fax (02) 746 3333.

## HK'S PAY-TV SET FOR OCTOBER

Hong Kong viewers should have a Pay-TV service by this October, when the colony's licensee Wharf Cable begins its HK$5 billion operations. The service is planned to provide eight channels of news, entertainment, sports, movies, education and financial information, and will give Asia's first 24-hour news service.

Programmes are being distributed to subscribers via microwave until 1996, when a fibre-optic network will become operational. Wharf Cable expects that nearly one million subscribers will be receiving the programmes by the end of 1994.

The company is spending nearly HK$50 million to commission an initial stock of six months' worth of local TV features, mini series, lifestyle programmes and music videos. Subscription rates are likely to be around HK$180 a month.

## 'BIG FOUR' AGREE ON VIDEO CD

Philips, JVC, Matsushita and Sony have agreed to establish a linear digital full motion video format ('Video CD'), based on the Karaoke CD standard, also known as the 'White Book'.

This standard, published by JVC and Philips in March 1993 and which is based on MPEG-1 digital full motion video, is already successfully established in the professional Karaoke market. This 'Video CD' format will be not only used for Karaoke products but will also now be supported by 'publishers' of movies, music videos and educational and training programs. These publishers therefore requested a renaming and a logo for the system.

It is anticipated that the format will be extended with new features in the future, ensuring compatibility with existing products.

'Video CDs' can be played back on a wide range of platforms: modified CD players (with a digital data output) with an add-on 'Video CD' box; computers with CD-ROM drives and MPEG decoders; 'Video CD' (movies) players; and CD-I players with an FMV (full motion video) extension.

Mr John Hawkins, director and general manager of Philips Interactive Media Systems, stated: "Philips expects that the 'Video CD' format will have the same impact on the video industry, as the compact disc had on the music industry 10 years ago. It means that publishers can start to produce interactive and linear products immediately."

The basic features of the 'Video CD' format are:

- The MPEG-1 (Moving Pictures Expert Group) ISO/IEC standard offers 74 minutes of high quality video and CD quality audio on a standard 12cm (five inch) disc.
- The ability to use existing video source software.
- On top of fast track access search, normal playback features like still pictures (pause), slow motion and fast scan are offered.
- An attractively priced dedicated video player, based on CD-ROM drive with MPEG decoder.
- The 'Video CDs' will play on CD-I players with FMV plug-in cartridge.
- The new format disc is compatible with all broadcasting standards worldwide. The discs are easy to use, easy to store, durable and are relatively cheap to produce.

## FIFTH ELENEX AT DARLING HARBOUR

ELENEX AUSTRALIA 93, the fifth Australian Electrical and Electronic Industries Exhibition, will be staged at Darling Harbour in Sydney, from 31st August to 3rd September. ELENEX is Australia's largest specialised exhibition for the electrical and electronical industries, organised by Australian Exhibition Services (AES).

The '93 event will occupy two halls at Darling Harbour. "The big names are there," said Exhibition Director Noel Gray, "leading companies like HPM, Hawker Richardson, Gerard, GEC, Critchley, Bell IRH, Davico, Le Grand, Cooper Tools, Industry Uniserve, Email Westinghouse and more," The UK has also reserved a large area in the show.

All aspects of the electrical and electronic industries will be featured, from industrial applications through to the most sophisticated electronic assembly equipment and componentry. Exhibitors will be separated into electrical and electronic areas to help buyers locate products of interest. This format proved to be very successful at ELENEX 92 in Melbourne, where the show attracted 8525 visitors.

The Circuit Mount and Circuit Board Association Conference will again be held in conjunction with ELENEX. The 1993 best new product awards for the electrical and electronic industries will also be judged and presented at the show.

ELENEX AUSTRALIA will be staged concurrently with AUTOMATE AUSTRALIA, the 4th International Robotics and Industrial Automation Exhibition, enabling visitors to see two major related events in just one visit.

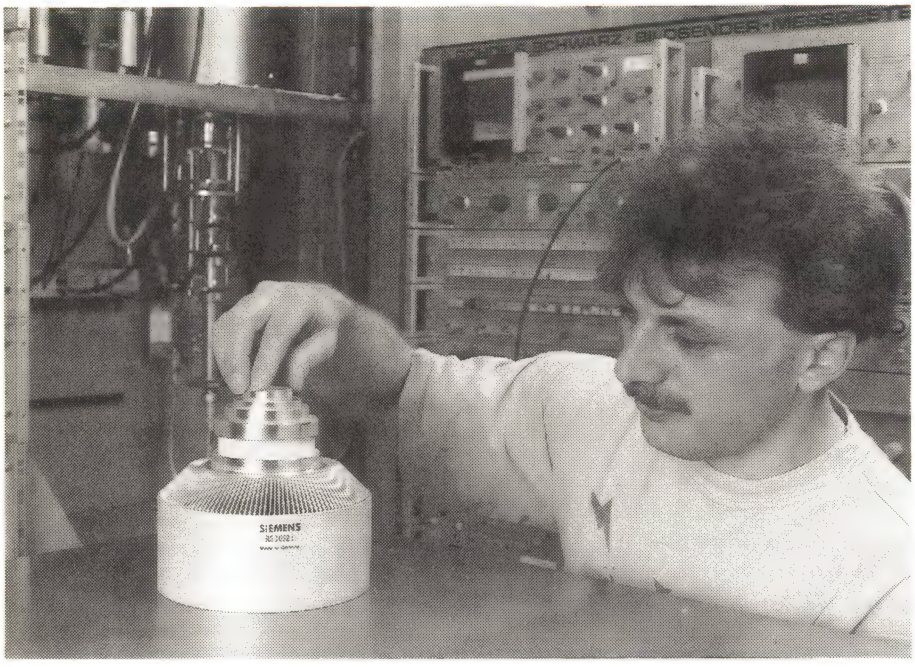


## NEWS BRIEFS

- From July 1st 1993, the ***NECA*** (National Electrical Contractors Association) will be the sole national voice of the electrical contracting industry. This follow the official wind-up of the Electrical Contractors Associations of Australia (ECAA), the body which previously represented the views of the industry in the national arena.
- The Magnetic Tape Division of ***Ampex Australia*** is now called Ampex Media International Corporation, a branch of Ampex Recording Media Corporation. Greg Martin heads up this new company, while Phillip Gardiner is now the head of the Equipment business which will continue as Ampex Australia. Both companies will operate out of the same Sydney headquarters in Talavera Road, North Ryde.
- The ***Surface Mount 93*** conference will be held on September 1-3 1993, in conjunction with the Elenex Exhibition at Darling Harbour in Sydney. It will not only look at Surface Mount technology but also at technical information which can be adopted by those using through-hole and mixed technology boards. For more information contact SMCBA, PO Box 5048, Hughesdale 3166; phone (03) 569 6393, fax 569 1047.
- The German Electrical and Electronic Manufacturers' Association, ***ZVEI***, has released a completely revised edition of its buyer's guide. The directory (available in four languages, including English) gives a comprehensive survey about the companies and products of the German electrical and electronics industry. Its retail price is DM96. Contact Verlag W. Sachon GMBH, POB 1463, D8948 Mindelheim, Germany; phone (08261) 999 0, fax 999 132.
- Mr Joseph Li Rosi has left Telecom Technologies to become the Product Manager of the Advanced Information Products department at ***Siemens***.
- ***Microelectronics '93***, the 13th Australian Microelectronics conference will be held from October 5-8 1993 in the Marriott Surfers Paradise Resort at the Gold Coast. It will cover all aspects of microelectronic research and development. For more information contact IREE Australia, PO Box 79, Edgecliff 2027; phone (02) 327 4822, fax 362 3229.
- From July 1st 1993 ***VSI Promark Electronics*** will become ***VSI Electronics (Australia)***— the name used prior to May 1991.

## SHUTTLE CERAMIC MAY REPLACE BONES

The same material that keeps the Space Shuttle from burning up when it returns from space may be useful in treating medical problems on Earth. Researchers from NASA's Ames Research Center in Mountain View, California, are working with physicians from BioMedical Enterprises Inc., and the University of Texas Health Science Center, both of San Antonio, to determine whether the Space Shuttle's ceramic surface insulation materials can be used as an implant for human skeletal reconstruction.




***A Siemens technician admires one of the company's new RS 1092L transmitter valves, designed especially for use in television transmitters at power levels up to 10kW. The new valve shows a high degree of linearity, for improved picture transmission quality.***

"We're still a long way from having a bone implant that's ready for human use," said Howard Goldstein, Senior Staff Scientist in Ames' Thermosciences Division. "But we have data that shows the tile material has excellent promise for use as a bone implant." Goldstein led the research, development and evaluation of the ceramic, known as Reusable Surface Insulation (RSI), in the 1970s and 1980s. He also will lead Ames' RSI research team on the new project.

Tiles made of RSI cover the Space Shuttle and keep it from burning up when it re-enters Earth's atmosphere. "The theoretical attraction of Shuttle insulation is that it is biocompatible," said Dr Dani Goldwater, Manager of commercial space programs at Ames. "It also provides a porous framework, which allows infiltration by normal bone cells and deposition of bone mineral. The result could be complete integration of the implant into normal bone," she said.

## LOCALLY DEVELOPED INTELLIGENT CHARGER

An intelligent battery conditioner/-charger which can recharge up to 24 laptop computer batteries at one time has been developed in Townsville by Process Control Engineers.

PCE managing director Errol Young said he had created the bulk recharger unit for schools and similar places, where unreliable laptop battery performance was often a problem.

"Laptops which have not been rotated properly can be a problem because they might not have fully charged batteries and therefore cannnot be relied upon to perform well," he said. "What we have come up with is a unit which the school can run 24 hours a day to cycle each battery every time it is returned."

"The idea is that when laptops are returned to the library or other central points after use, the batteries are removed and placed in our recharger as a matter of course. The unit removes the remaining charge from each battery, charges it at the recommended rate and then indicates when the battery is fully charged and ready for service."

Mr Young said that by using his company's bulk recharger unit in this way a store of ready to use, fully charged batteries was guaranteed, ensuring laptops performed to specifications and did not malfunction because of battery failure or unstable power delivery.

Further details are available from Process Control Engineers Pty Ltd., 4 Schmid Street, Garbutt Qld 4814; phone (077) 79 9566, fax (077) 79 9730. ❖

## *Data acquisition & control products:*

# NI's IEEE 488.2 card, LabVIEW for Windows

Texas-based firm National Instruments is a leading supplier of hardware and software products for computer-based data acquisition, analysis and control. Here we take a look at two of the recent additions to its range: a high speed IEEE 488.2 controller card for AT-compatible PC's, and the *LabVIEW for Windows* software package — designed to facilitate remote control and manipulation of instruments from the computer.

**by JIM ROWE**

More and more, personal computers are being used for remote control and manipulation of test instruments. This allows much faster and more efficient testing, for example in a production environment, and can also obviate having to use a human operator for long, complex or otherwise tedious data logging tasks.

The two main requirements for this kind of computer application are a suitable interface, capable of electrically linking the computer and a number of instruments, and matching 'driver' software to run on the computer itself.

One of the leading firms producing products to meet both of these requirements is National Instruments, with its headquarters in Austin, Texas and branches in many countries (including Australia). NI produces both hardware and software to link instruments to a variety of different computers/workstations and operating environments, using a number of standard interface bus systems.

It has interface cards and accessories for PC/XT/AT ISA-bus, EISA-bus and PS-2 microchannel IBM-compatible computers, Apple Macintosh computers (NuBus and LC bus), Sun, IBM RISC and DEC workstations — using the GPIB/IEEE-488 parallel bus, RS-232C serial bus and specialised VXI bus — together with dedicated DSP, A/D and D/A cards, and dedicated instrument and controller modules for the VXI bus. And on the software side, it has a variety of packages designed to facilitate remote control and manipulation of instruments from these computing platforms — from relatively basic driver routines to full-scale and very powerful integrated programming packages.




***The LabVIEW package comes on six 3.5" disks, but is accompanied by no less than seven quite solid reference manuals...***

## IEEE 488.2 card

For those wishing to use an ISA-bus 286/386/486 machine as a controller for instruments fitted with the GPIB/IEEE 488 interface bus, National Instruments provides the AT-GPIB controller/interface card. This is a short 16-bit card, with a single standard 24-pin 'Amphenol' type connector on the rear mounting plate. (Only a single connector is needed because the GPIB system can be wired in 'daisy-chain' or 'star' configuration, using 'piggyback' connector plugs.) The card is designed to transfer data at rates of up to 1MB per second, in both directions, and thus qualifies as 'high speed' GPIB interface.

Onboard the card incorporates NI's 'Turbo 488' and 'NAT4882' ASIC chips, which are claimed to give it 100% compatibility with the updated and tightened 1987 version of the GPIB standard, designated IEEE 488.2. This (current) version removes some of the ambiguities of the original 1975 version, by defining data formats, status reporting, error handling, a set of controller routines and a common set of configuration commands to which all instruments conforming to the IEEE 488.2 standard must respond in a precise manner. (At the same time, it generally allows communication with instruments designed for the original standard, as well.)

Being compatible with the IEEE 488.2 standard also makes the AT-GPIB card compatible with the recently-developed programming language for programmable

instruments, SCPI (standing for Standard Commands for Programmable Instruments). In other words, it's not only a high speed interface, but one that's fully compatible with the latest developments in the GPIB environment.

The AT-GPIB card comes complete with a set of driver software on disk, and no less than four manuals. One of these, the 'Getting Started' manual, deals with installation and configuration of the card itself, plus the basic techniques for installing and calling the supplied 'NI-488.2' MS-DOS handler routines, from Microsoft's *QuickBASIC* (V.4.0 or higher) and *C* (V.4.0 or higher) languages.

