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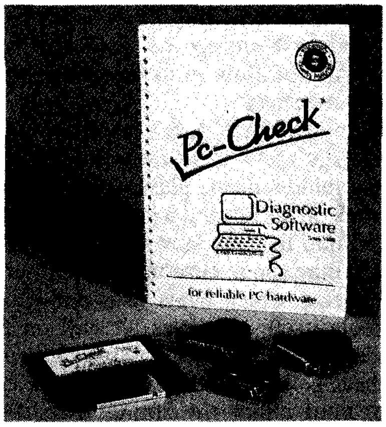
Electronics AUSTRALIA Professional Electronics & ETI

AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE — ESTABLISHED IN 1922

Faultfinding in PCs



Looking for a good diagnostic package for PC troubleshooting? You might want to consider Pc-Check, which is reviewed this month starting on page 86. It offers many interesting and useful features.

AC-3 surround amplifier

Yamaha's new DSP-A3090 Amplifier offers a built-in decoder for the Dolby AC-3 digital surround sound system, as used on the latest Laserdiscs and the coming Digital Video Discs (DVDs). But that's not all — as Louis Challis found, when he began to test one for this month's review. See his report, starting on page 10.

On the cover

Our main picture is a view inside the new 50W/Channel Stereo Amplifier, showing one of the power amplifier chips. As well as being low in cost, the amplifier is particularly easy to build. The smaller shot shows the transmitter unit for Rob Evans' new IR Remote Volume Control project. (Photo by Phil Aynsley)

Video and Audio

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Projects and Technical

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Professional Electronics

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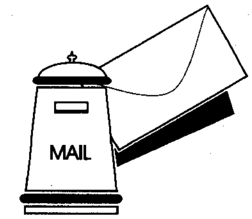
LETTERS TO THE EDITOR



Fax modems

I read with interest your reader contribution in the March issue on fax modem performance.

We purchased two fax modems, type Hayes Optima 288. Both modems refused to work reliably on our PABX.

After plenty of experimenting, we finally discovered that the modem transmit level was too high. Our problems disappeared after we changed the level setting from 0dBm to -13dBm.

The modem manual states that modems sold in Australia should have been factory set to -13dBm, but both of our modems had been set to 0dBm.

Gerd Kircher,
Ferny Grove, Qld.

Not normal twinkling

The January edition of *EA* carried an article on 'untwinkling' stars. The twinkling referred to was not the kind of twinkling most people would understand. Twinkling usually means fluctuating brightness, whereas the article was about apparent shifting in position. The former is, of course, caused by interference resulting from gravitational bending of the light as it travels across space while the latter is caused by movement of the Earth's atmosphere, as stated in the article.

I think a correction would be in order, even at this late date, as I think reputable publications should strive for accuracy.

Frank Murphy,
Temagog, NSW.

Fuse worry

I would like to bring to the attention of *EA* readers a disturbing flaw with certain slow-blow style glass fuses. The ones in question have no manufacturer's brand or standards symbols stamped on them, but are marked 250V. They incorporate a coil spring and are sold widely.

In the values from 2A to 6A my tests show that there are two distinct failure modes: firstly a normal failure mode above 50% overload the other at an overload of 300% or more. In the second case a quick failure of the fuse is needed, but does not occur. Instead the strand of wire inside the coil spring blows, followed by the remaining fuse parts overheating severely while still maintaining the circuit.

Tests have also found that the surge of current produced when a mains transformer is switched on can cause the same wire inside the coil spring to blow, transforming the fuse into one that will not blow in future at less than 400% overload.

Normally, such fuses go open when the solder melts in a tiny metal pot held in the middle of the glass, under tension by the coil spring and a straight wire soldered into the pot. However, in the second failure mode current passes through the spring which heats to a dull glow, anneals itself and loses all pull on the solder pot — after which up to 30 watts of heat is dissipated through to the end cap, until either the spring wire itself goes open or the fuse holder melts down.

As these fuses are commonly used in mains circuits, the above is quite alarming as the expected safety and equipment protection has gone.

Please note that I have found no such problem with branded fuses, presumably because they have passed approval testing as their symbol markings (UL, VDE etc) indicate.

I believe readers would be well advised, particularly for mains circuit use, to insist on approved fuses in case some non-approved fuse's reluctance to blow causes expensive damage or a serious safety hazard.

Phil Allison,
Summer Hill, NSW.

All valves ain't

Some time ago your serviceman reported problems with a radio in which only one make of valve would operate. I have waited for someone else to explain what caused the phenomenon, but as no none has done so I will endeavour to elucidate.

First a little history is required. Early valves had their electrodes connected to a base that had only enough pins for the internal connections — i.e., four pins for directly heated full wave rectifiers or directly heated triodes, five pins for indirectly heated triodes and so on, through the series of six pin, seven-pin small and seven-pin large bases. This required a large collection of sockets but when the octal, eight pin, bases were introduced only one type of socket was needed. This often left some spare terminals on the socket, and radio manufacturers used these as convenient terminations for external components.

Next the noval (nine pin) base appeared, and problems started as some valve manufacturers used the internal end of spare pins to secure structural elements. So 'nc' meant, literally, do not connect anything here — but these convenient tags on the socket were too much of a temptation. Hence there was trouble if the internal connections of one make of valve did not correspond with those of another which would work in the particular manufacturers product.

Not all valve or radio factories used these methods, but the problem was there waiting for just the right occasion. I hope this has cleared up this mystery.

I first met this problem in a special amplifier used by the Royal Navy in which 6K7G valves were used. We ordered from stores 6K7s and were supplied metal valves; unfortunately the earth terminal on the sockets was used as the distribution point for the HT and of course nothing worked — all current flow in the valves was to the metal shell. We discovered this when one of the boys tried to extract a valve, with the power on, and got a handful of 250V.

I have encountered this in early sets using noval valves and from memory Philips was the major offender, but other makes also sometimes used internal connections for structural purposes.

L.M. Cross,
Newtown, NSW.

Pioneers book error

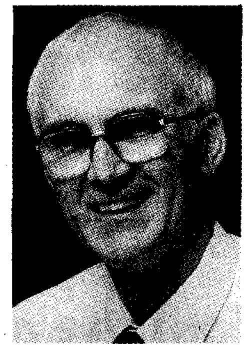
I wish to draw your attention to a minor error in the recently published *Australia's Radio Pioneers* by Neville Williams.

On page 40 in the chapter about Charles Maclurcan, my late father-in-law Raymond Edgar McIntosh's name is mentioned (he was then broadcasting as 2ZG), with the address as Lane Cove. It should read Lane Cove Road, or simply Pymble. The Pacific Highway at Pymble was, at that time, still called Lane Cove Road.

I intend writing you a separate letter which will include some associated historical matters which may be of interest to you. One point is that Raymond Edgar McIntosh was the actual operator who received the first telegraph message from the UK.

B.C. Fleck, VK2FS
Bonville, NSW. ❖

EDITORIAL VIEWPOINT



Feedback: we DO need it, even when it's negative...

I hope you'll find plenty to interest you in this issue. We've certainly put in a lot of effort to fill it with as many topical and varied items as we can — so that it should provide informative reading whether you're a professional, a hobbyist or an interested consumer. After all, the very future of publications like *EA* depends on our ability to give readers like yourself so much worthwhile reading that you'll want to keep supporting us, by buying the magazine!

Of course we're only human, and therefore quite capable of making both errors of judgement and plain old-fashioned mistakes. Sometimes we publish articles or project designs with errors that slip through our checking system, or we have difficulty in achieving a good balance of topics in a particular issue. At other times we perhaps miss an opportunity to present a good background article on an important topic, at the most appropriate time. In other words, with the best will in the world there will inevitably be times when you're not happy with us, either because of something we *have* done, or something we *haven't.*

What I'm leading up to is that when this occurs, please let us know what in your opinion we've done wrong — to give us a chance to do something about it. Send us a letter or a fax, or leave a message on the Reader Service BBS. We'd much rather you did this than simply stop buying the magazine, even if it means we get a constant stream of critical messages, because the feedback will help us to keep a good 'fix' on what the majority of readers need and expect from the magazine.

In the long run, of course, providing this feedback will also be helping yourself. If we know what readers like you want in an electronics magazine, there's a much better chance that we can give it to you...

Providing this kind of feedback takes valuable time and trouble, I know; however I can assure you that we read and consider all such feedback very carefully — even though it's often not possible to give everyone a personal reply. Like many small magazines we have a very small editorial staff nowadays, and producing the magazine itself takes just about all of our time.

I won't pretend that it's good fun getting a missive from an unhappy reader, taking us to task for some error or shortcoming. It can be pretty disheartening, at times. But by the same token it's important and necessary — a bit like nasty medicine. Not all that pleasant, but it does you good all the same...

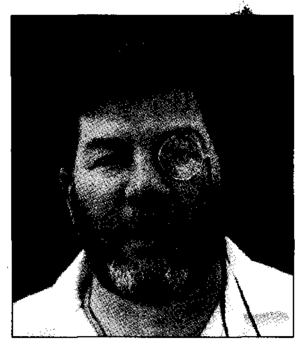
Mind you, it's also nice to get a bit of *positive* feedback from time to time. So if there's something that you especially like about the magazine or a particular issue, feel free to let us know about *that* as well. It's all feedback, and sometimes a gram of praise can achieve more results than a tonne of criticism!

Jim Rowe

PS: We've been advised by Austel that the telephone numbers in our area should be changing to eight digits during July, with the addition of a '9' prefix. That's why this issue shows the new numbers (including that for the BBS). However we couldn't find out the exact changeover date; so if you try one of the new numbers and it doesn't work, please use the original number instead.

Moffat's Madhouse...

by TOM MOFFAT



Tom the multimillionaire (almost)

MR MOFFAT, YOU'VE REACHED LEVEL 4 — YOU'RE OUR BIGGEST WINNER IN HISTORY WITH ELEVEN MILLION DOLLARS!

Well, that's it. I'm gone. Somebody else is going to have to write this stuff for you, because I'll never have to work again. I've just won $11 million. This rather welcome news arrived in the mail, in a large envelope with a transparent front. The message, in computer-generated letters 12mm high, was displayed through the window. And below was my full name and address — yes, they got the right Mr Moffat.

I ripped open the envelope to collect my $11,000,000.00 cheque. But there must have been some mistake, the cheque was missing. There were, however, more details of my good news further down the page: MR MOFFAT, YOU'VE JUST BROKEN THE TEN MILLION DOLLAR BARRIER — YOU'RE OUR FIRST AND ONLY $11,000,000.00 WINNER!

Well, maybe they're going to deliver my cheque personally. I remember seeing some TV commercial where a couple of guys in a helicopter are going to land in my front yard, knock on my door, and give me my cheque. I guess I'd better move the rubbish bins out of the way...

YOU DID IT, MR MOFFAT, YOU REACHED LEVEL 4 — YOU BEAT OUT EVERY OTHER WINNER ON OUR LIST, WITH A GUARANTEED PRIZE OF ELEVEN MILLION DOLLARS! And to prove it, the list in question was displayed nearby, bordered in gold. At the top: $11,000,000.00 LEVEL 4 WINNER: T. Moffat, Port Townsend WA. And below that, $10,000,000.00 LEVEL 3 WINNERS: Daniel Rodgers, Grand Rapids MI; Andrew Biggs, Phoenix, AZ, Marjorie Godzik, Saracuse NY; and so on down the list, right to the LEVEL 1 WINNERS at the bottom who only received a puny $1,000,000.00 — what a pity for them!