Further information on the NI-488.2 routines is given in the largest of the manuals, titled 'Software Reference Manual'. This also gives details on calling the routines from other widely-used Microsoft languages, including *BASICA* and *Professional BASIC* (V7.0). The two remaining manuals deal with the installation and use of the files (supplied) which allow the NI-488.2 routines to be called as a DLL from programs running under *Windows* (V3.0 or higher), and installation and use of a 'Universal Language Interface' utility (also supplied) called *ULI.COM*, a TSR which provides a set of low-level GPIB commands as used for programming many Hewlett-Packard controllers. The commands available with *ULI* can be used in virtually any language, as they effectively configure the GPIB port as a standard I/O device.

In short, then, the AT-GPIB card comes with a comprehensive set of both manuals and basic software routines, for people who are sufficiently experienced with both programming and the nitty-gritty of GPIB instrument control.

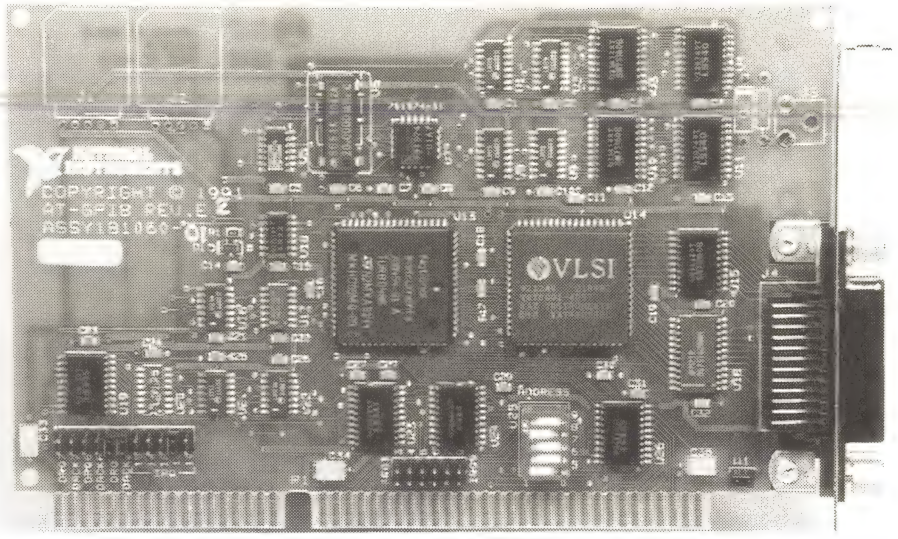
## LabVIEW for Windows

Of course not everyone is an experienced programmer, and/or wants to dive into the fine details of GPIB protocols simply in order to program a few instruments for some measurements.

Actually even if you *are* reasonably experienced in these areas, writing such a program in a conventional language like *C* or even *QuickBASIC* tends to be a fairly complex and tedious job.

Partly this is because of the lack of standardisation in the 'language' understood by many instruments in current use; partly too it's been because many of the standard 'procedure-driven' programming languages are not really suited for this kind of application.

As its solution to this problem, National Instruments has developed a number of graphics-based and 'object orientated' (OOP) programming languages, designed




specifically for the job. Rather than being procedure-driven these are essentially *event-driven*, making them not only easier to program but also more suitable for integrating the functions of instrument control, data acquisition, analysis and presentation. *LabVIEW* is one of these languages, and although originally developed by NI software engineer Jeff Kodosky for the Macintosh, is now available also for the *Windows* environment on MS-DOS machines as well as for Sun SPARC workstations.

The basic concept behind *LabVIEW* is that of a *virtual instrument* — a graphical representation of an instrument's front panel, on the computer screen, which can be used to manipulate the instrument just as easily as if it were the instrument's *real* front panel. These virtual instruments (or 'VI's) are then linked together using a graphical programming language called *G*, so that a complete data acquisition, analysis and display system can be created simply by drawing its 'block diagram' on the screen. (It's similar to the way modern circuit simulators work, in fact: you draw the schematic, and they do the rest...)

*LabVIEW* seems to combine the event-driven aspects of an OOP language with some of the timing, testing and looping features of a standard procedural language — like Do/While, For/Next, Case-Structure and Sequence-Structure. However in this case these are all programmed graphically, to make them more intuitive.

Another important feature of *LabVIEW* is that it's modular, and intrinsically expandable. Each VI module can be combined with others, and with signal processing, analysis and functional control modules, to form subsystem VI's, and these in turn can be combined to form more elaborate system VI's, and so on. When used in higher-level modules each module is represented by an 'icon'.

How is a VI actually created in the first place? Basically by first 'drawing' its front panel (or a suitable functional equivalent), by selecting and arranging representational icons for its controls, displays and so on, from *LabVIEW*'s extensive library files. In general these libraries are accessed by means of menues and subsidiary pop-up windows, each of which gives an array of applicable icons.

Each of these control or display icons actually represents a lower-level VI, which has been previously created. And every time you place such an icon on your 'front panel', an equivalent *functional icon* is added automatically to the panel's corresponding 'wiring diagram'. So when you've added all of your controls and displays, and given them the labels you want to produce the final VI front panel, you then move into the second phase — completing its wiring diagram. You do this by showing how all of the functional icons (which have accumulated there while you were drawing the panel) are 'wired' together to achieve the desired control, data acquisition, processing and display operations.

Needless to say, there are actually *additional* functional icons that you may need to add to the wiring diagram, to achieve 'internal' functions which may not have any corresponding front panel display item — like For/Next and Do/While control loops, repetitive timing parameters and data processing functions. Again *LabVIEW* provides libraries of these purely functional VI icons.

Once you've done all this, the virtual instrument you have created can be 'run', to achieve the desired result. When the VI is running you can simply 'adjust' the front panel controls, using the PC's mouse, to control things; similarly you can see the measurement data or whatever on its displays.

So this is the basic way in which *LabVIEW* is used. New virtual instruments

are made by combining those for lower level functional module VI's, and this is done by using their representational icons to 'draw' a front panel, and their functional icons to produce a block/logic diagram. Then the resulting instrument or system VI is run, and you interact with it on screen.

VI's are of course data files, which can be saved on disk and retrieved for later use. You can also print them out in graphical form (both the front panel and the wiring diagram), so that they are effectively self-documenting. And of course once they're created and saved, they can also be used as modular components, to make up higher-level subsystem VI's...

By the way, because *Windows* and MS-DOS are both limited to eight-character filenames, which would be rather limiting in terms of the names you could give to VI's, *LabVIEW* allows you to collect VI files together and save them in compressed form as *libraries*.

Although the library files themselves can only have the standard eight-character names (plus an appropriate extension, of course), the compressed VI files inside them can each have names with a total of 31 characters — including a '.VI' pseudo-extension. This is a neat trick, and perhaps owes its origin to the way *LabVIEW* was first created for the Macintosh (where long filenames are a fact of life), and then adapted to the MS-DOS environment.

## Instrument VI library

Although producing an instrument VI in the way just described can be pretty daunting, especially when you're initially getting used to the way *LabVIEW* works, it turns out that you don't necessarily have to produce your own VI's. National Instruments has thoughtfully included a fairly comprehensive library of pre-cooked VI's in the latest version of the *LabVIEW* package, to suit many of the more popular instruments from manufacturers such as H-P, Fluke, Keithley, LeCroy, Philips, Tektronix, Wavetek and Stanford Research. There are apparently around 200 of these ready-made VI's, so if you are using one of the instruments concerned, things can be somewhat easier.

Of course Murphy's Law often tends to apply in this sort of situation, to ensure that there's no pre-cooked VI in the library for the very instrument *you* need to use! This would be more likely if you are using older or less popular instruments.

*LabVIEW* for *Windows* runs under *Windows 3.1* in 386 enhanced mode, and works best on a 486 machine with 8MB of RAM. The entire package comes on six 1.4MB 3.5" diskettes, and requires about 15MB of hard disk space for installation — which typically takes about 20 minutes.

Along with the package itself you get a set of release notes and no less than *seven* substantial A4-sized manuals, each with spiral binding.

There's a Getting Started manual, explaining installation and taking you through a short tutorial course; a User Manual; a Function Reference Manual; a Data Acquisition VI Reference Manual; an Analysis VI Reference Manual; a GPIB and Serial Port VI Reference Manual; and a Code Interface Reference Manual.

## Our impressions

National Instruments Australia kindly loaned us a review copy of *LabVIEW for Windows*, and we were able to try it out for a while on a 33MHz 486 machine, with 8MB of RAM and running *Windows 3.1*.

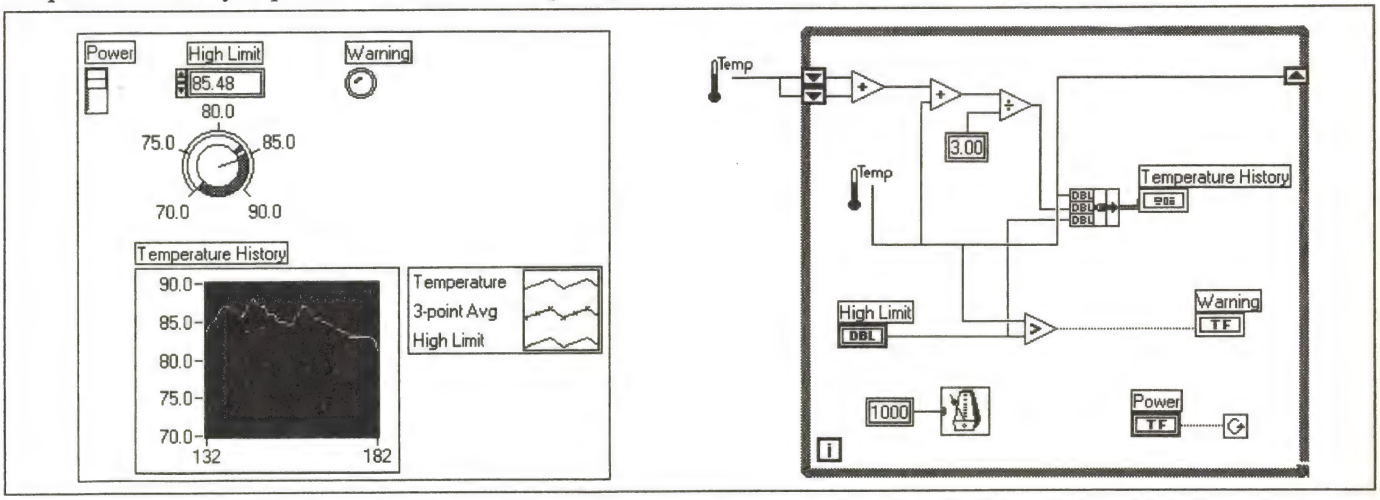
We installed it without any problems, and were able to work through the tutorial and get a reasonable feel for the way the package works and how it's used. The review package seemed to have only a few samples of the pre-cooked instrument VI library, but otherwise appeared complete.

To be honest, we found using it fairly heavy going, particularly at first. *LabVIEW* is such a powerful and comprehensive package, and so different from most other CAD packages and languages we've used, that it took quite while before we really felt half-way confident about driving it. In short, if you haven't used this kind of package before, it has a fairly steep learning curve. Unlike many of the more recent *Windows*-based packages it doesn't provide an on-line context sensitive help system, either. Most of the pop-up windows do have a text line which identifies icons when you're selecting them, but this is about as far as it goes. Beyond that you generally have to plough through those weighty manuals...

There's no doubt that because of its great power, flexibility and modularity, *LabVIEW for Windows* would be an excellent choice for those in a high-level R&D or production environment who need to be able to design and implement complex PC-controlled instrumentation and data acquisition systems. In this kind of environment the time required to become really proficient in driving the package would easily be justified. But for many of us at a lower level, with only a few instruments fitted with GPIB or RS-232C interfaces, my impression is that it may well represent 'overkill'.

The quoted price for NI's AT-GPIB card is $875, plus sales tax where applicable. Similarly the basic *LabVIEW for Windows* package is priced at $2132, while the 'Advanced Analysis' version costs $3795.

Further information on both these and the other products in the National Instruments range is available from National Instruments Australia, PO Box 466, Ringwood 3134; phone (03) 879 9422, or fax (03) 879 9179. ❖




***A key concept of LabVIEW is the creation of virtual instruments or VI's, which are produced by 'drawing' their front panel and the corresponding functional block diagram. At left is a sample front panel, with its block diagram on the right.***

# AUSTRALIAN ELECTRONICS DIRECTORY

*The best known and the most used Electronics Buyers Guide*

The 1992/93 (24th) Edition of the Australian Electronics Directory has again had thousands of additions and amendments since last year.

The 5 major product categories covered by this unique directory are:—

ELECTRONIC COMPONENT
CONSTRUCTION MATERIALS
MEASUREMENT AND TEST EQUIPMENT
SYSTEMS AND SUB-SYSTEMS
SERVICES

*The Directory is presented to you in four easily used sections:—*

## PRODUCT INDEX



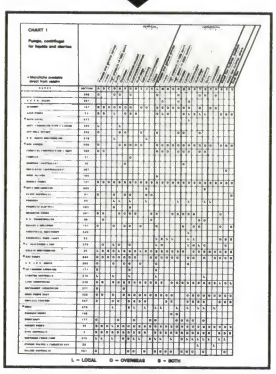

PRODUCT INDEX
(Buff Colour)
ALPHABETICAL LIST OF 2,800 PRODUCT CATEGORIES SHOWING PRODUCT CHART NUMBER

## OVERSEAS PRINCIPALS & TRADE NAMES



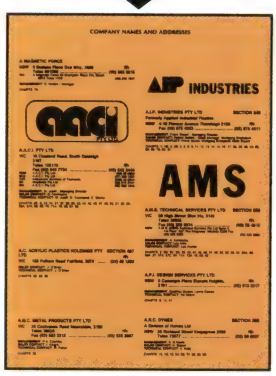

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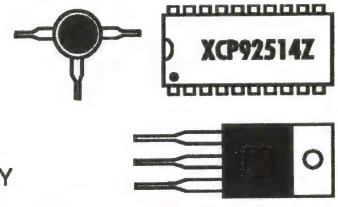
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# Solid State Update




KEEPING YOU INFORMED ON THE LATEST DEVELOPMENTS IN SEMICONDUCTOR TECHNOLOGY

## Surface mount PIN diodes

Hewlett-Packard has introduced a series of low price, surface mount PIN diodes, designed for battery powered RF switching applications that require low capacitance and resistance at low power levels.

The HSMP-389X series features a low capacitance of 0.30pF max at -5mA, and a low resistance of 2.5 ohms max, at 5V.

The devices provide superior performance in high frequency operations that require minimum power consumption, and are optimised for switching applications from 50MHz through 2GHz.

For further information circle 272 on the reader service coupon or contact VSI Promark Electronics, 16 Dickson Avenue, Artarmon 2064, phone (02) 439 4655, fax 439 6435.

## VHF ceramic bandpass filters

Trans-Tech has introduced Ceramic Bandpass Filters in the frequency range of 200MHz to 2.5GHz, which exhibit definite advantages in comparison to other filter technologies — including cavity, discrete component, helical, microstrip and SAW.

The filters are created by coupling ceramic resonators (poles), and are available in two and three pole, through hole and surface mount designs.

The filter becomes more frequency selective with additional poles, but at the expense of insertion loss. The lowest loss is provided with the two pole design, and increases slightly with each additional pole. With no moving parts, the filters provide ruggedness, mechanical stability and reliability.

They also feature: high Q ceramic with low insertion loss; high E ceramic with small compact design; and temperature compensation for frequency stability.

The filters are suitable for wireless communications, cellular radio, cordless telephones, GPS and spread spectrum.

For further information circle 274 on the reader service coupon or contact Electronic Development Sales, PO Box 822, Lane Cove 2066; phone (02) 418 6999, fax 418 6550.

## Lowpass filter IC runs on 2.5V

A prototype active lowpass filter IC from Toshiba achieves a dramatic improvement over the performance of conventional lowpass filters. The new device operates at 2.5V, with only 1.0mA of current, yet reduces signal distortion to approximately 1/10th of that achieved by conventional filters.

Designed for incorporation in digital mobile communications equipment, including cordless telephones, active lowpass filters suppress undesired signals and ensure high fidelity signals in low frequencies falling below a prescribed limit. Toshiba's prototype filter operates at a cutoff frequency of 192kHz, which is suitable for application in a wide range of equipment.

The 2.5V operation achieved by Toshiba's prototype makes possible operation with a single 3.6V lithium ion rechargeable battery. Also, conventional active lowpass filters use a Gilbert gain cell structure. However, low voltage operation results in heavy signal distortion in this structure, rendering it unsuitable for practical use. Toshiba's new circuit reduces distortion to some 10%.

Finally, the prototype filter IC's signal path is composed of NPN transistors. Compared with PNP transistors, NPN offers high speed operation and improves frequency transmission. In addition to telecommunications, this new technology can be applied to video signal processing.

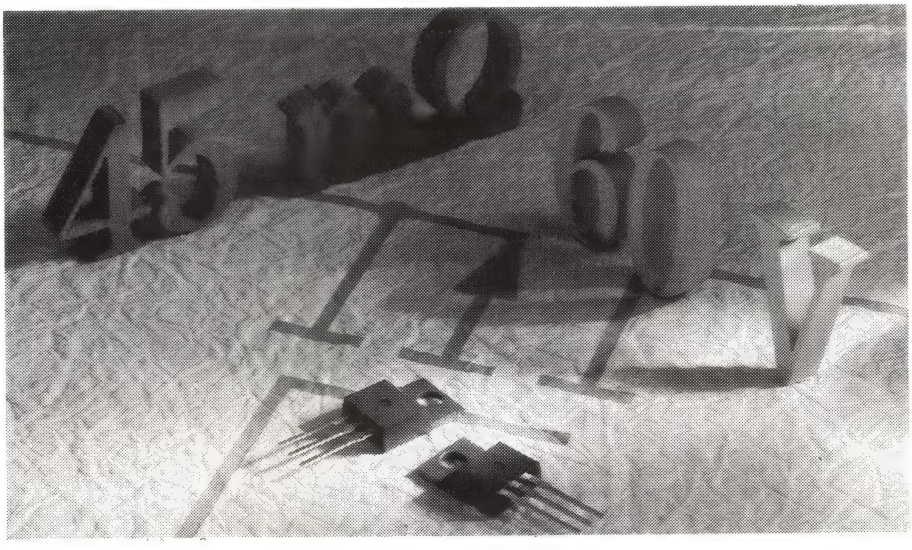
For further information circle 290 on the reader service coupon or contact Toshiba Australia, PO Box 350, North Ryde 2113; phone (02) 887 3322.

## Low on-resistance MOSFET

Claimed to have the world's lowest on-resistance P-channel MOSFET in a TO-220 package, Siliconix's SMP40P06, a 60V device, features a record-low $R_{DS(on)}$ of 45 milliohms — made possible by the firm's new dense-cell P-channel technology.

The new device allows designers of motor control and automotive electronics to eliminate extra circuitry by replacing one or more high side drivers with P-channel MOSFETs. Circuits built with the SMP40P06 will have fewer components and use a simpler, more elegant design, when compared with an N-channel using a floating supply such as a charge pump or boot-strap.

The new MOSFET is designed to drive single ended loads such as solenoids, heating elements, lamps, and relays in automotive applications. This 60V, 40A device is also ideal as a high side switch in bridge applications for driving the motors found in conveyor belts, compressors, blowers, and any other application involving speed control or accurate positioning. The SMP40P06 has the equivalent of 2.5 million P-channel transistors per square inch.



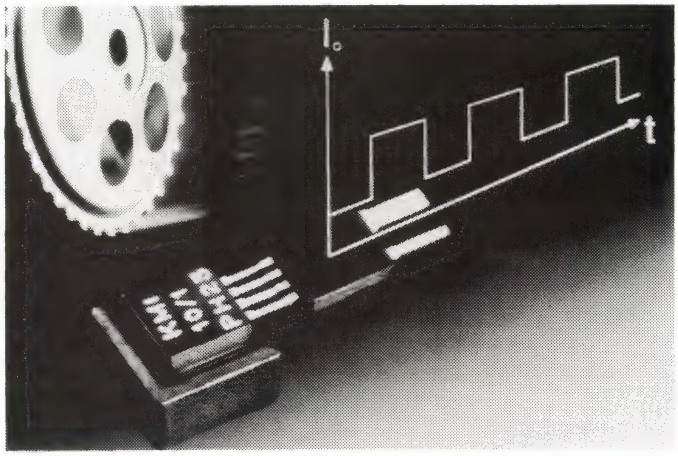
## Car speed sensor

Philips Semiconductor's KMI10/1 rotational speed sensor is a fully integrated contactless speed sensor, which is claimed to meet all the requirements of the automotive industry. Features include accurate measurement down to zero rpm, an ability to operate at tooth-to-sensor spacings as large as 2.5mm and at ambient temperatures as high as 190°C. The sensors operate with a wide variety of wheel teeth structures, while a built in hysteresis in the signal conditioning IC makes it immune to vibrations.

With a very small sensor head and no requirement for external magnets or additional components, the KMI10/1 is small and rugged enough to be integrated into ball and roller bearings. Two KMI10/1 sensors operating together can be used to detect speed and direction, or to make incremental measurements.

The KMI10/1 is a two terminal device which operates at tooth frequencies from 0Hz to 25kHz, producing a pulsed current output at tooth frequency. Unlike inductive sensors, the magnitude of this pulsed current (7mA in the low state and 14mA in the high state) is frequency independent. Only one low value resistor and capacitor are required to turn the output current into a TTL-compatible signal that is suitable for direct input to microcontrollers or other control logic. The KM10/1 operates from a 7.5V to 20V supply and is fully protected against continuous short circuit output conditions.

For further information circle 275 on the reader service coupon or contact Philips Components, 34 Waterloo Road, North Ryde 2113; phone (02) 805 4455.




For further information circle 273 on the reader service coupon or contact IRH Components, 1-5 Carter Street, Lidcombe 2141; phone (02) 364 1766, fax 647 1545.

## Tiny 2-channel optocoupler

Telecommunications and industrial control systems have to physically accommodate up to 32 interfaces for information input and output. In order to meet such requirements, where space is at a premium, Siemens is now bringing out four two channel optocouplers.




Designated ILD 205 to 207 and ILD 213, these are supplied in an SO 8 package, thus incorporating two channels in a standard optocoupler package. The four types are different current transfer ratios, and can therefore provide a tailor-made solution for any application.

The technical data of their single channel brothers (IL 205 to IL256) have been retained; however, for isolation testing a reduction to 2.5kV peak was necessary due to the small size of the surface mountable package.

For further information circle 276 on the reader service coupon or contact Siemens Advanced Information Products, 544 Church Street, Richmond 3121; phone (03) 420 7345, fax 420 7275.

## PC audio codec

Analog Devices' AD1848K Soundport stereo codec is a pin-register and functionally-compatible upgrade of the AD1848J device already designed into the Microsoft Windows Sound System and the Compaq DESKPRO/i and DESKPRO/M personal computers. This device significantly improves on the audio performance of the original AD1848J, released in mid-1992.

The AD1848K is a complete digital 'audio system on a chip' providing analog/digital conversion, digital/analog conversion, gain control, and mixing of multiple analog and digital data streams. Requiring minimal support circuitry, it is a low cost, highly integrated solution, providing CD-quality audio on an ISA or EISA motherboard or add-in card. The 'K' version improves on its predecessor with greater dynamic range (85dB vs 80dB) and lower distortion (0.02% vs 0.05%). The new chip reduces the noise floor at low sampling frequencies to inaudible levels, and eliminates even the softest 'clicks' and 'pops'. It also doubles the gain and attenuation range of the stereo auxiliary inputs from 22.5dB to 46.5dB, making it easier for users to balance analog signal levels from multiple sources. The new, optional plastic thin quad flatpack has a minimum stack height of 1.6mm.

The AD1848K is fully supported by Microsoft Windows Sound System software (available for license to OEMs). which features voice annotation, speech recognition and synthesis, and digital audio capture/playback from a 386, 486, or Pentium compatible host. Windows 3.1 drivers are available from Analog Devices, as is a Verilog bus-functional model — both at no charge.

For further information circle 278 on the reader service coupon or contact NSD Australia, Locked Bag 9, Box Hill 3128; phone (03) 890 0970.

## Power factor controller

The Motorola MC33261 and 34261 are active power factor controllers, specifically designed for use as a preconverter in electronic ballast and in off-line power converter applications. These devices feature an internal start-up timer for stand alone applications, a one quadrant multiplier for near unity power factor, zero current detector to ensure critical conduction operation, transconductance error amplifier, quick start circuit for enhanced start-up, trimmed internal bandgap reference, current sensing comparator and a totem pole output suited for driving a power MOSFET.

Also included are protective features: an over-voltage comparator to eliminate runaway output voltage due to load removal; input under-voltage lockout, with 6V of hysteresis; cycle by cycle current limiting; multiplier output clamp that limits maximum peak switch current; an RS latch for single pulse metering; and a drive output high state clamp for MOSFET gate protection.

The MC34261 is rated for operation over the range of 0-85°C, the MC33261 for operation over the -40 to 105°C range. Both are available in either eight pin surface mount or DIP packages.

For further information circle 277 on the reader service coupon or contact Veltek, 18 Harker Street, Burwood 3125; phone (03) 808 7511. ❖

# NEW PRODUCTS

## Miniature precision resistor networks

Siegert Electronic has announced some new sizes of miniature precision resistor networks. For SMD circuits, small standard packages SOT23, SOT143, SO8, SO14 and SO16 are now available.

The resistance element consists of resistance alloys spluttered on passivated silicon substrates. For wire bonding applications, such as in hybrid circuits, the unpackaged resistance elements are available.

The resistance properties for these small packages are good. Tolerances of +/- 0.05% and TCRs of +/-5ppm/K are available. The stability of these components after storage for 1000 hours at 125°C is better than 0.02% absolute and 0.005 relative. Standard types and custom specified versions can be supplied with six to eight weeks lead time.

For further information circle 242 on the reader service coupon or contact Micromax, PO Box 1238, Wollongong 2500; phone (042) 266 777, fax 266 602.

## Multi-fluid dispenser

EFD has released its versatile Mark 4 automatic fluid dispenser which is designed for use where multiple assembly fluids, in a variety of size deposits, are required at one assembly station.

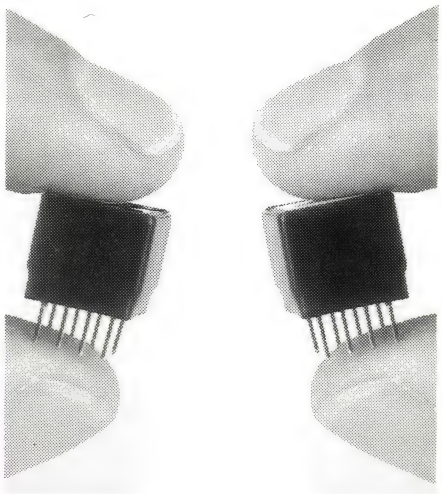
The Mark 4 is designed for use by one operator, and holds four industrial grade barrels and tips. Each of the barrel or tip reservoirs may dispense either the same or different fluids, according to the requirements. Each barrel and tip may be altered for different deposit requirements.