Excitement dying down now, it was time to read the fine print: "Dear Mr Moffat, Nobody in Washington or anybody else in the USA has ever broken through to Level 4 on our list." (But what about my uncle just down the road? He won eleven million dollars today too — we were going to have a party.) "But that will change in an instant if you return the winning entry for a history-making ELEVEN MILLION DOLLARS!"

Winning entry? Why do I need that? I've already won! You just told me so. I turn over the page. There are photographs of the other winners from the list, so they must exist. And above them all is a blank space labelled "reserved for our first and only $11,000,000.00 winner".

It turns out they want me to order some magazine subscriptions, to validate my winnings. This is no problem, since I was going to do it anyhow; *Newsweek* is required reading for my son's current-affairs class at school. I can order *Newsweek* here for about 1/4 the going rate, a very good deal, so I take the plunge. There is space for two magazines, so I order *Popular Mechanics* as well — better to be on the safe side and not jeopardize my $11 million...

A month later: Guess what! My magazines have started arriving, but there's still no sign of my eleven million dollars. But there is another letter, visible through that familiar transparent envelope: MR MOFFAT, YOU'VE BROKEN THE TIE AMONG OUR TOP FIVE WINNERS — YOU'RE OUR BIGGEST WINNER EVER WITH $11,000,000.00! Hey, it must have been worthwhile to order all those magazines; now they owe me $22,000,000.00.

Let's see what the fine print says this time: "Hold on to your hat, Mr Moffat... and hold on tight, because you may be heading for the ride of your life..." (They must have heard of my plans to buy a Lear jet.) "It will be a big day in Port Townsend WA if you're our new big winner, Mr Moffat."

Hey! What do you mean — 'IF'? I get the idea now, they want me to buy some more magazines...

Ah, the wonders of modern computer technology. What we're talking here is mega-word processor. There's a big printer somewhere, probably the size of a bus, squirting out these "personal letters" to people like me. Would it be unfair to say they're going to every household in the USA? And the 12mm characters — those headlines! Just think of the ink that thing must go through.

In all seriousness, I think it would be fascinating to see how this giant 'junk mail' machine operates. In addition to the letters, everyone gets a big page of stamps, like postage stamps. To order your magazines it is necessary to find the correct stamps displaying the magazine's logo, and stick them on the form you send back as your entry for your $11 million.

There are also special stickers that must be stuck on just the right part of your entry form, in order to 'validate' it. In fact there's probably 15 - 20 minutes work involved, to read the instructions and then to follow them carefully as you stick various bits of coloured paper here and there on your form. I guess they want you to feel like you've actually *done* something to win your eleven million dollars, instead of just lucking out.

What kind of machinery, what kind of computer equipment, would be required to print all this stuff, apply 'special authorization numbers' for each recipient, shove it all into an enormous envelope, and then send them to every household in America. How about the postage? The mind boggles.

One to every household in America? Not quite. So far I've received four of the things. The latest one lies on the floor next to my chair, unopened, even though it is adorned with a special sticker saying 'Registered Prize Claim

Documents Enclosed For Addressee — EXTREMELY TIME-SENSITIVE'. I guess I'd better open it soon. The company owes me $44,000,000.00 now, so maybe it's in that envelope.

The magazine distributors are improving the efficiency of their sales pitch with — yep! — junk phone calls. Soon after my fourth 'Notice from the Executive Prize Committee' turned up in the mail, I got a call from a lady in Des Moines, Iowa. "Mr Moffat, we're just phoning to check if you're happy with the quality of magazines you may be receiving". I told her "I'm very happy, thank you, and what's more, they're giving me 44 million dollars. What do you have to offer?" Well, *that* put a stop to that phone call pretty quick.

Junk phone calls: I grizzled about the ones in Australia some time ago in this column, but here in the USA they've reached new heights of sophistication. It's obvious that callers are most likely to get an answer around dinner time, so that's when the majority of junk calls arrive. And it seems most of them are trying to get you to switch to a different long-distance telephone service...

"Mr Moffat, have you considered the advantages of switching over to Sprint for your long-distance calls?" Here is an answer that works every time: "I'm sorry, I'm having dinner just now. Why don't you let me know what time you have dinner and I'll phone you back?" Gotcha!

Robot Caller

The above rejoinder, of course, assumes you are talking to a person. More and more unsolicited calls are placed by a robot, a computer gadget that rings your number and then plays a recorded message at you. For instance:

Ring! Ring! "This is Port Townsend High School. Our records show that your student has been absent from class for one or more periods today. Could you please contact the attendance office as soon as possible." (Click)

My oh my, don't the kids hate this one! Every time they wag school, their name is entered into the computer, and then at the end of the day (dinner time) the computer gets on the phone and dobs them in to their parents. Big Brother lives!

In fact, that robot ringer-upper is part of the very latest voice mail system that has just been installed at the high school. When you phone the school you get the robot saying "You have reached Port Townsend High School. Could you now press the four-digit number of the extension you require."

When you do this you get a recording of the person you want: "Hello, this is (blah-blah). I'm not at the phone right now, could you please leave a message." The robot's voice then comes on again with "To ring the extension press one. To leave a message press two". If you press one, the phone rings about four times, hardly long enough for the person to answer unless they are sitting right next to it. The system then reverts to "Hello, this is (blah-blah)" again.

By now, you're really wishing you could talk to a person, but if your person isn't quick on their feet, it is not to be. However I have learned how to bulldoze through the voice mail system to bring about instant, and satisfying, results.

When the computer answers with "You have reached..." you just key in your extension right over the top of the message (it's hard to be rude to a computer). Then when you get "Hello this is..." you just pop the one key and the phone rings immediately. If you don't get an answer the first time, hit one again just as it cuts out, and maybe after four more rings the person you're after will get to the phone.

Best of all, I have learned that if you enter '5555' on the initial message, you get a lovely lady named Jan Boutilier who is a real person. In fact she is the office secretary, the real person who would have answered your call in the first place if the voice mail thing had never existed.

Have these voice-mail contraptions infected Australia yet, to the extent they have infected the USA? You try to ring any business, any commercial operation at all, any government department, and all you get is the run-around from some damn robot.

When I left Tasmania around eight months ago, there were just a couple of them in Hobart. Most businesses still had real people operating their phones. I suppose this column is going to unleash a stream of complaints from suppliers of voice mail systems, but please — I appeal to you — isn't there some way to make them more user-friendly?

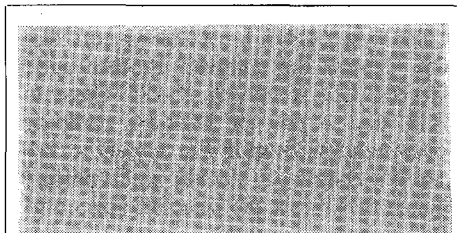
Are these things really necessary in the first place? Maybe they save the wages of one employee — a friendly human voice on the end of the line. But consider how many callers simply hang up in frustration and even rage. I know I do! And if I stumble upon a business with a real person on the phone, that's where my custom goes.

Now for a real-time footnote. I am going to open that last envelope — 'Mr Moffat, you're our first winner on record...'. There could be a cheque for $44,000,000.00 in there. Here goes: (Pause, rip...)

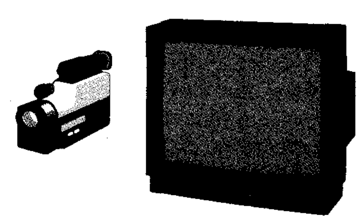
OK, in order of appearance: the letter, with qualifying codes, and advice that I have to get it back to them within 24 hours to win the full $11,000,000.00 this letter offers. There's a sticker labelled 'Confidential'. It's a scratch-and-win; there's a 'bonus number' under it, and I now have gold paint under my fingernails.

Next page: a sticker saying 'activate stage three numbers #26ZDA'. Next page (two copies of it): NOTICE OF MAILING LIST EVALUATION. Pre-cutback Status Evaluation. Re: Mailing status - AT RISK! Next page: an ad for magazines. Next page: the magazine stickers. Next page: the form to stick the stickers onto: Next page: an envelope marked 'place postage stamp here'. Cheapskates!

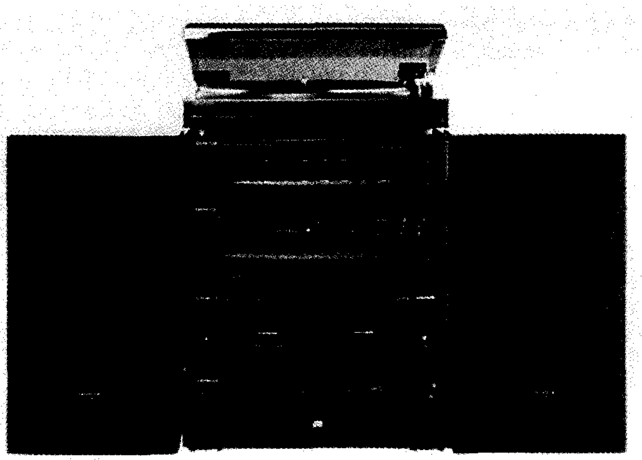
I am sad to report that there was no cheque of any kind. Now that this column is finished, I am going to ceremoniously tip the whole lot of that stuff into the rubbish bin. And, since my mailing status is 'AT RISK!', maybe that will be the end of it. Good try, fellas, but it won't work again. ❖



What's New In VIDEO and AUDIO



Keenly priced midi system provides 75W/ch



Kenwood describes its M-29M midi system as 'high power', and it delivers up to 75 watts RMS to the each front speaker. Each three-way fixed grille speaker employs three drivers, 160mm woofer, 50mm midrange and 25mm tweeter.

The system also incorporates Kenwood's Acoustic Signal Processor, which recreates the ambience of an arena, jazz club or stadium. ASP technology adds to the excitement of the live performance and is also beneficial in enhancing music that sometimes can be left 'flat' due to compression and other multidubbing techniques.

For those who enjoy a sing-along or karaoke, the M-29M features two mic inputs, plus mixing and level controls that can be varied to suit the appropriate song.

A five-disc CD player incorporates the latest single bit DAC technology. An optional P-29 turntable is available for those with a collection of vinyl records.

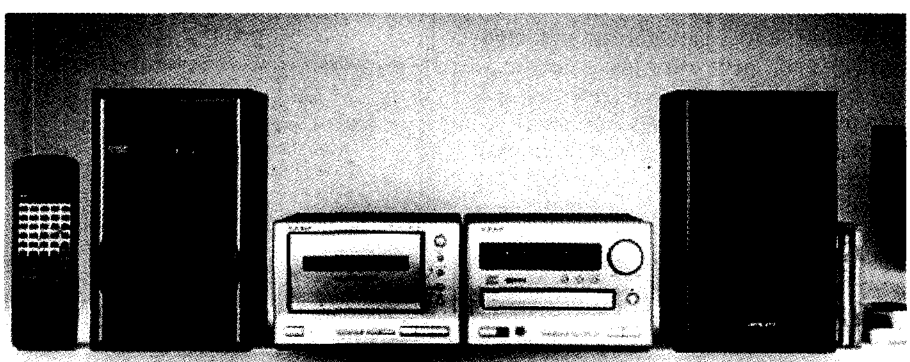
The M-29M (RRP $999) is covered by a two year warranty and is available at selected Kenwood dealers. For further information circle 141 on the reader service card or contact Kenwood on (02) 746 1888.