The unit offers four independently controlled air outputs for tinned or 'by-eye' dispensing. Pulse time is adjustable from 0.01 to 1.02 for automatic, repeat deposits. A selector switch allows the operator to choose which barrel reservoir receives the air pulse. Once selected, the operator initiates each deposit by pressing a foot pedal. Each barrel holder includes a solvent bottle to prevent fast-drying fluids from clogging the dispensing tip.



For further information circle 241 on the reader services coupon or contact Electronic Development Sales, PO Box 822, Lane Cove 2066; phone (02) 418 6999.

## Line isolation transformer



Selectronic Components has released the PI760, an ultra low cost version of the popular PI720 600 ohm/600 ohm line isolation transformer.

Claimed to be the smallest on the market, the PI760 measures 13 x 11.6 x 12mm and has Austel approval. It achieves a return loss greater than 20dB.

Manufactured in Australia by Selectronic Components, the PI720 and PI760 have been designed for use in the isolation of mains operated equipment in private and leased telephone lines.

For further information circle 243 on the reader service coupon or contact Selectronic Components, 25 Holloway Drive, Bayswater 3153; phone (03) 762 4822, fax 762 9646.


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CL-500 SP-DS3

READER INFO NO. 17

## Rugged solar module

BP Solar Australia has released a solar module specifically designed for the marine market. The new design incorporates a flush fitting, white, robust fibre-glass frame, and is finished with Gelcoat, in addition to the trusted reliability of a fully laminated toughened glass panel.

BP Solar designed the frame to have a low profile, and at the same time be compatible with many marine vessels, taking into account most aspects of being at sea. The rigidity is given by incorporating 'U' channels in the fibreglass, which also serve to aid drainage behind the module. Smooth contours eliminate sharp edges or ridges to trip on or stub a toe when the module is mounted on the deck. Knockouts are included in the frame to allow the user to conveniently position the cable as preferred.

Although the module was designed primarily to withstand the rigours of the marine environment, this makes it suitable also for rugged applications on dry land, where the module can be used for electric fences, portable lighting, portable refrigeration, camping, four wheel driving, caravanning and remote power systems where normal grid power is not accessible.

The new design is available in two sizes, one for trickle charging and the other for light loads.

For further information circle 244 on the reader service coupon or contact BP Solar Australia, PO Box 519, Brookvale 2100; phone (02) 938 5111, fax 939 1548.


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*– Jerry Pournelle, Ph.D., Byte Magazine*

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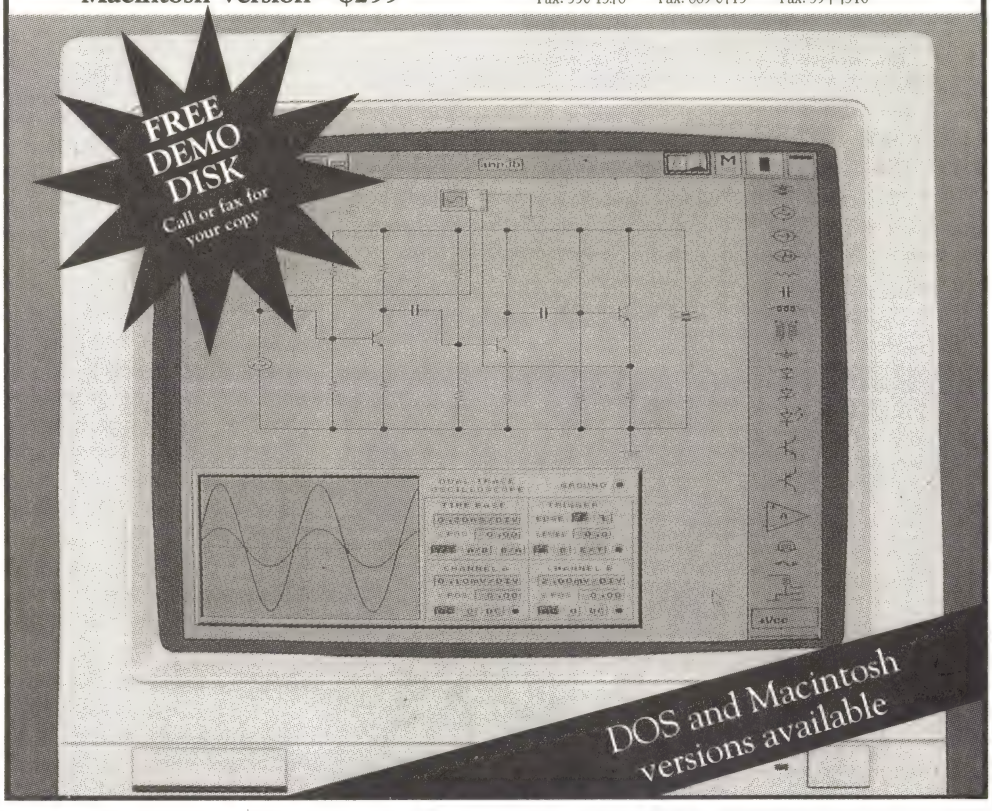
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READER INFO NO. 18


## Light sensors

The Skye range of radiation sensors are fully sealed, to operate in a wide range of extreme environmental conditions. They are suitable for use over the temperature range -35°C to 75°C, and can be used in wet foliage conditions, or even underwater to a depth of four metres.

The sensors have cosine corrected heads, allowing fully reproducible comparisons, and are designed and constructed for long life reliability. They can be used in conjunction with handheld measuring meters giving an instantaneous read-out, or in conjunction with data loggers for long term recording.

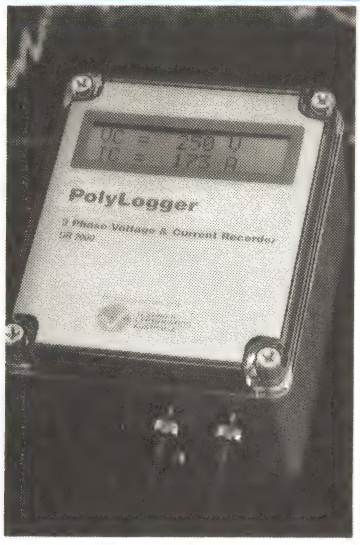
Some examples of available sensors include ultraviolet sensors, which have great importance in climatology and meteorology studies. There is also a quantum sensor, which measures quanta falling between 400 and 700nm — the waveband used for photosynthesis — where the number of quanta is related to sugar production. This sensor can be used in natural or artificial light and is used in studying the photosynthetic efficiencies of different light sources, design of greenhouse and environmental chamber lighting, and prediction of plant growth.

An energy sensor which measures energy in units of watts/m$^2$ falling in the photosynthetic waveband 400 - 700nm is also available. This is used in filtered or artificial lighting in greenhouses, etc, to compare photosynthetic energy with total solar radiation in ecosystem studies.

And finally there is a photometric light sensor, which measures light in the Photopic Curve — the spectral response curve of the human eye. Typical applications include building design, design of specific lighting for animal housing and psychological experiments.

For further information circle 250 on the reader service coupon or contact Agridry Rimik, 331 Taylor Street, Toowoomba 4350; phone (076) 33 2299, fax 33 2084.

# NEW PRODUCTS




## Power line logger

A new improved version of Testing and Certification Australia's Polylogger is now available through CHK Engineering.

The unit provides three phase voltage and current logging with detailed computer analysis. Since the instrument was introduced in 1991, it has become widely used throughout the power industry.

Some of the more important improvements now incorporated into Polylogger are: four-fold increase in memory — 128KB permits 72 day recording of five minute logs; capability of being connected to modem for remote retrieval of data; new impact resistant and weather proof CTs designed for the harshest environment; and more flexible software, including user-selectable sampling and averaging, and programmable start/stop times.

Polylogger is complemented by a related instrument, the Maxiamp, which is a medium demand indicator capable of showing the time of the maximum on each phase and the phase balance.

For further information circle 246 on the reader service coupon or contact CHK Engineering, 31 Hope Street, Ermington 2115; phone (02) 874 3899, fax 874 4546





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READER INFO NO. 19

## Improved RF signal generator

Marconi Instruments has announced that key specifications of its popular model 2022D RF signal generator have been improved. The 2022D covers from 10kHz to 1GHz, with 10Hz resolution and +13dBm output. Internal modulation oscillators of 400Hz, 1kHz and 3kHz are available, and FM modulation to 999kHz can be achieved.

The generator incorporates a high quality oven controlled oscillator, which now offers a stability of better than 0.05ppm from 0 to 40°C. This performance is necessary to allow testing of pagers and cordless telephones. The phase noise is now specified as less than 130dBc/Hz at 150MHz carrier and 20kHz offset.

The 2022D now also complies with the stringent EEC directives for EMC, and offers GPIB control as an option. The unit is also currently being offered at a substantially reduced price.

For further information circle 245 on the reader service coupon or contact Marconi Instruments, 1/38 South Street, Rydalmere 2116; phone (02) 638 0800, fax 638 3131.

## Simple to use time domain reflectometer

Tektronix has introduced the TS100 TelScout time domain reflectometer (TDR) for testing copper cable on telephone local loop applications. The product combines ease of use, high performance, rugged packaging and competitive price with a feature set optimised for telephony. A high speed, 32-bit microprocessor makes the automatic operation possible, though, for experienced technicians who prefer it, manual operation is also available. Up to 20 sample waveforms can be stored in memory for comparison and reference.

Tektronix designed the TelScout for telephone local loop maintenance. More than 90% of telephone company cabling is found in the local loop, and more than 95% of cable maintenance costs are spent on it. Key costs for cable maintenance are training and field labour. Despite the growing use of optical fibre in telecommunications, copper pair remains the dominant media, and is expected to remain so well into the next decade.

TelScout features both a shorter and longer pulse width than competitive units. The shorter pulse width, less than 20ns, offers better close-in performance and better two-fault resolution. The longer pulse width, up to 3ms, offers better performance on small diameter wire and at long ranges.

The unit has a measured distance accuracy within +/-0.6m from 0 to 600m. And to eliminate high frequency noise and produce a cleaner waveform, it features waveform smoothing based on a 150kHz high-pass filter and OTDR-style averaging.

For further information circle 252 on the reader service coupon or contact Tektronix Australia, 80 Waterloo Road, North Ryde 2113; phone (02) 888 7066, fax 888 0125.



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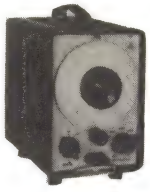
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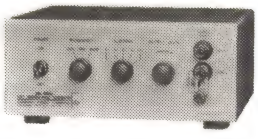
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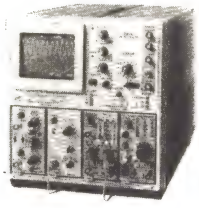
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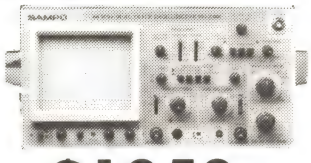
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| HP 312A | Selective Voltmeter to 18MHz | $250 | HP 8007B | Pulse Generator to 100MHz | $850 | 0,1,2,4,6,7 | | 3pcs/$4.50 |
| HP 410B | VTVM 20Hz-700MHz AC/DC ohms | $145 | HP 8405A | Vector Voltmeter to 1000MHz | $1250 | 3,5,8,9,10 | | 3pcs/$5 |
| HP 419A | DC Null Voltmeter | $275 | HP 8600/8601 | | | WHITWORTH THREAD TAPS | | |
| HP 606A | RF Gen 50KHz-65MHz 50ohms | $375 | 110 MHz RF Sweep Marker System | | $1475 | 3/16" Whitworth Sets | | 3pcs/$3 |
| HP 778D | Dual Dir.Coupler 0.01-2GHz | $1500 | HP 8640B | Sig Gen 100KHz-512MHz AM/FM | $3750 | 1/2" Whitworth Sets | | 3pcs/$5 |
| HP 1640B | Serial Data Analyser | $650 | HP 8731B | PIN Modulator 0.8/2.4GHz | $285 | 1/8" Whitworth Sets | | 3pcs/$3 |
| HP 1645A | Data Error Analyser | $70 | HP 8732A | PIN Modulator 1.8/4.5GHz | $190 | 9/16" Whitworth Sets | | 3pcs/$3 |
| HP 3320B | Frequency Synth to 13MHz | $550 | HP 8733A | PIN Modulator 3.7/8.3GHz | $160 | 3/4" Whitworth Plug HSS | | $2 |
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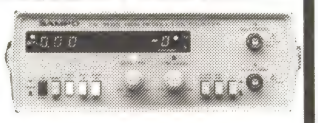
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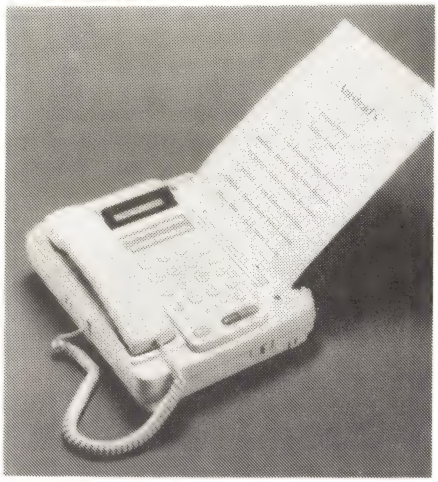
## Energizers for cellular phones

Building on its recent success in the rechargeable camera battery market, Eveready has expanded its Energizer battery range into the steadily growing mobile communications market.