Onkyo debut micro hifi system

The new Onkyo L-185 micro hifi system features the compact 185mm wide CR-185 CD Receiver, K-185 Cassette Deck and a pair of D-052A compact loudspeakers. Despite the system's tiny size it's claimed to deliver audio performance that rivals the best full-size component systems.

At the heart of the new system is the CR-185 CD Receiver, a top-grade single-bit CD player coupled with an RDS FM receiver and programmable timer. The amplifier section is engineered for maximum efficiency and employs an audiophile grade discrete output stage with an independent high-current power transformer. It is rated to deliver 20W RMS per channel.

Features of the CR-185 include 20-track CD programming and three repeat modes, 30 FM station presets, motor-driven volume control, a Super-Bass function, front panel headphone jack, reinforced high rigidity anti-resonant chassis with large tri-point feet, solid aluminium front panel, and a full-function infrared remote control.



The K-185 Compact Cassette Deck features an auto reverse mechanism with high density hard permalloy heads, Dolby B/C noise reduction, Dolby HX Pro headroom extension system, one-touch recording with the CR-185 and full logic controls.

The D-052A compact loudspeakers complement the electronics of the L-185 system. Just 259mm high, these true two-way systems deliver big performance that belie their compact size. With an MDF cabinet of bass reflex design, each loudspeaker features a 130mm cone woofer and 25mm soft-dome tweeter to deliver crystalline highs, a detailed midrange and driving bass.

The Onkyo L-185 Micro System is available in an attractive brushed aluminium finish and has an RRP of $1999.

For further information circle 144 on the reader service card or contact Amber Technology, Unit B, 5 Skyline Place, Frenchs Forest 2086; phone (02) 9975-1211 or fax (02) 9975-1368.

BASF launches one hour VHS-C tape

Consumers wanting longer tape lengths for their VHS-C camcorder should welcome the Australian release of an extended 60-minute tape by BASF.

Industry trends suggest the new 60 minute camcorder tape will be as successful as the 45-minute tape which now outsells 30-minute camcorder tapes by a factor of 20.

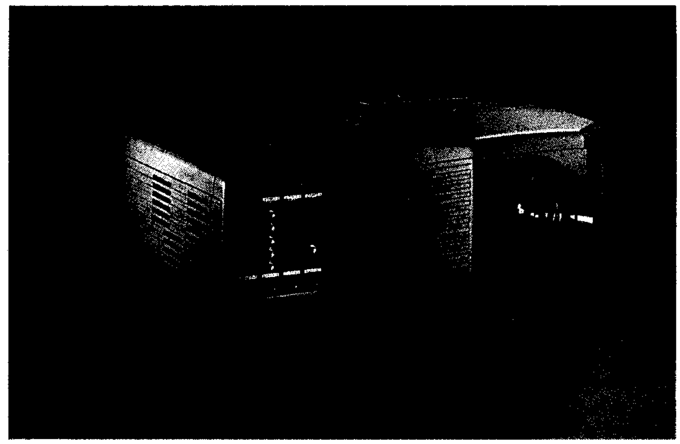
BASF's entire camcorder range, including the VHS-C EC45 and VHS-C EC30, now features a new formulation claimed to give reduced dropout rates. It also uses an improved tape housing system, plus BASF's Safety Lock System, a new braking system designed to prevent tape looping which can cause tearing and other damage. In another improvement, BASF has opted to help buyers identify the appropriate camcorder tape for their needs.

Badged the BASF Master range, it identifies four quality tape grades and an chart of suitable tape applications:

- Standard Master - suitable for everyday and holiday film making;
- Archive Master - a premium high grade tape most suitable for archival storage of valuable recordings such as important family events;
- Edit Master - for editing, archive storage and for semi professional users;
- Profi Master - especially suited to S-VHS-C and Hi8 systems.

For further information circle 143 on the reader service card or contact BASF Australia, 500 Princes Highway, Noble Park 3174; phone (03) 212 1500 or fax (03) 212 1502.

Single panel LCD colour TV projector



Barco has announced its first lightweight single panel full colour LCD projector, the BarcoData 2100. The new unit combines the ease of use and installation of small LCD projectors in a compact and handy design, with the power and impact of large screen CRT and LCD light valve projectors. Equipped with a 575W metal-halide lamp and one active matrix LCD panel with S-VGA (800 x 600) resolution, this projector produces crystal clear and razor sharp images of more than 500 centre lumen on screens up to 5m wide.

An integrated advanced video decoder and a built in high-performance pixel map processor enable the 2100 to display all video sources (PAL, SECAM, NTSC) as well as computer video formats with resolutions up to 1024 x 768 pixels. Nevertheless the unit weighs only 25kg and can easily be transported and installed by one person.

In addition, the BarcoData 2100 features new and user-friendly intuitive on-screen menus, accessible through a convenient backlit infrared remote control. Extensive user facilities, such as image size, shift, pan, zoom, freeze and built-in test patterns guarantee easy control and unmatched versatility.

For more information, circle 142 on the reader service card or contact Trace Pacific, 8 Prohasky Street, Port Melbourne 3207; phone (03) 9646 5833 or fax (03) 9646 5887.

Panasonic projection CTV has wide screen

The most recent addition to Panasonic's range of wide screen CTVs is the TX47WG251-I, a rear projection model with a 119cm diagonal screen. Wide screen receivers offer a screen aspect ratio (W:H) of 16:9 rather than the conventional 4:3, allowing movies and other productions to be viewed closer to the original format and giving greater impact. The 16:9 aspect ratio has a viewing angle much closer to the 28 - 30° which is regarded as ergonomically correct for the human eye, and said to result in less eye fatigue.

Manufactured in Japan, the TX-47WG25H includes a host of hi-tech features including multi-screen, whereby the screen can be split into two equal parts or up to nine images at the same time.

In split screen mode, two people can actually watch two separate programs or sources (e.g., camcorder footage, VCR, Teletext, laser disc, etc.) at the same time, and there are separate front headphone sockets for each side of the screen.

As well as split screen and multi-screen, the TX-47WG25H has both a picture-in-picture feature and picture-out-of-picture, where a small picture is displayed at the side on a black background while the main picture is viewed in 4:3 aspect mode on the remaining screen.

Another advanced feature known as STROBE allows the viewer to have a detailed movement analysis. In this mode, eight stroboscopic pictures will appear on the right hand side of the screen. This feature is particularly good for sports, where important action can be analysed by the applying the strobe effect.

You can also freeze the image on the right side of the screen while the action continues uninterrupted on the left side of the screen, using the STILL feature. This is helpful for allowing time to find a pen and paper to write down a telephone number or ingredients of a recipe...

Like Panasonic's current Wide Screen televisions, the new model has five aspect modes: NORMAL, ZOOM 1, ZOOM 2, FULL and JUST. It automatically selects Digital JUST mode for standard television transmission and Digital ZOOM mode for video tapes, laser discs or television programs with wide screen formats.

The Panasonic TX-47WG25H is available from leading electrical retailers for an RRP of $9999. For further information circle 140 on the reader service card or contact Panasonic's Customer Care Centre on 132 600. ❖

YAMAHA'S DSP-A3090 AC-3 SURROUND AMPLIFIER

One of the first domestic amplifiers to incorporate a decoder for the Dolby AC-3 digital surround sound system (as well as Dolby Pro Logic and very powerful DSP), the new Yamaha DSP-A3090 is an outstanding example of the 'next generation' of home theatre components. This month our reviewer Louis Challis had the opportunity to try one out; here's his report...

Whilst the American and Japanese markets have heartily embraced the 'home theatre' concept, most Australians have been content to relax at home with their medium sized, or even small television sets, their trusty VCR, and a hired video cassette from their local video shop.

As you read this review, at least one major Japanese manufacturer (Toshiba) will be almost ready to ship the first Digital Video Disc (DVD) players destined for the US market. Over the next few months, at least two more manufacturers will commence shipping their products, adding to what will ultimately become a flood of new DVD players in the shops. At that stage, our perception of how and what we wish to view as the preferred form of home entertainment is likely to change dramatically.

DVD is a multi-faceted product. Most prospective purchasers will be entranced by, and will ultimately focus their primary attention on, the visual (video) component of the system. I don't wish to play down the video component, but it only constitutes one part of the story.

Dolby's AC-3

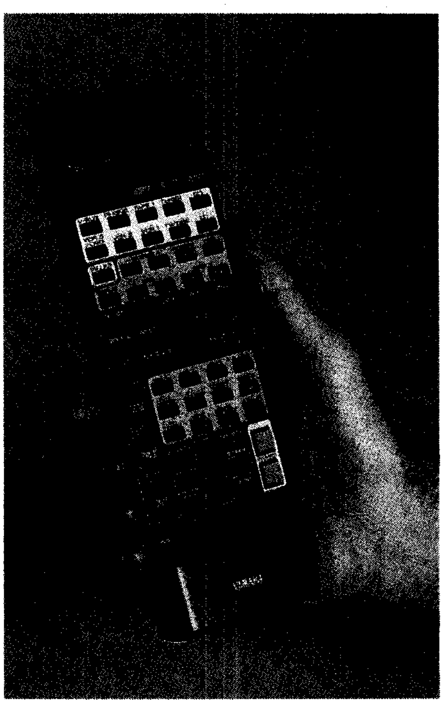
The audio component of the new DVD players has the potential to revolutionise our perception of high fidelity sound and how it can, or may be presented. The fundamental differences between DVD and your existing video/cassette is that DVDs have adopted the Dolby AC-3 surround sound system. AC-3 is at least evolutionary, if not positively revolutionary, as a result of its development program.

Now the Dolby AC-3 system is a *perceptual* digital audio coding technique, which offers unprecedented efficiency, quality, and versatility. Although few cinemagoers may have been conscious of its presence, it has provided multichannel digital sound in premium cinemas since 1992. Demonstrations of its ability to deliver multichannel digital surround sound from both tape and disc-based home video formats have already generated considerable interest within the consumer electronics industry.

AC-3 was an 'also ran' until it was selected to provide digital surround sound with High Definition Television (HDTV) broadcasts in the US. Those broadcasts will commence on an experimental basis at the end of this year.

The Dolby AC-3 system is unusually versatile. It is not a single rigid scheme, but rather a flexible family of processes which facilitate a number of changes in primary parameters. Those options include the data bit-rate, as well as the number of audio channels required for any specific application. Each variation on the basic theme is based on the same operating principles, which have been engineered to ensure compatibility amongst the different formats — both now and into the future.

The most significant feature of the AC-3 system is its ability to combine high fidelity multichannel sound with a remarkable data rate efficiency. Thus by way of example, although it enables multichannel surround sound at a lower bit-rate than is needed for just one channel on a Compact Disc, the resulting sound quality remains consistent with most listener's expectations.



The remote control unit for the DSP-A3090. There's a bewildering array of buttons, but it lets you control a huge range of functions and system parameters.

Brief history

To comprehend what Dolby Laboratories have achieved with AC-3 requires a brief overview of the history of stereo sound research and development. Probably few of you would be aware of Bell Laboratories' early experiments with stereo sound in the 1930s. Those experiments used three channels, and ultimately lead to Walt Disney adopting the new system for the 1941 film *Fantasia*.

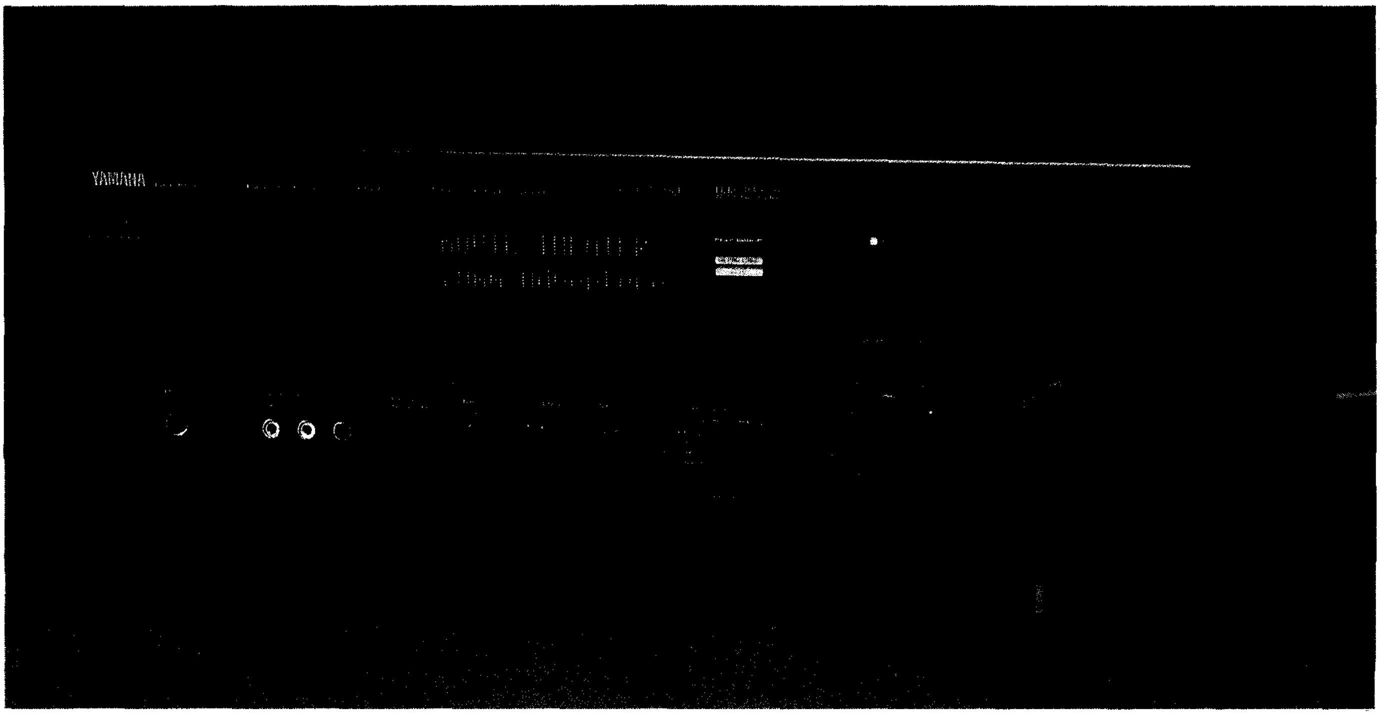
By the 1950s, four channel stereo systems were adopted for a small number of 'box office hits' at the cinema. Those films all used magnetic sound tracks for both 35mm, and 70mm film formats. It took another couple of years for stereo to finally make it into the home arena, but with only two channels of sound. As you will realise, that was all that the microgroove recordings of that era could accommodate.

It was the technological limitation, and not listener preferences which lead to two channel stereo becoming the standard for home sound reproduction.

By contrast, film makers continued to regard four channel sound (left, centre, right and a surround channel), as being the minimum necessary to create a convincing 'life-like' sound in the cinema.

In the early 1980s, we saw the widespread adoption of the new 35mm Dolby Stereo format by the motion picture industry. That system matrix-encoded four channels of sound onto the two optical soundtracks of a standard movie release print. The four channels were recovered by means of a Dolby proprietary sound processor, supplemented by additional electronics.

Few people realised that when a Dolby stereo film was transferred to a two channel video format, the original four channel encoded sound survived intact. Following that development, Dolby surround sound decoders have facilitated the decoding process through which the majority of multichannel home stereo systems became a feature in American homes.



Today millions of homes in America, Japan and elsewhere in the world are equipped with multichannel surround sound systems. The vast majority of those systems feature Dolby surround decoders. There are of course other systems as well — the most impressive of which is the Lucas THX system, which has also vied for a portion of that market.

The primary impetus which resulted in the development of AC-3 came as a result of the US Government's decision to embark on a standardisation process for the then-proposed HDTV. The initial proposals, around 1987, were that a four channel sound system would be matrix encoded, into a digitally coded stereo pair for primary transmission.

By 1990 four or more discrete channels were considered as being preferable, as there was a widespread fear that the four channel quality would be compromised by the then proposed audio matrixing system. It was soon realised (and accepted) that with the technology available at the time, the proposed four channel system would have required at least twice the bit-rate.

It was at that point in time that Dolby Laboratories conceived a multichannel audio coder, operating at a slightly faster bit rate than that required by two independently coded channels.

The fundamentals of the new system were based in part on a previous adaptive-transform coding system known as Dolby AC-2, which although technically viable, had failed to gain technical recognition or acceptance.

How AC-3 works

The digital audio coding (16-bit PCM) used on a compact disc yields a total range of 96dB from the loudest sound recorded down to the noise floor. The CD achieves this with 16-bit samples, with 44,100 samples per second in each of the two channels.

A data bit-rate of that magnitude is so large that both its storage and its transmission imposes significant limitations on the data channel bandwidth requirement. When two data channels are involved, those requirements are doubled. In order to circumvent this bandwidth hiatus, as well as the data bit-rate problem, a new form of digital coding, which is frequently described as *perceptual coding* was developed.

Sony developed its 'Adaptive Transform Acoustic Coding' (known as ADTRAC) for its MiniDisc, whilst Philips developed a separate 'Precision Adaptive Sub-Code' (PASC) for its digital compact cassettes (DCC). Both of those systems employ digital coding and functional bandwidth compression, and both systems have proven to be particularly effective. However, whilst that technology is most effective in its current two channel format, it simply has not provided a means of encoding four channel data in a form suitable for either home or cinema entertainment systems.

Dolby's interest in perceptual coding was a direct follow-on from their pioneering work with Dolby noise reduction systems (Dolby A, B and C). Those systems lower the noise threshold in an analog recording system in the absence of an audio signal. At other times, in the presence of a strong audio signal, the Dolby noise reduction system covers up or 'masks' the noise.

The psycho-acoustic phenomena adopted by each of those encoding systems is known as *auditory masking*. The auditory masking process is more complex than you may realise, as even when an audio signal is present in one part of the audio spectrum, the Dolby noise reduction systems reduce the noise levels in other parts of the spectrum in order to ensure that the residual noise is imperceptible.

In Dolby AC-3, bits are distributed amongst the filter bands as required by the particular frequency spectrum, or by the dynamic nature of the program. The coder incorporates an auditory masking model which allows it to alter its frequency selectivity, as well as its time resolution at any time. This ensures that a sufficient number of bits are used to replicate the audio signal in each sub-band of frequencies, so that the background noise is adequately masked.

The AC-3 system also decides where and how the bits are distributed amongst the various channels, from what is described as a 'common bit pool'. By this means, those channels with a greater frequency content can use more data bits than the channels which are sparsely occupied.

The sophisticated masking model and shared bit pool arrangement are the key factors underlying AC-3's extraordinary spectral efficiency. Whilst other coding systems employ precious data to carry instructions to their decoders, the AC-3 system uses proportionately more of the transmitted data to represent the audio signal, and thus achieve a higher quality sound.

The AC-3 system is based on a nominally 20-bit dynamic range audio signal over a 20Hz to 20kHz bandwidth, with a +/-0.5dB resolution, with -3dB points at 3Hz and 20.3kHz. These figures apply to the five main or full bandwidth channels. The bass effects (or sub-woofer) channel covers 20Hz to 120Hz +/-0.5dB, with -3dB points at 3Hz and 121Hz.

The system supports three sampling rates of 32, 44.1 and 48kHz. The data rates range from a low of 32kb/s for a single mono channel, to a high of 640kb/s. The conventional '5.1 channel' Dolby Surround Digital consumer format operates at a bit rate of 384kb/s.

Yamaha's DSP-A3090

At the end of March this year, Yamaha released its fourth generation DSP-A3090 amplifier. This is the first Yamaha amplifier to support 5.1 channels of AC-3, as well as the seven channels of Yamaha's DSP surround setting for the Dolby Pro Logic sources. The amplifier provides five 80 watt amplifiers for the two main, centre and rear effect channels, and a further two 25W amplifiers for the front effect channels.

As if that weren't enough, the DSP-A3090 amplifier is an unusually sophisticated piece of equipment as it incorporates more digital signal processing power than any other item of consumer equipment to be released on the Australian market. And the DSP circuitry incorporates unprecedented volumes of memory to achieve its performance. Yamaha's semiconductor facility has developed two extremely sophisticated and powerful large scale integrated (LSI) circuits. The foremost of those is the YSS-214, which provides 33% more processing power than the company's previous premium LSI chip.

Unlike conventional parallel processors in which the DSP and Dolby Pro Logic or the AC-3 circuits act simultaneously, the Yamaha serial processing system takes the output of the AC-3 chip or the Dolby Pro Logic chip with its directionality already in place. It then adds DSP functions to further expand and develop those effects, where required.

When operating in the Dolby Pro Logic mode, the Yamaha system adds 'phantom' speakers to the mono rear channels to recreate the speakers along the sides of a movie theatre. Following the development of the AC-3 system, Yamaha's engineers visited and measured the acoustical characteristics of a large number of existing cinemas. They decided that it would be desirable to recreate the acoustic field of those cinemas in residential living rooms.

The YSS-214 chip contains four high density modules to supply the cinema DSP processing. The amplifier also incorporates the YSS-213 chip, which is dedicated for decoding the digital Dolby Pro Logic signal.

Other technical advances include newly developed A/D converters, which are handled by a 64X oversampling 20-bit chip, and the D/A converters, which use an 8X oversampling 29-bit chip.

Great flexibility

The DSP-A3090 amplifier offers 30 program modes and six different AC-3 settings. The music based programs include five different concert halls, live concert settings, two different churches, two rock concert environments, and two jazz clubs. The cinema DSP programs include four concert video modes, two TV theatre programs, four 70mm movie settings, Dolby Pro Logic, and enhanced Dolby Pro Logic.

On close scrutiny of the handbook, as well as the rear panel of the amplifier, you will observe an unusual level of sophistication. This includes the provision of a plethora of digital as well as analog inputs, for five components.

A CD player or changer can be connected via three different possible inputs — analog RCA sockets, a coaxial electrical socket, or an optical digital socket. The same choice of three alternative inputs applies to the Laserdisc and TV inputs.

Toslink and analog inputs are also provided for the Tape Recorder No.1 input, while there are standard RCA input jacks for a turntable, tuner, Tape Recorder No.2, VCRs 1 and 2, as well as auxiliary inputs.