The new Energizer rechargeable cellular telephone battery range has nine models, designed to fit all major cellular telephones available in Australia. These include phone brands such as Motorola, NEC, Mitsubishi, Audivox and Uniden.

For further information circle 270 on the reader service coupon or contact Eveready Australia, 30 Harcourt Parade, Rosebery 2018; phone (02) 667 0444.

## Phone/fax



Amstrad Australia has released the new Amstrad FX7000 Phone/Fax, an exceptionally compact combination of a fully featured, hands-free telephone and a facsimile machine in a unit barely larger than a conventional telephone handset. The Phone/Fax looks and works just like a phone. It is only 100 x 230 x 270mm, taking up less space on a desk — or kitchen or coffee table — than a sheet of A4 paper, and weighs only 2.5kg.

The Phone/Fax uses a single telephone line, automatically switching to fax mode when a fax is being received. Its compact size is achieved by placing the fax components 'sideways', with faxes being sent and received from the right hand side of the handset unit. Despite its tiny size, the Phone/Fax uses conventional 15m fax paper rolls, each sufficient for up to 50 A4 pages of incoming faxes. It operates as a CCITT G3 facsimile.

The phone features of the unit include: full hands-free operation, including on-hook dialling, using a built-in speakerphone; PABX/PBX compatibility; and ten one touch dialling keys, with memory storage of up to 20 phone or fax numbers of up to 24 digits each. The FX7000 has a recommended retail price of $699.

For further information circle 269 on the reader service coupon or contact Amstrad Australia, the Lake Business Park, Lord Street, Botany 2019; phone (02) 316 5289.

## 100MHz real-time DSO

Tektronix Australia has introduced its low cost 100MHz digital real-time oscilloscope, which uses 'oversampling' to boost the single-shot bandwidth to the full analog bandwidth of the scope. The latest addition to the popular TDS (Tektronix Digital Scopes) family, the TDS-320 is designed primarily for the service market, but is also suitable for education and design.

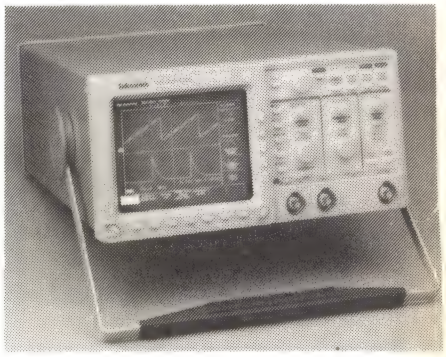
The input circuitry on each of the TDS-320's two channels digitise at the rapid rate of 500 million samples per second (500MSps) — claimed to be twice the rate of any 100MHz DSO (digital sampling oscilloscope) on the market today.

This oversampling capability, made possible by a mixed signal technology, eliminates the potential for aliasing of the input signal. The TDS-320 gathers two and half times the number of samples needed to faithfully reconstruct the signal. This capability enables an honest reproduction of the waveform up to the full bandwidth of the scope, even for single-shot waveforms.

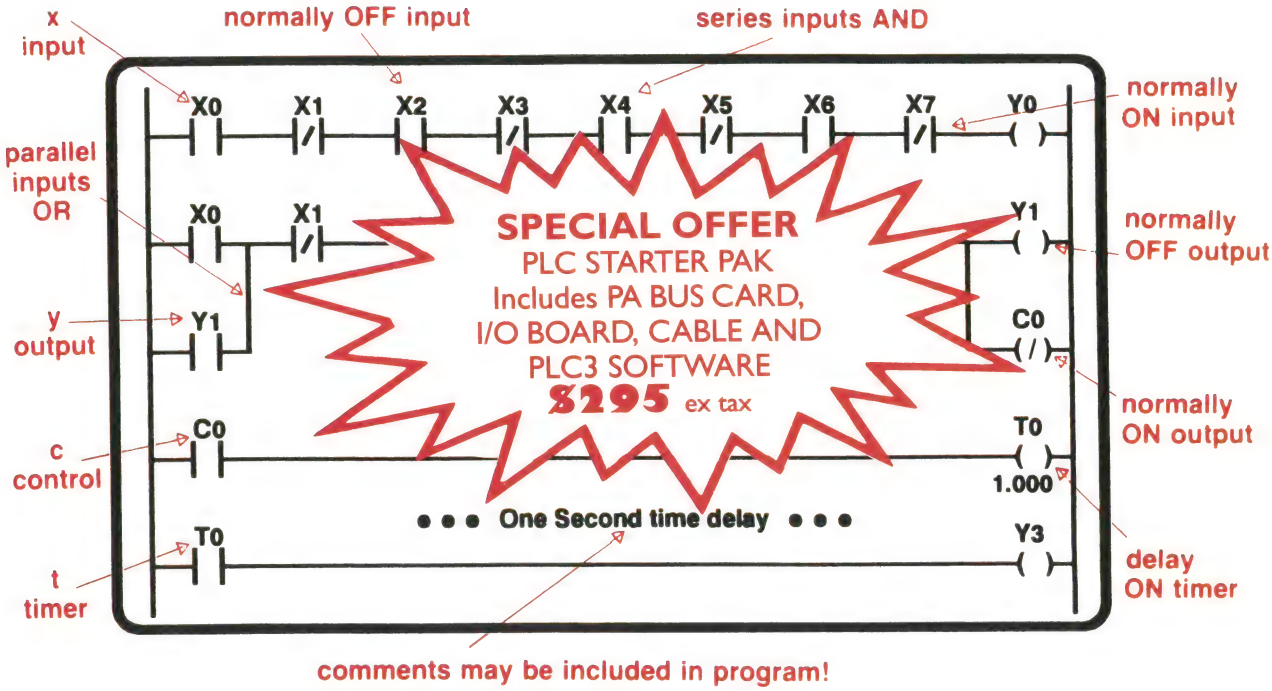
When the scope displays waveforms at slower sweep speeds, the peak detect mode captures high frequency information buried in lower frequencies.

In addition to over 20 waveform measurements, the TDS-320 offers four acquisition modes — sample, peak detect, envelope and average. With edge and basic video triggering, the TDS-320 can capture the waveforms the service technician or digital designer needs to see. The unit also offers the viewer the choice of dot or vectored display.

For further information circle 268 on the reader service coupon or contact Tektronix Australia, 80 Waterloo Road, North Ryde 2113; phone (02) 888 7066, fax 888 0125. ❖



# DISCOVER PROGRAMMABLE CONTROL!




## EXTENDED VERSION OUT NOW! CONTROLS 128 INPUTS AND 120 OUTPUTS

**Programmable control from your IBM-PC or compatible? Imagine being able to write and test logic control programs as easily as switching on a light bulb. Procon Technology has done just that with its PLC version 2.0 software. This program provides a relay ladder logic style of programming – shown above – that's easy to learn and easy to understand. What's more, it's the style of language used in multitudes of industrial controllers worldwide!**

Together with our I/O board, this software turns your PC at home or in the office, school or laboratory into a powerful, yet flexible, programmable controller. Your computer becomes the centre of the control system – it monitors the inputs, scans and solves logic and performs other special functions to determine and set the output conditions.

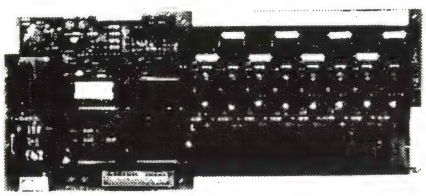
The PLC editor facilitates the entering, deleting and altering of comments and ladders off-line or on-line. On-line editing allows modifications to be made to the program without disruption to the control operations. E.g. You could adjust a time delay, correct a logic error or add more functions whilst the program continues to run – uninterrupted.

Unlike other programming languages, PLC version 3.0 also provides real-time indication of logic conditions continuously on the screen – again with no interruption to program execution. Each closed contact or activated output is highlighted on the screen and each timer's remaining duration is displayed. Monitoring and debugging control programs couldn't be easier!

Once a program has been debugged, it can then be loaded for execution in background whilst the computer is used for other things (such as word-processing or spreadsheets).

With additional I/O boards, numerous PLC application programs may run in the background providing an economical means of controlling many different items of equipment.

Applications include: Home or business automation and security systems, model control, laboratory automation and educational and training needs.



The NR-12VAC I/O board is mounted externally (up to 30 metres from the computer) and provides 8 isolated 12 Volt AC or DC inputs and 8 independent relay outputs. LED indication is provided on all inputs and outputs and all connections are via screw terminals. The system is capable of expanding to 240 I/O from one PA-BUS card inserted into a single card slot in the computer.

Other I/O options are available, including an industrial version. The I/O boards may also be controlled from other high-level languages.

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READER INFO NO. 24

## *Handy add-on product for PC's:*

# 486 COOLER FROM JAYCAR

Recently small fan-assisted 'active coolers' have appeared on the market, designed to reduce the temperature rise of large VLSI devices like the 80486 CPU. Jaycar Electronics has just added one of these to its product range, and sent us a sample to check out on your behalf. Here's what we found...

**by JIM ROWE**

I was particularly interested in trying out one of these new fan-assisted cooling units, because it's becoming obvious that they're going to be used more and more in the future.

In the 'old days' — well, not all that long ago, really — when a transistor or other semiconductor device ran too hot, we simply attached a heatsink to it (or vice-versa).

The heatsink improves the dissipation of heat, via radiation and air convection, thus lowering the 'thermal resistance' between the device's internal chip and the surrounding ambient. And as a result, the temperature of the device falls for a given amount of power being dissipated.

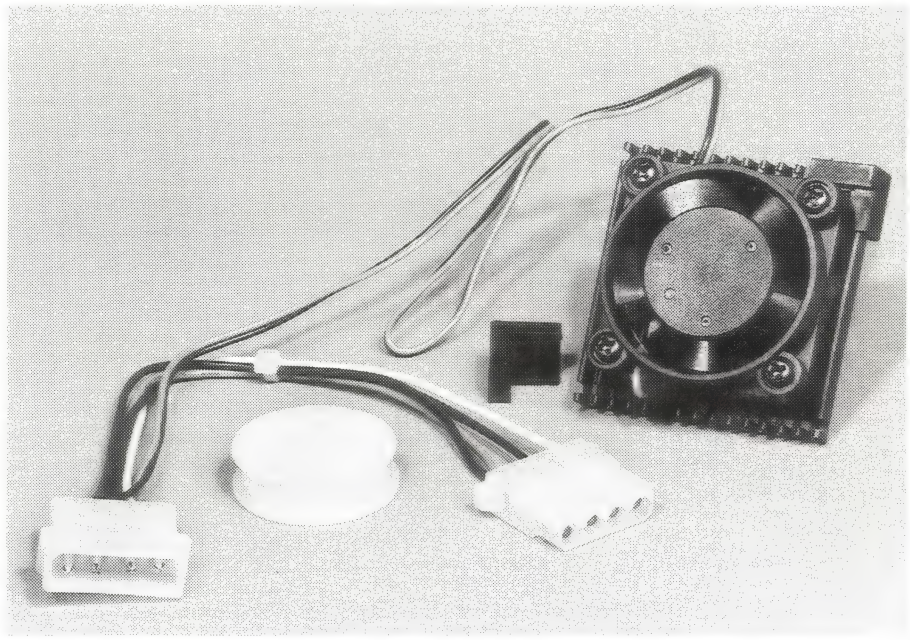
This kind of 'passive assistance' has been fine in the past, and of course it's still perfectly OK as a technique for cooling many semiconductor devices — especially discretes and low-level IC's. However there are three trends in modern electronics which have stretched this approach to its limits:

- The inexorable move towards more and more complex IC's, which pack ever-increasing numbers of active devices into a single package;
- The equally inexorable move towards faster and faster device and equipment operation; and
- The trend towards smaller and smaller equipment, which involves packing all of the devices more and more densely inside.

These trends are all inter-related, of course. But the bottom line is that the first two both tend to cause an increase in the amount of heat dissipated in the device packages, while the third is making it harder and harder to get that heat *out*, using passive heatsinks. By definition, the more heat it has to dissipate, the larger a passive heatsink needs to be...

Modern VLSI microprocessor chips are an excellent example of this developing problem. The Intel 80486 chip now used in many of the latest high-end personal computers contains over a million transistors, and when the DX2 version is running at 66MHz, its compact PGA (pin-grid array) package can be dissipating up to six watts. The newly-released Pentium chip has 3.1 million transistors and apparently dissipates over twice this figure — about 13 watts!

Since the ceramic PGA package used for these devices has a thermal resistance to ambient of around 12°C/W, and a top-surface area measuring only about 50mm square, it's becoming increasingly harder to keep them cool using passive heatsinks. In a nutshell that's why fan-assisted and other 'active' cooling devices are becoming necessary — especially in countries like Australia, where the ambient temperature can rise to 40°C and above.



### Jaycar's cooler

The active cooler now being sold by Jaycar is designed specifically for the PGA package used for '486 CPU and similar VLSI devices. With a basic area the same as the '486 package, it consists of a square of aluminium extrusion which is flat on the underside for contact with the top of the PGA package, and finned on the top surface.

Attached via small spacers above the finned surface is a tiny 'muffin' fan, arranged to blow a steady stream of air downwards and past the fins. The whole assembly clips to the top of the PGA package with plastic clips on diagonal corners, after the package surface is prepared by smearing it with a thin layer of thermally conductive grease (supplied in a small container).

The fan motor runs on low voltage DC, and is provided with a small lead

and 'piggyback' connector assembly, so that it can tap into the power for one of your disk drives. It draws very low current (a few tens of milliamps), so the computer's power supply barely notices the difference. The five-bladed fan is also very quiet in operation, and effectively adds nothing to the computer's noise emission.