Whilst the electrical connections are relatively straightforward, they are comprehensive. Control over all of those optional inputs is by means of a sophisticated remote control. The remote control is smarter than most, as it incorporates the ability to 'learn' the codes of your other remote controls, such as those used for the TV, CD player, or a new DVD player. Having stored each of those functions, it can 'take over' all remote control functions so that you only need one remote control for everything. A most convenient facility, and one that Yamaha pioneered...

Objective testing

Before taking the amplifier home, I put it on the bench in my laboratory, connected up a series of loads to each of the outputs, and evaluated the performance of its main amplifiers.

With all inputs driven, the DSP-A3090 amplifier is hard pressed to provide 80 watts output out of each of the five main channels, as it does not incorporate a cooling fan. Although the output stage heatsinks are large and effective, they rely on convection cooling, and are designed for music and cinema format program content, and not for playing continuous rock music.

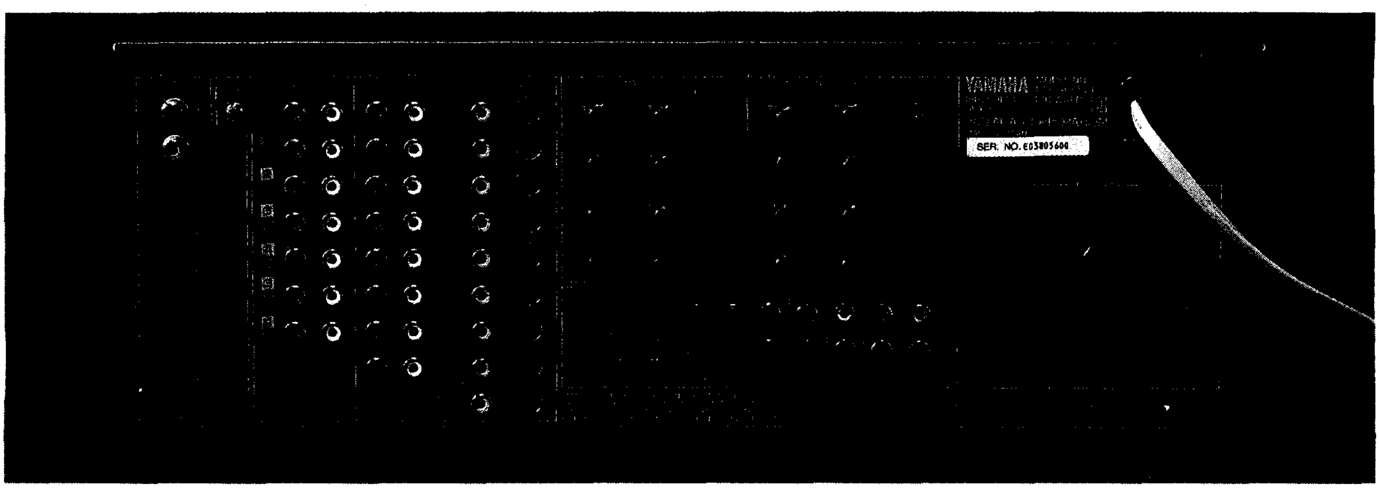
At 80W output, the amplifier's distortion is somewhat higher than the manufacturer's claimed 0.015% THD (total harmonic distortion). I measured 4.6% at 80W, and 0.084% at 70W. The transformation from low distortion to high distortion is fairly sharp at just under 80W output. At lower power outputs, in the 1 - 65W level, the total harmonic distortion is relatively low, and generally well within the manufacturer's published performance range.

The signal to noise ratio characteristic of the amplifier's phono input is excellent, with -104dB(A) referenced to full power output, and -83dB(A) relative to 1W output.

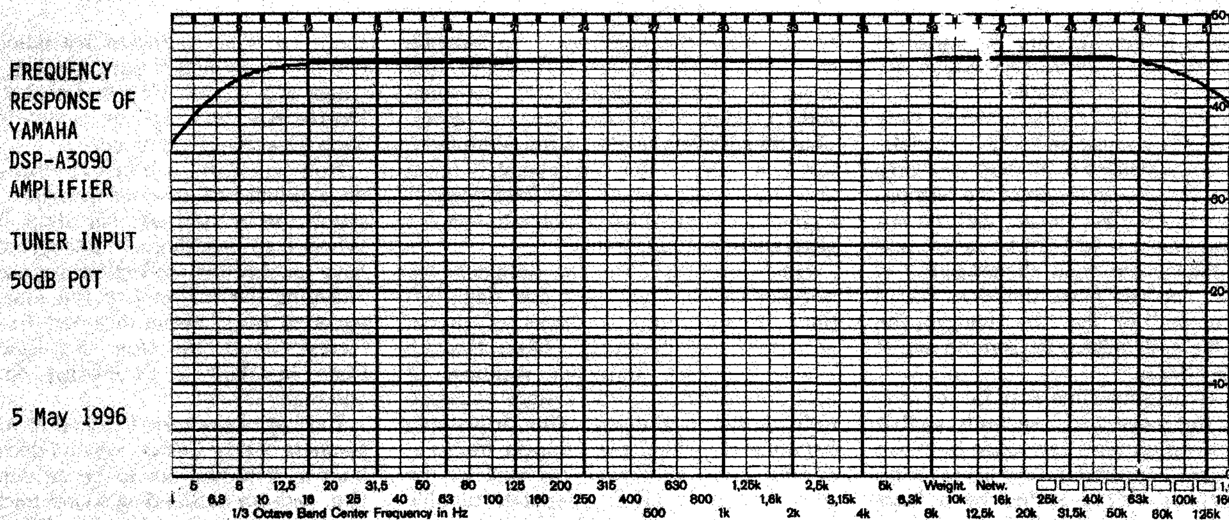
The frequency response of the DSP-A3090 amplifier's main channels is typically 6.3Hz to 125kHz +0.5/-3dB. The IEC total difference frequency distortion measurements are excellent, all the way up to 70V peak-to-peak output into an 8Ω load, at which stage the onset of clipping changes the nature of the equation.

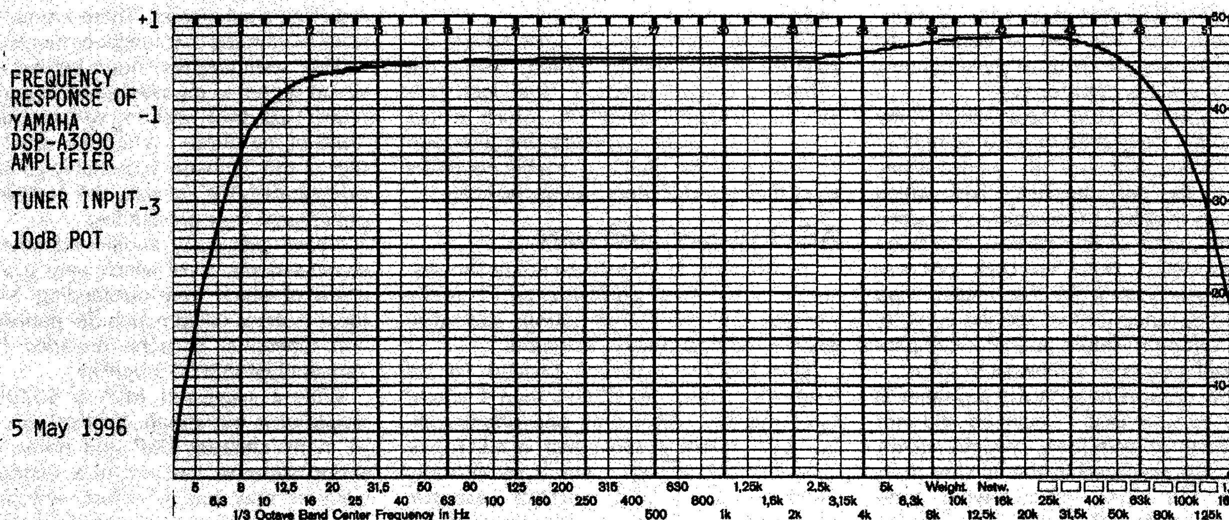
Subjective testing

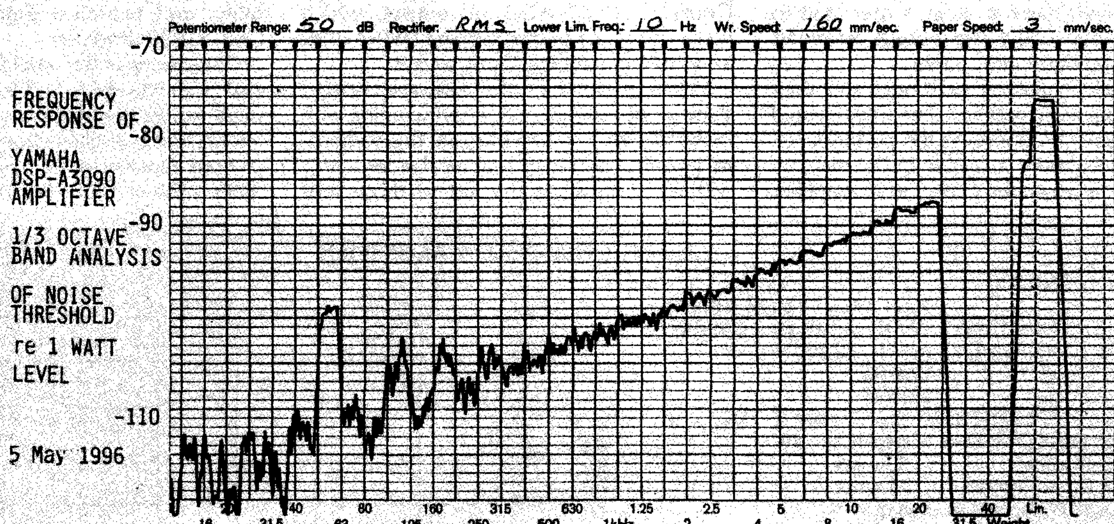
It was only after I got the amplifier home and read the handbook more closely that I discovered that there were a host of additional functions and features which I had not been aware of during my objective laboratory assessment. The first and fore-



With no shortage of connectors, the rear of the DSP-A3090 shows how complex a beast it really is. Note the row of optical connectors at far left, and the video connectors in the centre.







Three measurement plots which give a good idea of the DSP-A3090's performance. At top is the overall response measured from the tuner input, with a 'magnified' version in the centre; note the -3dB points at 6Hz and 125kHz. The bottom curve shows the noise floor, measured using 1/3 octave filters.

most of those functions are the range of digital sound field parameters which are user adjustable and definable.

You can select the timing between early reflections over a range of 0.1 to 2, to make your room sound like a small room or a large space, at will. You can re-adjust the relationship between the direct sound and the first reflections over a 1 to 99msec range, and thereby change the echo characteristics of the space. You can make the room sound 'dead', 'normal' or 'live', by changing the range of the early reflections and the rate at which they decay.

The reverberation time may be set anywhere in the range 1 to 5 seconds, so that the reverberation time can range between that normally expected in your living room, to as long as that provided by a large church or major music hall. Each of these functions can be selected on your TV monitor screen, and adjusted to conform to your specific requirements or personal perception of what is right for you.

When I came to set up the amplifier in my family room, I was forced to use a number of different B&W, KEF and JBL loudspeakers. They were the only speakers I had, which were readily available (moveable) in my office and home. None of the speakers had been designed for AC-3, Dolby Pro Logic, or Lucas THX program content for that matter. Had they been designed for that specific purpose, then the setup procedure and inter-compatibility would have been somewhat simpler.