So far, so good. But how does it all work out in practice — and does it provide a worthwhile degree of cooling?

## What we found

It was fairly easy to fit the cooler to the '486 chip in our test computer. The messiest bit was smearing a thin layer of thermal grease evenly over the top of the chip — it's pretty viscous stuff, and doesn't spread easily.

Fitting the second securing clip proved a little tricky, as both clips have a small ridge, both of which have to tuck between the bottom of the PGA package and its socket, before the second one will go fully into the cooler and allow its plastic 'locking plug' to click into place. Still, it was all achieved in a couple of minutes, and connecting the power lead into one of the disk drive leads was done very quickly.

Before the cooler was fitted, we had left the computer running for an hour or so and then used a thermocouple probe to measure the temperature of the '486 package — at both the centre of the top surface, immediately above the chip, and along one edge (because we knew that would be the only place we'd be able to measure the temperature after the cooler was fitted).

The chip runs in this machine at 33MHz, and with an autumn ambient temperature of around 20°C, it turned out to be running at 65°C at the top centre, and 45°C at the edge.

Fairly obviously the ceramic package has a significant thermal resistance from the chip to the outside edges, and this plus the radiation and convection of the package itself would account for the 20° difference.

When the cooler had been fitted and had been running for a fair while, we measured an edge temperature of 31°C — a drop of 14°.

Does this mean that the 'top centre' temperature would also have dropped by only 14°C? No, we'd expect it to have fallen by considerably more than this, because the overall thermal resistance between the centre and the edges would be significantly lower with the cooler attached.

The aluminium extrusion is about 3mm thick, and is thermally bonded to the PGA package over its full top area — quite apart from the cooling effect of the fan's air flow, which hits the top centre first and then moves outward. The combined effect of these factors should result in a far smaller temperature differential between centre and edge; we'd guess closer to 8°C than the original 20° figure.

So we'd estimate that the cooler was quite possibly lowering the temperature of the '486 chip itself to about 39-40°C. This is a drop of around 25°, which is very worthwhile indeed. If you were using the computer on a summer's day, with an ambient nearer 30°C, this kind of cooling would certainly result in the CPU running at a much safer temperature.

In short, then, our reaction is that this cooler provides a very significant degree of cooling, and should extend the life and enhance the reliability of '486 and similar CPU chips quite significantly. For the quoted price of $39.95 it seems a jolly good investment, in fact.

Jaycar sells the cooler as catalog number XC-5040, and it's available at any of their stores. My thanks to Jaycar for the opportunity to try one out. ❖


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READER INFO NO. 26

# Silicon Valley NEWSLETTER



## Consortia agree on US HDTV standard

In a move that will clear the way for the rapid adoption of a US HDTV standard, the three remaining consortia that submitted bids for an all-digital HDTV standard, announced they have agreed on a single common standard which incorporates the best features of each of the three proposals — thus eliminating most of the shortcomings each of them incorporated. The deal should enable HDTV to become a reality in the US as early as 1995.

Meanwhile, the US computer industry is getting into the HDTV standard act by asking the FDC to ensure that the HDTV standard also meets the needs of the computer industry.

The agreement comes after three months of often-heated debate among representatives from the three rival groups, which earlier this year were ordered by the Federal Trade Commission to cooperate on the development of a single standard. Each of their individual proposals was deemed inadequate in one way or another.

The three groups competing for the landmark standard were General Instruments/MIT, Zenith/AT&T, and a group led by NEC, Philips Electronics, Thomson, and Compression Labs.

According to Joseph Donahue, a senior vice president for Thomson who was involved in the negotiations, discussions during the past three months often got so heated they took on 'a religious fervour.'

But in the end, he said, all agreed that the benefits of cooperation on a single standard outweighed all other concerns.

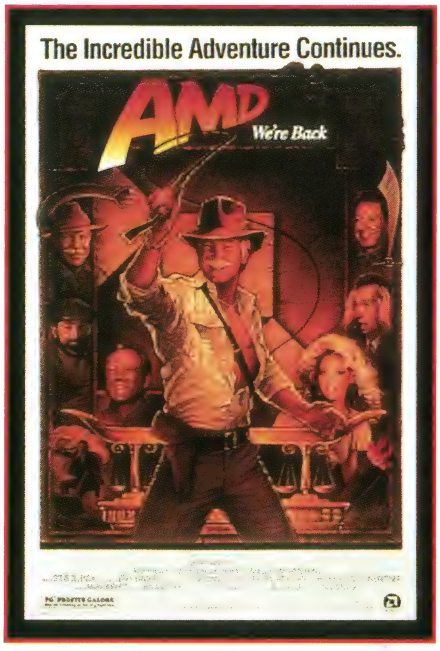
The FCC and the Clinton Administration are eager to get the HDTV program under way, as this could revive the US television industry and literally create tens of thousands of new jobs in manufacturing.

Meanwhile, Apple Computer chairman John Sculley announced he has sent the FCC a letter on behalf of the Computer Systems Policy Project, which has the chief executives of America's 11 largest computer makers as its sole members. In the letter, Sculley pleads with the FCC to ensure that whatever HDTV standard is adopted it should be compatible with the needs of the computer industry. Sculley said the computer industry would favour an HDTV standard based on a 'progressive scanning' system, which would eliminate any kind of flickering and other typical disruptions from the TV or computer screen.

Apparently, the computer industry has a strong ally in the FCC, in ensuring the HDTV standard meets computer industry requirements for interoperability between TV, cable and computer networks.

"We're not talking about a prettier picture. We are looking for interoperability, not just between broadcasting and cable, but also with computers. This has applications in factory automation, medical imaging, and even defence," said Richard Wiley, chairman of the FCC's HDTV advisory committee.

Members of the new HDTV alliance said their test version of the new standard could be available in as little as nine months. Some of its features include a capability to transmit images in a number of different formats suitable for different users (TV, computers, etc), and in different levels of picture resolution.




***Advanced Micro Devices has a reputation around Silicon Valley for its creative approach to marketing. The latest example is this new 'Indiana Jones' type poster, with AMD president Jerry Sanders as the hero and Intel's chief Andy Grove shown as the anguished villain. Officially, the poster was meant only as an inhouse morale booster — but unofficially AMD is having trouble keeping up with demand for it from outside fans.***

## AT&T acquires PDA maker EO

As part of an effort to become a leader in the market for PDA's and similar advanced handheld integrated computer and communications devices, industry giant AT&T has increased its stake in tiny EO of Mountain View, from 20% to 51%. AT&T also announced plans to use its sales force of more than 10,000 people to aggressively market EO's Personal Communicator devices to corporate and other customers.

AT&T will market the EO devices, which sell for between US$2000 and $3300 and combine personal computer features with fax, e-mail, and cellular telephone capabilities, under its own name.

"For us to piggyback on AT&T gives us great leverage. It makes a statement that AT&T is behind us and is fully committed to the EO personal communicator architecture," said EO president Alain Rossman. At AT&T, communications and computer products chief Robert Kawner said that EO communicators will someday be as commonplace as the telephone. "EO has cracked the code on the tight integration of communications and computing, and we see the EO architecture all the way from the kitchen countertop to intelligent PBX exchanges."

EO was founded just two years ago with large start-up funds provided by AT&T, as well as Matsushita and Marubeni of Japan. For EO the new AT&T deal comes at a time when the company is facing stiff new competition from both Apple Computer's Newton and the 'Zoomer' which is being introduced by Tandy. Also Hewlett-Packard is about to launch its OmniBook. Industry analysts said that without AT&T's help, EO may

have fallen by the wayside in the face of such formidable competitors.

## CES focus on computer technology

In one of the clearest signs to date that computer and consumer electronics technologies and markets are merging, the spotlight at the latest Summer Consumer Electronics Show in Chicago was on a new generation of handheld computer and communications devices.

Among them, Tandy introduced its new 'Zoomer' personal digital assistant. The PDA will sell for about US$600, and allows users to scribble information onto its LCD display. The system will keep track of phone numbers, addresses, personal calendars, and personal finances, among other applications.

Meanwhile 3DO of San Mateo demonstrated a prototype of a US$700 'interactive multiplayer', an advanced new video game console which is expected to be in stores by Christmas from such companies as Panasonic, whose parent, Matsushita owns part of 3DO along with Time-Warner.

Apple Computer used the CES show to promote its Newton, and EO continued to impress show-goers with its personal communicator. The attention focused on computer-type devices is unique in the history of the CES, which has traditionally focused on new televisions, VCR's, camcorders, and other traditional consumer electronics devices.

"Personal computers have become packaged goods. It is not a technology anymore," said consumer electronics industry analyst Seymour Merrin.

## Tandy sells PC business to AST

Just days before it jumped into the personal digital assistant market with the 'Zoomer' PDA, Tandy announced it was getting out of the personal computer business and selling the division to AST Research of Irvine in Southern California.

Included in the US$175 million deal is Tandy's 'Grid Systems' subsidiary in Fremont, which makes pen-based computers. Also included are several of Tandy's state of the art PC manufacturing facilities in the United States and Europe.

The move came as a surprise to many computer industry analysts and observers. Tandy has been a significant player in the personal computer market since it launched the TRS-80 series machines in 1977.

Earlier last year, Tandy announced it would turn its manufacturing operations into an independent new company. But AST ended up presenting the company with a more lucrative alternative to that plan.

For AST, the deal with Tandy has several key advantages. For one, the company is picking up Grid's advanced pen-based computer technology — a key future market in which AST has no presence. In addition, Tandy's considerable sales will give AST a big boost in overall PC market share. With Tandy's sales, AST will become the fourth largest PC vendor after IBM, Apple, and Compaq. That is important, since the PC market is rapidly becoming a market in which the economies of scale determine the success or failure of companies.

## 'Ghostbuster' chip cleans up TV picture

Zoran, a Santa Clara-based chip start-up, has developed a 'ghostbuster' chip that eliminates ghost images from television pictures. The chip will add about US$100 to the cost of a television. Existing televisions can attach a special US$300 adaptor, incorporating the chip, to their set.

The microprocessor chip is based on the so-called 'Ghost Canceller Reference' standard which was recently approved by the Federal Communications Commission. The chip works in conjunction with a special signal that is broadcast alongside the regular TV signal by the broadcaster. The signal is transmitted 30 times a second. The Zoran chip performs some 18 billion calculations per second, measuring distortion in the signal and using that measurement to cancel out the ghost images.

Already some 80 television stations, including many top broadcasters in major metropolitan areas across the US have jumped on the Zoran bandwagon and have agreed to start transmitting the special signal.

The chip is also useful for TV's hooked up to cable TV, as cable broadcasters often retransmit live television images which could include ghost images. And some ghosting also occurs naturally in cable networks.

## H-P to launch new portable computer

Hewlett-Packard is making a bold effort to become a leader in the handheld computer market, with the so-called 'Omnibook' — a machine that will cost around US$2000 and incorporate many advanced communications features to keep mobile workers in touch with larger computer systems at the office.

The three-pound Omnibook was developed in cooperation with Microsoft. The machine incorporates a version of Windows etched onto a silicon chip.

H-P officials said the Omnibook was designed to avoid some of the flaws in today's notebook computers and new personal digital assistants. H-P believes that neither notebooks that try to mimic a PC or PDA's, which have no keyboard, are adequate for the needs of most travelling workers and executives.

The Omnibook is designed to take advantage of certain PDA features, such as remote communications, while letting users use familiar software programs.

## Foreign chip share in Japan declines

After increasing dramatically during the last quarter of 1992, the foreign share of the Japanese chip market declined during the first three months of this year, prompting new concerns about Japan's sincerity in meeting the terms of the US-Japanese Chip Trade Agreement.

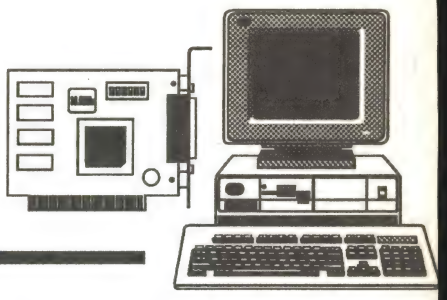
According to the Semiconductor Industry Association in San Jose, the latest market figures compiled by the US Commerce Department and Japan's Ministry of International Trade & Industry, show the foreign share of Japan semiconductor declined from 20.2% in the last quarter of '92 to 19.6%.

The decline comes after a stunning 4.6% increase from the third to fourth quarter of last year. That increase enabled Japan to meet the 20% marketshare target that was mandated under the chip trade agreement which expired at the end of 1992. The increase avoided a major escalation in trade tensions between the US and Japan.

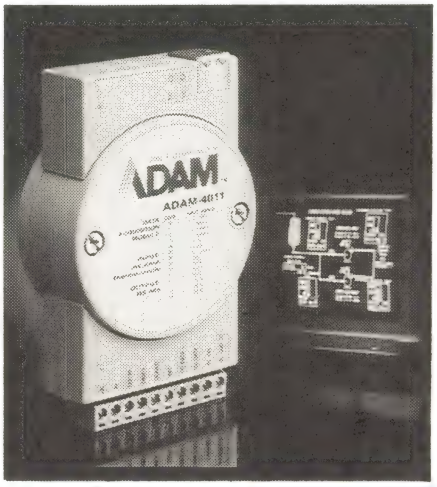
At the SIA president Andy Procassini said the latest figures from Japan are cause for concern. "Any decline in foreign marketshare is cause for concern. However, having just returned from productive meetings with electronics company executives in Japan, we are encouraged by their commitment to continue to work with the US industry to achieve the goals of the semiconductor trade pact."

While the SIA appeared willing to give Japan the benefit of the doubt that the decline will be a one quarter blip in a continuous positive trend, Procassini added that the SIA will 'strongly urge' US Trade Representative Mickey Kantor to ensure that the foreign marketshare in Japan will average at least 20% for all of 1993. "Steady improvement in US marketshare is certainly warranted, given the competitiveness of the American industry in all markets outside Japan." ❖

# Computer News and New Products



## Compact DAQ interfaces




Adam modules are compact, intelligent sensor-to-computer interfaces. Supervised by a host computer over an RS-485 network, the modules with built-in microprocessors are able to monitor and control processors independently.

Six types of modules are available: analog input modules, analog output modules, digital I/O modules, relay modules, an RS-485 repeater module, and an RS-232/RS-485 isolated converter module.

Together they provide the following functions: 16-bit A/D and D/A conversion, RS-485 communication, isolation, ranging signal conditioning, data comparison, alarm functions and event counting.

The modules communicate with the host computer via a two-wire RS-485 multidrop network, using an ASCII command/response protocol. Every Adam RS-485 repeater allows the addition of 16 modules to the network while extending it another 1200m. Up to 16 repeaters can be daisy chained to connect a total of 256 Adam modules.

The modules are 100% field-configurable by software. Calibration, configuration and settings for various sensor and I/O ranges are all done remotely from the host computer. All modules enclose

## Video workshop

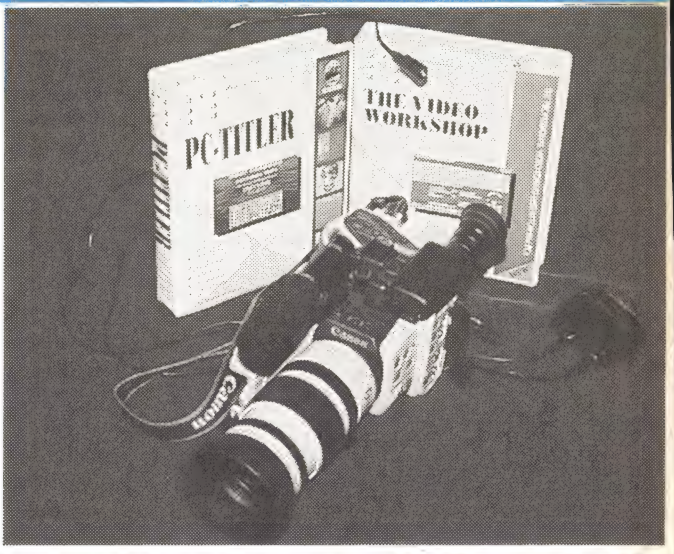
Maze Technologies of London has produced a fully functional video editing system called Video Workshop, controlled by a PC. This PC-based system can be used with either professional video equipment or domestic video cassette recorders. Video Workshop controls up to four inputs (these can be either players or cameras) and one output.

Using simple key strokes you can automatically mark the 'in' and 'out' points from each tape. These scenes can then be moved, inserted and deleted to make the final cut. The whole production can be previewed and the assembly points altered as required. Edit lists are easily compiled on screen and can be saved or printed out for later reference.

Video Workshop can also generate special effects such as slow motion, accelerated playback and time lapse. It also interfaces with PC-Titler (also by Maze Technology), which is a broadcast quality video titling and overlay package. You simply type the titles into the script and Video Workshop automatically calls them up as they are required in the final edit.

The program supports most video checks through either LANC (Sony, Canon & others) or five pin (Panasonic) control interaces, and all domestic video recorders through the infra-red interface. Time coding is also available using the Sony RCTC timecode system. However, it can achieve up to three frame accuracy on most modern VCRs.

The Professional version is an internal card, supporting up to




four input devices and one output, with full support for video titling and overlay. The Life version ($912, ex tax) is an external adaptor which plugs into the parallel port and can have a maximum of two inputs and one infra-red output.

For further information circle 180 on the reader information coupon or contact Lako Vision, 1/45 Wellington Street, Windsor 3181; phone (03) 525 2788.

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their circuits within hardened plastic shells, and can be placed near the process to be monitored and/or controlled. They are designed to accommodate unregulated power supplies, commonly used in the industry, of +10 to +30V DC.

For further information circle 177 on the reader service coupon or contact Priority Electronics, 5/23 Melrose Street, Sandringham 3191; phone (03) 521 0266, fax 521 0356.

## VGA for miniature PCs

DGE Systems has released the GCAT-4000, a VGA/LCD controller to complement the range of add-on cards now available for the miniature GCAT series of embedded PCs.

The GCAT system consists of a processor card not much larger than a credit card with onboard PCMCIA connector, ROMdisk capability, CGA/LCD video, RS-232 port, and up to 1MB RAM. A peripheral daughter board provides an additional RS-232/485 port, floppy and 8-bit IDE controller, and an 8-channel 12-bit A/D converter.

The new controller card gives users of the GCAT access to VGA LCD, colour LCD, Plasma, or EL, while still being able to use a high performance CRT. As standard, the board is fitted with 512KB of video memory, expandable up to 1MB, and can give resolutions of up to 1024 x 768 x 16 colours, or 800 x 600 x 256 colours. An additional keypad interface is included on the GCAT-4000, allowing a standard 6 x 4 keypad to be used in parallel with, or instead of, a full keyboard. A depopulated version is available for users requiring only the keyboard interface.

For more information circle 178 on the reader service coupon or contact DGE Systems, PO Box 111, Hamilton 2303; phone (049) 61 3311, fax 69 5067.

## A3 flatbed scanner

The new Primascan flat bed scanner manufactured by Primagraphics of the UK, provides exceptionally fast input of monochrome or full colour pictures. High quality digitised images can be produced at up to 5000 x 7000 pixels resolution (equivalent to 425dpi for an A3 original). The total scan time is 10s for the monochrome scanner and 30s for the colour scanner. A model offering 500dpi resolution, over an area of 14" x 10", is also available.

The Scanner incorporates the latest CCD linear arrays to generate 8-bit greyscale (265 levels) or 24-bit full colour (16 million shades) in a single pass.

Hardware compensation circuits automatically remove the effects of variations in the sensitivity of the individual cells in the array to ensure that no spurious stripes are present in the image. Built in firmware functions include windowing, thresholding, reflection and reverse scanning.

An optional JPEG image compression module may be incorporated in the scanner to reduce the volume of data without affecting the scanning speed. Compression ratios of 10:1 for monochrome images and 25:1 for colour images are achievable with minimal degradation.

The Scanner is connected via a SCSI2 interface which provides up to 4.5MB per second transfer rate in synchronous or asynchronous modes. Software is available for IBM PCs, various Unix Workstations and Macintosh computers.

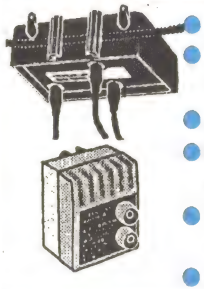
For further information circle 179 on the reader service coupon or contact The Dindima Group, PO Box 106, Vermont 3133; phone (03) 873 4455, fax 873 4749.



## 'Oversized' A3 printer

LaserMaster and Mitsui Computer have released details of their first 'oversized' laser typesetting unit, the Unity 1200XL-O, which is specifically designed to print a true A3 size page, or two A4 size images, plus crop marks, printer's registra-


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tion marks and bleed areas. This larger area allows professional desktop publishing users to send 1200dpi final artwork and typesetting to their printers with all the correct alignment marks and image bleeds, so it can go direct to camera. The maximum printing area is 332 x 482mm (13.1" x 19").

As with the other LaserMaster typesetters in the Unity range, the 1200XL-O uses multi-platform technology which can instantly connect it to Apple Macintosh, DOS-PCs, OS2, Unix, Sun and just about any other form of computer hardware operating on networks or standalone systems.

It comes complete with LocalTalk, serial, parallel connectors and an inbuilt Ethernet adaptor. LaserMaster's SmartSense interpreter automatically switches between PostScript and PCL so that output from various applications is no problem at all, no matter what combination of computers is used.

The LaserMaster Unity 1200XL-O has an onboard 80MB hard drive which holds 235 factory-installed Type 1 fonts and 32MB of RAM to handle the increased print area. The unit retails for $18,660 (ex-tax), which includes all connectors, adaptors, paper handling equipment, software and 235 Type 1 fonts.

For further information circle 174 on the reader service coupon or contact Mitsui Computer, PO Box 738, Hawthorn 3122; phone (03) 882 8866, fax 882 7073.

## 'No frills' industrial control modem

Banksia Technology has released a low cost, high performance industrial control modem, which really is stripped down to the 'bare essentials'. The single PC board modem was developed to solve what has been a problem for many manufacturers. They didn't want the usual modem-in-a-case — they wanted one to mount inside other equipment. It had to be small, it had to be low cost, and it had to offer performance at least as good as 'standard' modems.

Banksia's response was a PCB measuring just 15 x 20 x 70mm, without a case, instruction manual or power supply.

The modem, which was designed, engineered and manufactured in Australia using the latest surface mount technology, is a fully featured synchronous and asynchronous unit offering up to 2400bps, full duplex data communications. With V.42 error correction and V.42bis data compression built in, the modem offers effective throughput of up to 9600bps, and is suitable for both PSTN and leased line applications.

For further information circle 166 on the reader service coupon or contact Banksia Technology, 83 Longueville Road, Lane Cove 2066; phone (02) 418 6033, fax 428 5460.

## New NEC FG monitors

NEC Home Electronics Australia has released two additions to its FG monitor range, the 3FGe and 5FGe. The new monitors are designed to provide optimal display performance in the mainstream GUI (Graphical User Interface) market, which includes the popular Microsoft Windows operating system.

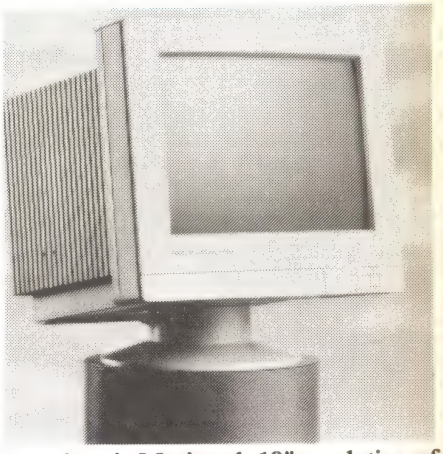
The new monitors incorporate the innovations and standard NEC introduced when it launched the FG series in October 1991.

These include larger, flatter overscan screens, higher refresh rates, advanced ergonomics (including compliance to the Swedish MPR 2 emission standard) and brighter, sharper focus with an Invar shadow mask.

The two FGe monitors add extra features like higher refresh rates and increased scan rates, all at lower prices for mainstream GUI users. Firstly, the 15" NEC 3FGe at $1400 (including tax), offers similar features to the existing 3FG priced at $1200, but adds a higher bandwidth of 65MHz and increased horizontal scan frequency, providing compatibity with a wider range of computers and standards.

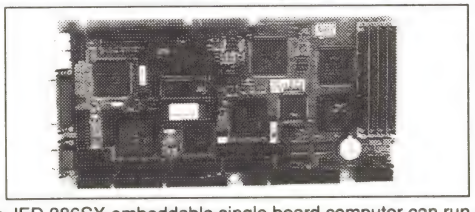
These include IBM's new XGA-2 standard of 640 x 480 at 75Hz refresh, Macintosh platforms Mac II and Quadra, including 640 x 480 at 67Hz and 832 x 624 at 75Hz, and finally the VESA guideline of 1024 x 768 non-interlaced at 60Hz.

The 5FGe is a 17" model priced at $2650, or $425 less than the current 5FG. With a bandwidth of 80MHz and horizontal frequency of 62kHz, the 5FG3 is targeted at users wanting a larger screen and high refresh (76Hz) 1024 x 768 mode, but not requiring the 1280 x 1024 mode as featured in the 5FG. IBM's new XGA-2 standard of 1024 x 768 at 75Hz is supported, as is Macintosh 19" resolution of 1024 x 768 at 75Hz.



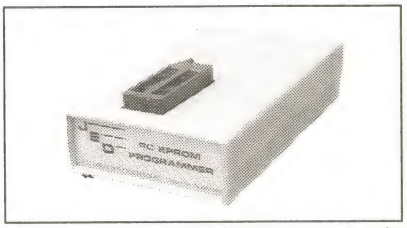
For further information circle 172 on the reader service coupon or contact NEC Home Electronics Australia, 244 Beecroft Road, Epping 2121; phone (02) 868 1811, fax 869 1112. ❖


**Australian Computers & Peripherals from JED... Call for data sheets.**



The JED 386SX embeddable single board computer can run with IDE and floppy disks, or from on-board RAM and PROM disk. It has over 80 I/O lines for control tasks as well as standard PC I/O. Drawing only 4 watts, it runs off batteries and hides in sealed boxes in dusty or hot sites. It is priced at $999 (25 off) which includes 2 Mbytes of RAM.