My only complaint with the amplifier is that the version that I received did not have Universal terminals, which accept banana plugs (as fitted to the version marketed in the USA). After having gone through all the trouble to equip my speaker leads with banana plugs, I then had to detach them to use the output terminals on the amplifier's rear panel...

Yamaha's marketing personnel and their design engineers realised that there would be problems in optimising the performance of speakers already available in the majority of homes in which the DSP-A3090 amplifier system would be purchased. To minimise the setup and alignment problems, the designers have provided built-in test tones which can be fed into any channel — accessible through the remote control. With those test tones, the owner can separately select and individually adjust any loudspeaker's high frequency balance response to match a given room's requirements.

Not surprisingly, Yamaha designers did not stop there. They went one stage further, incorporating a series of digital equalisers and parametric filters through which the high frequency response of each loudspeaker in the system could be individually optimised. The adjustable parameters include the turnover frequency and gain adjustment, as well as the selectivity and gain of a separate tunable parametric equaliser provided for each individual channel.

Once the parameters are selected and initialised, they can be locked, using the 'Memory Guard' function. That lock precludes accidental alteration, which would prove to be mighty embarrassing after you had taken all the time and trouble necessary to optimise your system's performance.

AC-3 player, software

In order to be able to evaluate the system's subjective performance, I really needed an AC-3 compatible Laserdisc player and appropriate software.

The Laserdisc player proved to be somewhat easier to obtain than I would have guessed. After only one phone call, Pioneer Australia sent over a CLD-D99 CD/CDV/LD Player, which is literally Pioneer's latest (and greatest) Laserdisc player. It provides a convenient direct Dolby surround AC-3 RF output, which feeds directly into the Yamaha DSP-A3090 amplifier's matching input socket.

When it came to the software, neither Yamaha nor Pioneer were forthcoming with material with which to evaluate this composite system. I also tried four local video shops without success. At the last of those four shops, the owner admitted that although he had previously rented out Laserdiscs, he no longer did so. He suggested that I go to Double Bay, and visit the Laser's Edge at Shop 12 in the Royal Arcade.

Now although I had been in that arcade on a number of previous occasions, I had simply never noticed that shop before. When I arrived there, I discovered they have an excellent collection of Laserdiscs, including the majority of the new AC-3 encoded titles. Those included *True Lies*, *Forrest Gump*, *The Lion King*, *Guys and Dolls*, *Free Willy 2*, *Dr Zhivago*, *Amadeus* and many others.

The last of the titles I looked at was *The Madness of King George*, which I decided to borrow. It turned out to be an enjoyable film, with an outstanding sound track. (My reasons for choosing it included its lack of requiring a subwoofer. There are no explosions warranting that function, mercifully!)

After spending two hours setting up the sound system to my satisfaction in my family room, I sat down with my wife to enjoy the 'fruits of my labour'. Whilst the visual attributes of the film were reasonably good (considering its NTSC format), the audible component was truly outstanding.

I have previously auditioned other DSP sound systems, all of which were good, and a few of which were outstanding. None of those systems could match the performance and functional panache provided by the Yamaha DSP-A3090 amplifier.

With a suggested RRP of $3499, the amplifier is not cheap. Whilst I am aware of many cheaper DSP and home movie sound systems, I would now venture the opinion that few of those systems can hope to approach the performance, flexibility, and technical functionality of the DSP-A3090 amplifier.

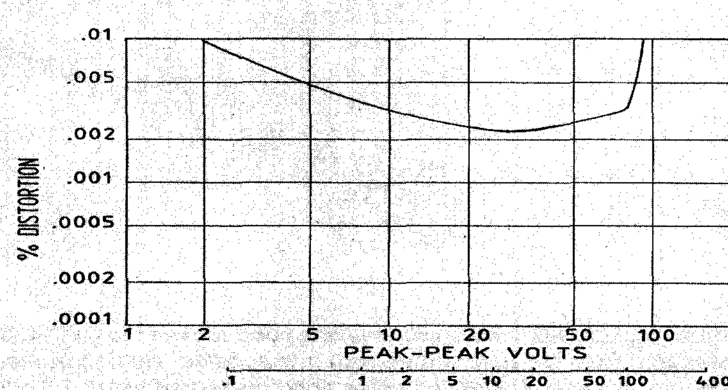
Dimensions of the amplifier are 325 x 170 x 477mm (WxHxD), and it weighs 21kg. The rated power consumption is 400W. Further information is available from Yamaha dealers, or from Yamaha Music Australia; phone (03) 9699 2388 or 1800 805 413. ❖

YAMAHA DSP-A3090 AMPLIFIER

Serial No EO380560Q

1. SIZE: 325 x170 x 477mm (W x H x D)
2. FREQUENCY RESPONSE: 6.5Hz to 125kHz +0.5/-3dB
3. SIGNAL TO NOISE RATIO: (re 1W into 8W)
   - Left Channel -82dB(A)
   - Right Channel -83dB(A)
4. CHANNEL SEPARATION: CD input 77dB(A) @ 1kHz
5. POWER OUTPUT: At onset of clipping into 8W
   - Main Channels 80 watts
   - Front Effects Channels 25 watts
6. DISTORTION: (Right Main Channel at 1kHz)

	1W	5W	20W	50W	70W
2nd	-90	-90	-98	-70	-70
3rd	-96	-94.5	-101.5	-66.5	-66.5
4th	-106	<-110	<-115	-69	-69
5th	-109	<-110	<-115	-65	-65
THD	.0035%	.0037%	.0015%	.084%	.084%



SHORTWAVE LISTENING

with Arthur Cushen, MBE

International broadcasters face competition

The introduction of international broadcasters into the satellite field has resulted in a noticeable reduction in shortwave services, and budget cuts in some areas. However on the other hand new transmitters are scheduled for additional service.

The Radio Australia relay base at Carnarvon is under discussion, with a possible closure; however when I talked with the transmission section in Melbourne the indication was that there is no finality at the moment. Apparently the ultimate plan is to move the 300kW transmitter to Darwin, the 100kW transmitter to Shepparton and to dismantle the remaining 250kW unit.

Carnarvon was Radio Australia's third station to be built, and serves the South East Asian region. The station opened in 1976 as a stop-gap facility, following the loss of the Darwin station due to Cyclone Tracey. In 1984 Telecom significantly upgraded the station with the addition of a 300kW transmitter — the most powerful in the Radio Australia network. The Carnarvon aerials can be directed to any part of the Asian region, from the Indian sub-continent through to China and Japan.

The BBC World Service has announced plans to build two 600kW mediumwave and four 250kW shortwave transmitters at a new site in Oman. These transmitters will in due course replace the present transmitting facilities on Masirah, which is the present BBC Eastern Relay Station, consisting of two 750kW mediumwave and four 100kW shortwave transmitters. The Masirah facility is expected to be taken out of service in the year 2001.

The Maltese Government has declined the renewal of the operation of Deutsche Welle from their Cyclops transmitting site. Deutsche Welle had operated under a 20-year agreement which has expired and as the Maltese Government will not renew this agreement, the transmitters are being dismantled and shipped back to Germany. As well as the Deutsche Welle relay closing this also means that the programmes of the Voice of the Mediterranean have ceased transmission. The Cyclops facility consists of one 600kW mediumwave transmitter and three 250kW shortwave transmitters.

Radio Canada International, after an unsatisfactory future in the past few years when budgeting was always doubtful, has been granted a year's funding by the new Heritage Minister of the Canadian Government.

The Canadian Government plans to add additional taxes on telephone calls, videos, computer services and other areas in which funds can be extracted from the taxpayer, to ensure that the CBC continues to operate.

The latest information from the BBC is that their relay base in Lesotho is to close in September. The base has consisted of two 100kW transmitters, and when they are taken off the air the programme services which they carried will be transferred to South Africa and broadcast on the Meyerton transmitters.

There is uncertainty at the moment in the field of international broadcasting, as new transmitters are put into service and others are closed — mainly for a better position in the target area. This has been the case in South Africa, where the transmitters are now being used by the Voice of America, BBC and Trans World Radio for their services into Southern Africa, to give them a better broadcasting position than they had in the past.

Radio Budapest is 70

Celebrations of broadcasters continue to be held as international broadcasting moves into history. One of the latest to celebrate its long achievement is Radio Budapest in Hungary, which has now been operating for more than 70 years.

Experimental broadcasts began a couple of years before, but Radio Budapest consider December 1, 1925 as the official date of its first broadcasts. It was then that a 2kW Telefunken radio transmitter operated on Csepel Island, south of the Hungarian capital Budapest.

To celebrate the 70 years there were special events including an academic meeting about radio broadcasting in Hungary held in Marble Hall, the headquarters of Hungarian Radio. An exhibition was also opened which included the history of Radio Budapest and the international broadcasts of Hungarian Radio.

Radio Budapest broadcasts in English to Europe 2000-2030UTC on 3975, 5970, 7250 and 9835kHz; 2200-2230 on 3975, 5935, 7250 and 9835kHz; and to North America 0200-0230 on 6190, 9850 and 11,870kHz; and 0330-0400 on 5965, 9850 and 11,870kHz. ❖

AROUND THE WORLD

BANGLADESH: Dhaka has been heard at 1555UTC on 4880kHz. At 1600 there is a time signal, then English news for nine minutes. At 1609 there is comment followed by local music at 1615.

DENMARK: Radio Denmark International in Copenhagen, using Norway transmitters has been heard in English on Sunday at 2045UTC. The programme, presented by Julian Isherwood on 7485 and 9590kHz, is broadcast on the first Sunday of each month, the next broadcast being Sunday July 7th.

ECUADOR: HCJB, Quito is broadcasting to Europe in English at 0700-0830UTC has dropped 6050kHz and is using 11,615kHz; at 1900-2100UTC it is using 15,540kHz. The transmission to the South Pacific at 0700-1130 remains on 5900kHz.

FINLAND: Helsinki in English 1030-1100 has been well received on both frequencies of 13,645 and 15,235kHz.

ISRAEL: IBA Jerusalem has English broadcasts 0400-0415 on 7465 and 9435kHz to North America, and on 17,545kHz to Australia; also 1900-1930 on 7465, 9435, 11,605kHz, 15,615kHz and 15,640kHz for coverage to Europe and North America.

KOREA: KBS Seoul can be heard on Sundays with shortwave feedback at 1030UTC on 11,715kHz, a programme in which Bill Matthews introduces shortwave news. The transmitter is via RCI, Sackville.

NEDERLAND: Radio Nederland at Hilversum has broadcasts to the South Pacific 0730-0830 on 9720 and 11,895kHz from the transmitter on Bonaire; 0830-0900 on 9720kHz; and 0930-1030 on 9720kHz, also from Bonaire. From 0930-1030 the programme is also carried through transmitters in the CIS on 12,065kHz and 13,705kHz. The writer's contribution to Media Network is heard on the first Thursday of each month at 0750 and 0950UTC.

SINGAPORE: Radio One has been heard on 6155kHz with news at 1030 and a business report at 1045. Radio Singapore International, the External Service is heard on 6015kHz opening at 1100, but suffers severe interference from a Chinese signal.

SWEDEN: Radio Sweden, Stockholm can be heard on 9430kHz with English 2030-2100UTC; it was also noted at 0230 on 7115kHz. ❖

This item was contributed by Arthur Cushen, 212 Earn Street, 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 New Zealand Standard Time.

WINRADIO: COMMS RECEIVER ON A CARD

Fitting a complete HF/VHF/UHF communications receiver onto a single plug-in card for a PC is by no means a trivial exercise — particularly as the inside of most PCs is anything but a hospitable environment for a receiver. However Melbourne firm Rosetta Laboratories has met the challenge and come up with its award-winning WiNRADiO, fully designed and built in Australia.

by JIM ROWE

Most people who have tried using a communications receiver or scanner anywhere near a PC and its peripherals will be aware that computer systems generally radiate a huge amount of RF noise — spurious signals, many of them surprisingly strong, and spanning a wide range of frequencies. On the surface, then, the idea of trying to make a communications receiver/scanner work *inside* a PC seems a bit daft.

Yet at the same time, there are many potential benefits. A significant proportion of the cost of many traditional communications receivers is tied up in the 'user interface' — the front panel controls, frequency readout and signal strength indication, and so on. This means that quite a lot of the hardware can be 'left out' if the PC's screen, keyboard and mouse can be used to perform these user interface functions.

In this sense, communications receivers are similar to test instruments, where manufacturers have been able to achieve quite a significant saving by producing PC-driven versions of their instruments, with the PC's display and controls replacing a complex array of dedicated displays and controls on the traditional instrument front panel.

Another potential advantage of having a PC-based communications receiver is that software can be used to control many of the more specialised functions — like control and storage of scanning parameters, provision of receive channel/mode memories and so on. Having these functions controlled by software rather than hardware or firmware gives greater flexibility, virtually unlimited memory depth and the ability to customise receiver functions relatively easily.

Yet again, having a complete receiver on a single PC card has the potential to allow a number of receivers to be controlled by the one PC. This could be an attractive proposition for people and organisations who must monitor a large range of frequencies on a continuous basis.

Of course we shouldn't forget that virtually all modern scanners and communications receivers have one or more microcomputers inside them anyway, to control their front panel and other functions. So the idea of putting a receiver inside a PC is really just reversing the usual arrangement, where the computer

The hardware side of the WiNRADiO package — a medium-length card which plugs into a standard AT-bus slot. As the inside of a PC is not the ideal environment for a communications receiver, all of the actual receiver circuitry is on a separate PCB and enclosed in a shielding box.

The WiNRADiO software presents you with a complete "virtual front panel' for the receiver, with both digital and analog 'tuning dials' and just about all of the usual communications receiver controls.

is inside the receiver. And since it's clearly possible to achieve a high order of receiver performance with the latter arrangement, the former must be feasible as well, at least in principle...

Mind you, the microcomputers inside a modern communications receiver have been especially designed for the task, with a very high level of shielding. This is hardly the case with most of today's PCs!

Enter WiNRADiO

Apparently this challenge wasn't one to daunt Melbourne firm Rosetta Laboratories, though. Taking it in their stride, they've produced the new WiNRADiO package — a combination of a communications receiver/scanner on a medium-length AT bus card, plus matching control software. And the package has attracted a lot of interest, especially after it won a 'Best New Hardware' award at the recent PC96 show.

As the name suggests, the WiNRADiO software is mainly intended to run under Windows 3.XX or Windows 95, although there's also a DOS program called DOSRADIO that allows command-line operation. The card and software will run on a 386 or higher PC, with 640KB of memory minimum for the DOS software or at least 4MB for the Windows software.

WiNRADiO's performance specification is quite impressive. A PLL synthesised superhet, it covers from 500kHz (just below the AM broadcast band) right up to 1300MHz — well into the UHF region, and just above the 23cm amateur band. The tuning step can be varied from a minimum of 1kHz up to 1MHz, and four different reception modes are available: AM, SSB, FM-N (narrow band) and FM-W (wide band). The receiver has a rated nominal input sensitivity of 1uV.

Like most sound cards, the WiNRADiO card has its own on-board audio amplifier. This develops up to 200mW of audio, and is intended to drive an external 8-ohm speaker.

The card itself measures 122mm high, extends 294mm forward from the rear mounting bracket, and has a total width of about 20mm — so it may need to occupy two adjacent slots in some systems. As the card is fully software controlled, the only hardware adjustment is a jumper strip used to select its I/O address (default 180H). On the rear bracket there's only a BNC socket for the 50-ohm antenna input, and a 3.5mm stereo jack for the external speaker.

Actually the main card itself appears to be used only for the digital circuitry involved in interfacing the receiver to the rest of the computer. This uses surface-mount chips on the usual 'copper side' of the card. The receiver proper is on a separate smaller board, fully enclosed in a sturdy metal shield box measuring 185 x 107 x 15mm, attached to the other side.

Incidentally at the 'front' end of the board on the shield box side, there's clear provision for another daughter module of some sort, with the silk-screened legend 'DSP Option' — presumably for a planned future audio signal processing option. At the rear bracket end there's also provision for a DB-9 connector, whose purpose is as yet unexplained...

Needless to say the software side of the WiNRADiO package is of particular interest, because it provides the user interface. And although the receiver *can* be operated using the DOSRADIO command line program, most users are going to use the Windows-based software because it's far more friendly and convenient.

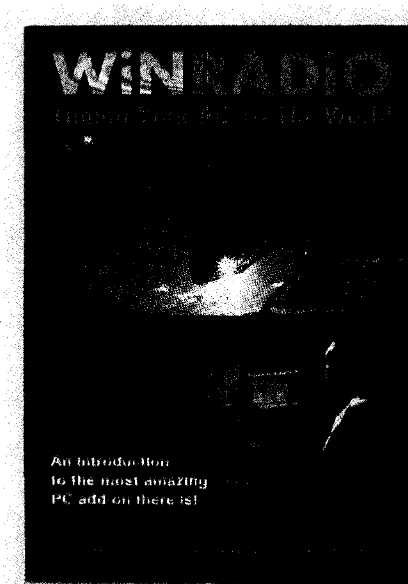
As you can see from the screen dump, the software essentially provides a 'virtual communications receiver' front panel on the monitor screen, with on-screen displays and various 'controls' that you operate using the mouse or keyboard. It's all quite intuitive, especially if you've ever driven a conventional communications receiver.

The most obvious display is the digital readout for tuning frequency, which has large green characters and is reminiscent of a conventional fluorescent readout — except that it's rather more readable. Below this display is an 'analog tuning dial' equivalent, a little like the horizontal tape bandspread dial on some traditional receivers. Both of these readouts are continuously updated, and always show the current carrier frequency.

Down in the lower left-hand corner of the virtual panel, there are two smaller 'displays', one showing the local time and date, and the other World time and date. The local time and date are taken from those maintained by your computer's DOS, while the World time/date are set up using the program's Configure menu options. (They will obviously depend on your longitude.)

Along the upper right of the panel, three smaller displays are allocated to display of the current tuning step, the receiver memory channel in use (in memory mode) and the BFO offset (used for SSB or CW reception, in SSB mode). Then in the centre right there are two even smaller displays, showing the current volume control and squelch control settings. Below these again is a larger 'S Meter bar graph' display, showing the strength of the signal currently being received (if any). And finally near the bottom right-hand corner there are three 'virtual LEDs', used to indicate Squelch operation, PLL lock status and the 'Power' status of the WiNRADiO receiver. This last 'LED' is right next to a 'power switch button' in the very corner of the panel, which you click on with the mouse to enable or disable reception.

Turning now to the receiver 'controls', a couple of 'buttons' at the top left of the virtual panel are used to select either 'DX' (full) or 'Local' (lower) sensitivity — with the latter used to prevent overload or cross-modulation from very strong signals. Whichever setting is selected becomes 'illuminated' to



The WiNRADiO package includes this handbook, which is particularly well written.

remind you of the current status.

Just to the right of the tuning displays, there are two pairs of small 'buttons'. Those to the side of the digital display allow incrementing or decrementing of the tuning itself, in tuning steps which you can select via the display and button immediately to the right. On the other hand the two lower buttons, alongside the 'analog dial', allow you to change its scaling — or effectively 'zoom in or out'. (You can't do *that* on a traditional bandspread dial!)

Below the analog dial again is a large 'tuning knob', which you can also use for tuning. When the mouse cursor is positioned on the top half of the knob, the left and right mouse buttons take you down or up in frequency respectively; on the other hand if you position the cursor on the bottom half of the knob, this functioning of the mouse buttons is reversed. In each case the mouse cursor changes into a small curved double-ended arrow, curving either upward or downward as appropriate; it's all quite intuitive.

By the way, you can also tune the receiver using the computer keyboard. For example you can increment or decrement the frequency in the currently chosen step size, simply by pressing the Page Up or Page Down keys. To jump to a new frequency altogether, you simply key in the new figure and hit the Enter key.

Four large 'buttons' to the left of the tuning knob are used to select the reception mode — AM, SSB, FM-N or FM-W as appropriate. As with the DX/Local buttons, the selected mode button 'illuminates' to indicate the current mode. In SSB mode the BFO Offset 'display' at upper right also becomes active, allowing you to adjust the offset in 5Hz steps by up to 3kHz either side of the carrier. This allows convenient LSB or USB reception, and also some degree of adjustment to separate a CW signal from nearby signals...

Alongside the volume and squelch displays at centre right, there are again small increment/decrement buttons to allow convenient adjustment of both settings. The volume level can be adjusted from 0 to 31 (i.e., 32 levels), while the squelch level (the signal threshold below which receive muting takes place) can be adjusted from 0 to 100. Just to the right of the squelch display and buttons is a larger button marked Mute, which can be used for fast silencing of the receiver — when the phone rings, for example.

Between the tuning knob and the volume and S-Meter displays are a group of five buttons, used for control of the receiver's scanning functions. WiNRADIO provides a fairly comprehensive range of scanning options, from immediate 'scan up' or 'scan down' modes through frequency range and memory range scanning. As with many modern comms receivers you can enable automatic storage in memory of signal frequencies found during a scan.

Setting up WiNRADiO's scanning parameters is quite straightforward, using dialog boxes which appear at the appropriate times. In fact when it comes to setting up both the scanning and memory functions, the program seems significantly more 'friendly' and intuitive than most of today's standard communications receivers (some of which require quite tricky keypress sequences).

How we found it

Rosetta Labs sent us a sample WiNRADiO, which we tried out in a typical 33MHz 486 machine running Windows 3.1. Both card and software installed without any real hassles, and once we hooked the receiver to a reasonable outdoor antenna it sprang to life.

Incidentally, WiNRADiO comes with a Handbook/User Manual, and this is particularly comprehensive and well written. As well as providing the necessary information on driving WiNRADiO, it also gives an excellent introduction to shortwave listening, with antenna data and a surprising amount of information on world frequency bands and where to look for interesting signals. Included in the many data appendices there's also the 'nitty gritty' reference information needed to write your own programs, to make use of the WiNRADiO card and its DDE/DLL software interface. In short, we'd describe the manual as first class.

(About the only thing it *didn't* seem to include was the correct wiring for the 3.5mm stereo plug used for the external speaker. We had to guess the correct connections, and luckily got it right...)

The WiNRADiO kit also includes a 'starter' antenna consisting of a 3m length of coaxial cable with a similar length of unshielded wire at the end — the idea being to dangle the unshielded section out of the window, or whatever. As with any communications receiver, however, a decent outdoor antenna will give much better results.