**$125 PROM Eraser,complete with timer**



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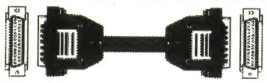
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## NEW Parallel Data Cable



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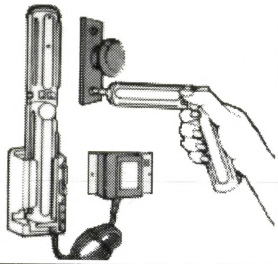
With our new CC21 cable! Simply connect the two printer ports and, using the latest version of DOS, you're away. What could be simpler? **Cable CC-21** 25pin male DB25 to 25pin male connectors. 1.8m long approx and only **$19.95**

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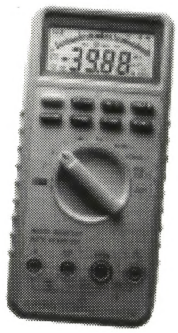
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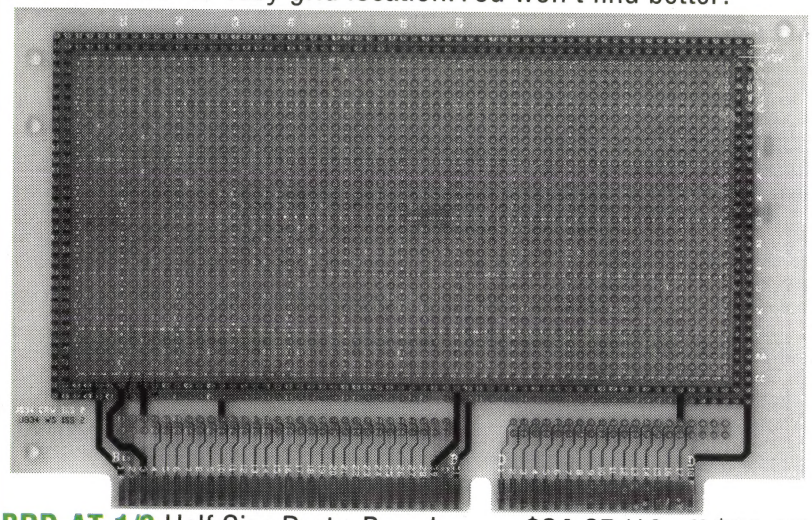
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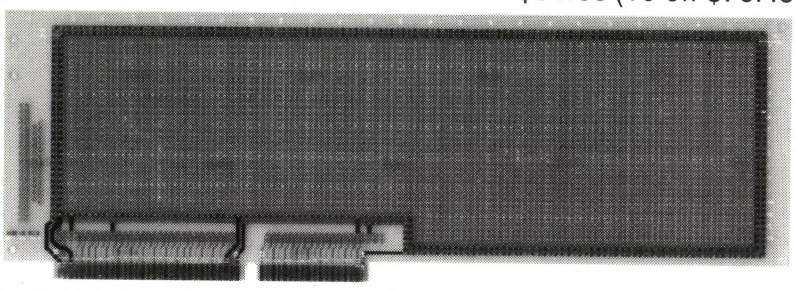
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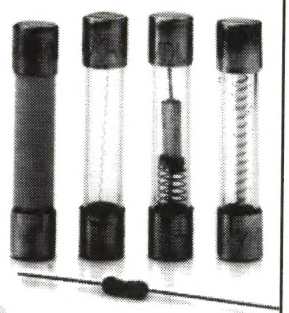
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## STEPPER MOTOR

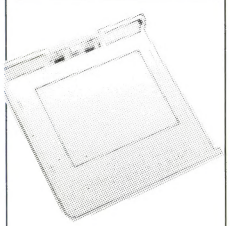


These are brand new units, main body has a diameter of 58mm and a height of 25mm. Will operate from 5V, has 7.5deg. steps, coil resistance of 6.6 ohms, and it is a two phase type: Six wires. ONLY:

**$12**

Suitable driver IC and circuit: **$9**

## FLUORESCENT BACKLIGHT



These are new units supplied in their original packing. They were an option for backlighting Citizen LCD colour TV's. The screen glows a brilliant white colour when the unit is powered by a 6V battery. Draws approximately 50mA. The screen and the inverter PCB can be separated. Effective screen size is 38X50mm.

**$12**

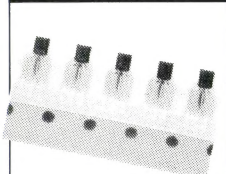
## MASTHEAD AMPLIFIER KIT

Based on an IC with 20dB of gain, a bandwidth of 2GHz, and a noise figure of 2.8dB, this amplifier kit out performs most other similar IC's and is priced at a fraction of their cost. The cost of the complete kit of parts for the masthead amplifier PCB and components and the power and signal combiner PCB and components is PRICED AT AN INCREDIBLE:

**$20**

For more information see a novel and extremely popular antenna design which employs this amplifier: MIRACLE TV ANTENNA — E.A. May 1992: Box, Balun, and wire for this antenna: $5 extra.

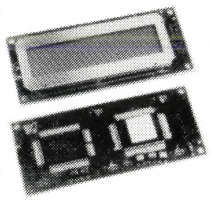
## BC548 TRANSISTORS



Brand new Philips brand BC548 transistors with in line leads and taped to a cardboard strip. Designed for automatic insertion machines. Leads are spaced by 3.5mm and 13mm long. A BARGAIN:

**$6** for 100

## LCD CHARACTER DISPLAYS



We sold out of these new 16 character by 2 line alphanumeric LCD display modules, but have obtained new stocks recently. They have surface mount control circuitry mounted on the rear of the display, and only require a few mA at 5V to operate: Information included. Although they have different pin positioning they can be used directly with the project published in S.C., entitled ALPHANUMERIC LCD DISPLAY BOARD: See S.C. May 93 issue. New units at about ½ of their real value:

**$18** or 5 for $80

## LASER POINTER



When this magazine goes to print we will have in stock a very small 5mW-670nM laser diode based pointer. This pointer actually uses a 5mW laser diode: Very bright! Do not be misled by advertisements that advertise pointers with a power output of 5mW maximum, as these could have a power output of as little as 1mW. The SPECIAL introductory price for our pointer is an all time low:

**$139**

## SOLAR CHARGER



Use it to charge and or maintain batteries on BOATS, for solar LIGHTING, solar powered ELECTRIC FENCES etc. Make your own 12V-4WATT solar panel. We provide four 6V — 1 WATT solar panels with terminating clips, and a PCB and components kit for a 12V battery charging regulator and a three LED charging indicator: See March 93 S.C. Incredible value!

**$42**

6.5 Ahr. PANASONIC gel battery $35, ELECTRIC FENCE PCB and all onboard components kit $40: See S.C. April 93.

## 68W SWITCHING POWER SUPPLY

115-230V AC input, 5V at 4A and 12V at 4A output. Brand new, very compact: 140 X 82 X43mm. UNBELIEVABLE PRICE:

**$28** ea. or 2 for $50

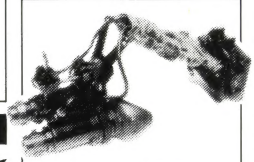
## MINI EL-CHEAPO LASER KIT

The smallest and most efficient tube — invertor kit combination we ever offered. The used laboratory quality 1mW tube is 155mm long and has a diameter of 25mm, and the power supply would occupy a similar volume. The switched mode supply is very efficient! Draws approximately 600mA from a 12V battery, and it could be easily modified for operation from lower and higher DC voltages. A very compact combination that produces a very bright and low divergence beam. Great for portable use. Incredible pricing:

**$69**

for the tube, the inverter kit and the instructions.

## IR BINOCULARS



High quality helmet mount, Ex-Military binocular viewer. Self powered by one 1.5V, "C" size battery. Focus adjustable from 1 metre to infinity. Requires IR illumination. These units are all "Full spec." and operational but may need a little cleaning up. Limited stocks:

**$399**

## 5mW NEC LASER

A brand new "Full Spec." large visible red N.E.C. laser head and one 12V Universal Laser Power Supply MKIII kit. The head has a diameter of 45mm, is 400mm long, and it is fitted with a shutter. For the more serious applications.

**$249**

## TV TUNERS



These famous brand TV tuners were intended to convert some colour computer monitors to COLOUR TV recievers: The monitors that have a composite video input, not the RGB types. They contain all of the ncessary signal processing and channel switching: Antenna IN, to Composite video and line level audio output. They are a commercial product which is completely enclosed and mains powered. The channel is selectable by 12 illuminated pushbutton switches and seperate preset adjustments allow each of the pushbutton to access any channel in the VHF-UHF range. Supplied with a "rabbit ears" antenna. A circuit for the unit is provided. We should have more information and circuits, showing how to convert the composite video output to an RGB output, convert this unit to a Stereo TV tuner. LIMITED SUPPLY.

**$139**

## CCD CAMERA AND MATCHING MONITOR



Monochrome CCD Camera and a matching 100mm CRT monitor. The miniature camera is totally assembled on a small PCB and includes an Auto Iris lens. It can work with illumination of as little as 0.1Lux and it is IR responsive. Overall dimensions of camera are 24 X 46 X 70mm and weighs less than 40 grams! The monitor employs a flat faced CRT and has overall dimensions of 30 X 191 X 100mm. Australian standard frequencies (CCIR) are used in both the monitor and the camera. Incredible introductory prices:

**CAMERA $199**

**MONITOR $210**

## 5" COLOUR MONITOR

These brand new open frame construction 5" COLOUR MONITORS have a flat faceplate, 640 X 200 dot resolution, CGA and hercules compatible, standard interface connector, degaussing coil included, 12V DC operation, 15.75KHz horizontal frequency, 60Hz vertical frequency. These frequencies are both adjustable to the Australian standard TV frequencies: Information supplied. Use them for computer monitors, experimenting, education, disco displays etc. etc. Don't miss out on this BARGAIN!:

**$149**

## FLUORESCENT LIGHT INVERTER

At the heart of this kit is a fluorescent light inverter capable of powering 4-20W flourescent tubes. It also has control inputs that enable it to be switched from a movement detector. We also supply a crystal controlled ultrasonic movement detector and an incadescent lamp switch — flashing circuit. Even the ultrasonic transducers are included. Three separate kits that can have many applications for a total reduced price of:

**$40**

ON SPECIAL FOR TWO MONTHS! See "Multifunction flouro light": E.A. NOV. 92

## SOME DIFFERENT COMPONENTS

1000pF/15KV Disc ceramic capacitors **$5**

20KV PIV-5mA Av./1A Pk. Fast diodes

**$1.50**

3KV PIV-300mA/30A Pk. Fast Diodes

**60c**

0.01uF/5KV Disc ceramic capacitors

**$1.80**

680pF/3KV Disc ceramic capacitors **30c**

BUZ11 MOSFETS

**$3.00**

Flexible DECIMAL KEYPADS with PCB connectors to suit

**$1.50**

High output 940nM IR LEDS

**60c**

**or 10 for $5**

High output 880nM IR LEDS

**60c**

**or 10 for $5**

Rectangular IR Pin diode (Very fast) detector diode, 780nM-1000nM, similar to BPW50

**$1.20**

**ea. or 10 for $10**

100 LED BARGRAPH DISPLAY Yes 100 LED's, plus IC control circuitry, all surface mounted on a long strip of PCB. SIMPLE, a 4 bit binary code selects which one out of the 10 LED groups will be on, whilst another 4 bit binary code selects which one of each group of 10 LED's will be ON. Latching inputs are also provided. We include a circuit and a connecting up diagram. VERY LIMITED QUANTITY

**$7**

## LASER DIODE HEAD

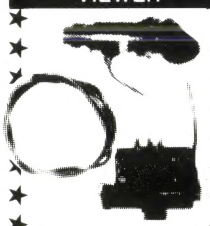


This diode head produces a well collimated beam and employs a 5mW-670nM laser diode. It is the same head that is used in the laser pointer advertised elsewhere in this advertisement. Current consumption 85mA, 3V battery operation, 10.5mm diameter, 22mm long, red and black leads provided, beam diameter 6mm at 5 meters, copper shell material. Unbelievable price:

**$109**

Constant current source kit included. Enables operation from other supplies apart from just 3V batteries.

## BARGAIN MONOCULAR VIEWER



A very small but complete IR telescope which only needs an EHT power supply, which is provided in kit form: See S.C. Nov. 92. We have got a LIMITED STOCK of some units that are "Full Spec." but may need a little cleaning up. We are offering them at a greatly reduced price of:

**$179**

Includes the IR telescope, power supply kit (box included), and an IR filter: See S.C. Nov. 92. Alternatively, instead of the kit power supply, we can provide the original power supply for these tubes, at the same price: Specify choice of supply.

## SPEAKER GIVEAWAY



One 3" tweeter, one 4" woofer, a non polarized crossover capacitor, plus a diagram:

**$10** for the set

2 sets (STEREO) for

**$18**

We don't have much more information on these new components that appear of high quality. The tweeter alone is worth over $12.

## 12V OPERATED LASER



This combination includes one used 3mW SIEMENS visible red laser tube and one 12V Universal Laser power supply MKIII kit. The inverter is easy to construct since it is supplied with a prewound transformer, and solder masked and screened PCB.

**$89**


**OATLEY ELECTRONICS**

PO Box 89, Oatley, NSW 2223

Telephone: (02) 579 4985 Fax: (02) 570 7910


MAJOR CARDS ACCEPTED WITH PHONE AND FAX ORDERS

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READER INFO NO. 2

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* *PRICES EXCLUDE SALES TAX*

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Who says you can't get the advantages of high performance equipment for the price of a basic tool? Not Hewlett-Packard.

With the HP 34401A DMM, you not only get 61/2 digit performance, but the best combination of resolution and accuracy in its price class. And, as if that wasn't enough, our DMM also offers you superior flexibility on the bench with HP-IB & RS-232 and three built-in programming commands - including Fluke 8840 - plus dB, null and frequency test functions.

Add the fact that all this performance comes standard for only $1,700, and you'll see why no other comparable DMM measures up.

For more information, call Toula at our customer information centre on 131347, and we'll be happy to send you literature.

| **HP 34401A Digital Multimeter** | |
|---|---|
| DC Accuracy (1 year) | 0.0035% |
| AC Accuracy (1 year) | 0.06% |
| Maximum input | 1000Vdc |
| Reading speed | 1000/sec |
| Resolution | 100 nV,10nA<br>100 μΩ |

HEWLETT PACKARD