First off, we tried it out on a variety of bands, using a balanced long-wire antenna for the lower frequencies and a discone antenna for VHF and UHF. In general it gave a very good account of itself, although reception did seem rather noisier than with our usual communications receivers (Icom IC-R72 and IC-R100) using the same antennas. We found out by accident that this was largely due to WiNRADiO picking up a noticeable amount of RFI from the computer's video card — when the Windows screen saver almost blanked the screen (we use the 'starfield' pattern), the noise level dropped markedly.

Sufficiently encouraged by the results so far, we checked out the receiver performance with our RF signal generator and SINAD measuring setup. Here the sensitivity for 12dB SINAD, with the receiver set to the 'DX' position and using AM mode for the HF range and FM-N for the VHF and UHF ranges, turned out to vary from below 0.9uV up to about 2uV, near the top end. In the 'Local' position the readings rose somewhat, moving up to around 5uV. These figures agree reasonably well with the rated nominal sensitivity of 1uV, and suggest that although WiNRADiO may not be quite as sensitive as the 'hottest' of modern communications receivers or scanners, it's probably capable of doing the job quite adequately in most practical situations...

The measured bandwidth of WiNRADiO in AM and FM-N modes was around 14kHz, rising to around 200kHz in FM-W mode and dropping to about 5kHz in SSB mode.

Summarising, then, the WiNRADiO card seems to be well conceived, nicely made and a good solid performer. The Windows software is particularly friendly, and if anything rather easier to use than most conventional receivers and scanners. The User Manual is also excellent, unlike many computer products from overseas.

So on the whole, WiNRADiO should be well worth considering, both for the professional needing a compact computer-driven comms receiver, and also for the newcomer to shortwave listening/scanning looking for a reasonably priced and especially easy to drive receiving setup.

The quoted retail price for the WiNRADiO package is $799.00, including sales tax. An optional 'World Radio Station DataBase Manager' program is also available, with a database listing over 300,000 radio transmitters from all over the world, for a further $299.00.

Further information is available from Rosetta Laboratories at 222 St Kilda Road, St Kilda 3182; phone (03) 9525 5300 or fax (03) 9525 3560. They can also be reached on the Web, at **http://www.kiss.net.au/winradio.** ❖

A SHORT HISTORY OF EARLY RADAR - 1

Here is the first of three articles explaining the development of radar from its earliest beginnings to the modern systems we see in use today. In the articles we will be looking at some of the major technical challenges which had to be overcome, especially in the early days when radar was used mainly to help combat the threat of bomber aircraft during the Second World War. It remains an extraordinary story of technical innovation — which, although born of military necessity, now also contributes to much of the comfortable modern life we now lead.

by JOHN BELL, B.E., M.Eng., F.I.E.E., F.I.E.Aust

Today radar is an entrenched factor of modern life, whether it is being used to assist in the orderly control of civil aircraft, as a navigation aid, for mapping, predicting weather patterns, military purposes or even to detect speeding motorists. Furthermore the technical challenges needed to develop radar have necessitated the invention of new electronic devices and techniques, which now permeate our modern world — from the magnetron used in our microwave cooker to advanced communication and digital techniques.

Because of the secrecy and often haste associated with military applications, and one must add commercial enterprises as well, the development of radar has not always been well recorded. In fact a definitive history could be expected to run to many volumes.

The history of radar is also a history of ideas, as well as of their implementation. It cannot be viewed in simplistic

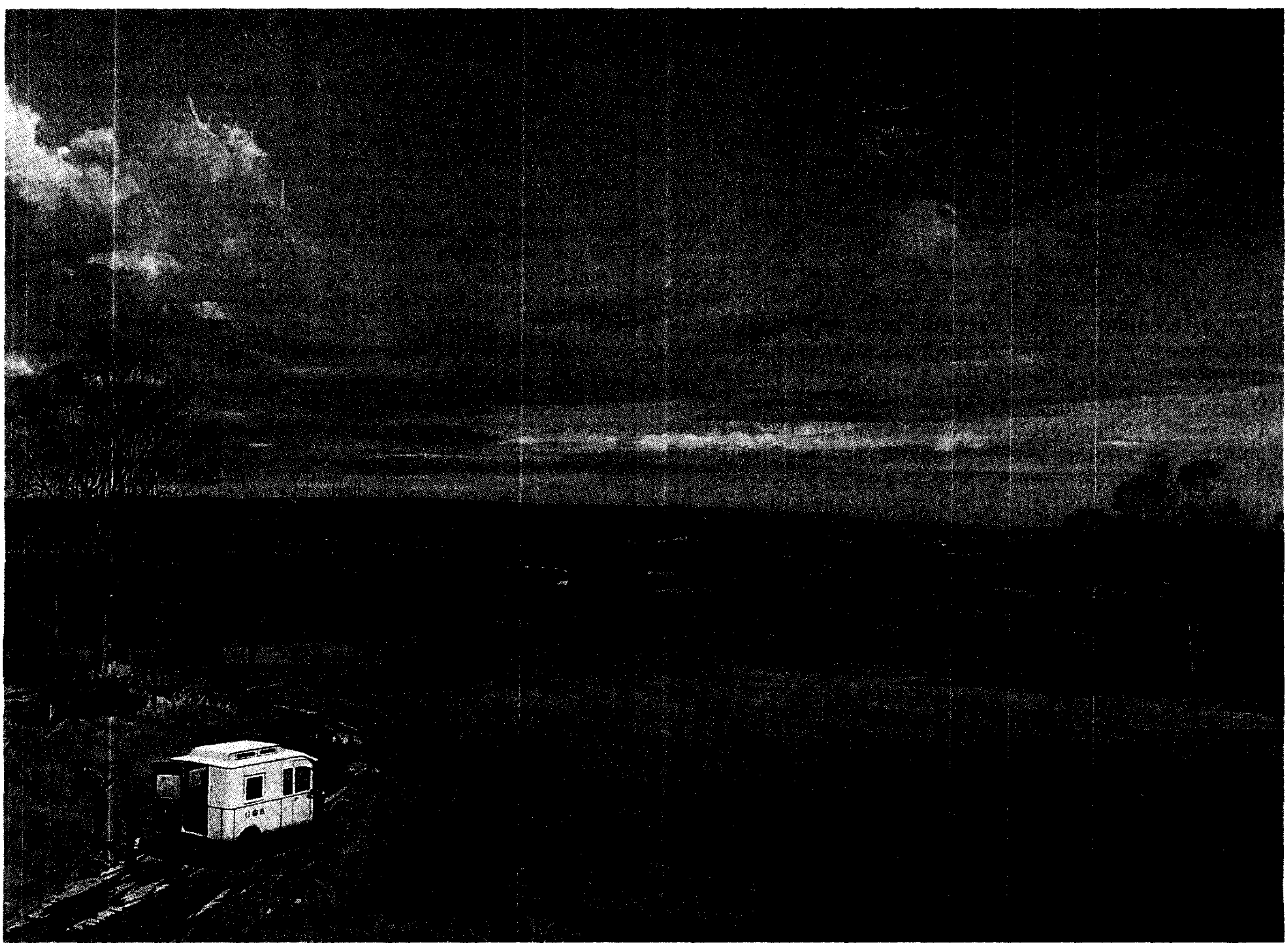
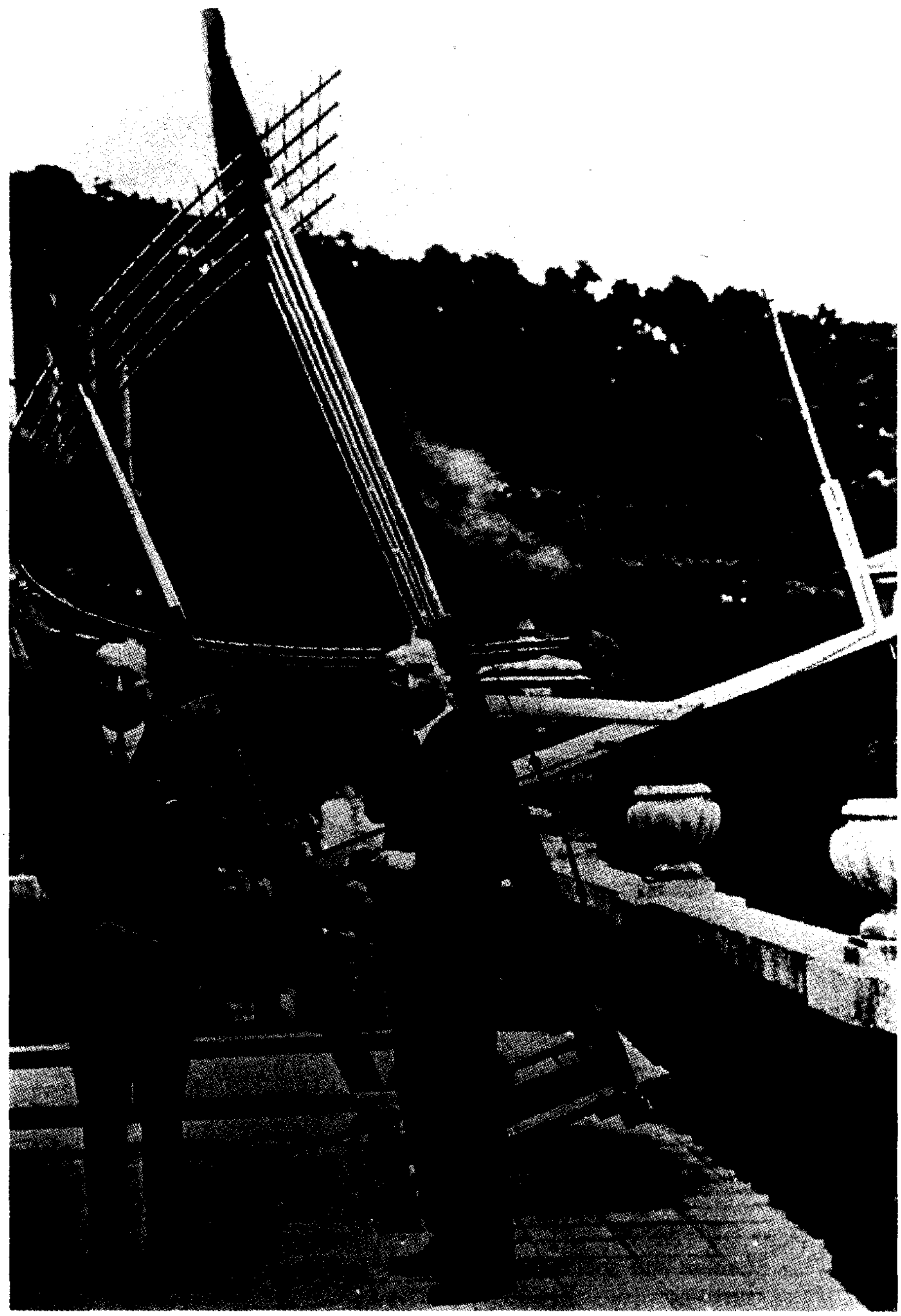


Fig.1.2: An artist's impression, drawn from a sketch by Arnold Wilkins, of the Daventry experiment which heralded the birth of radar in the United Kingdom (Courtesy GEC-Marconi).

Fig.1.1: Guglielmo Marconi (left), pictured during experiments in Italy in 1930, on directional propagation of 57cm waves (526MHz).



terms. Given its initial rapid development and — all too often — lack of supporting documentation, the task of reconstructing these ideas and accomplishments can only be accomplished little by little. There are many unrecorded interactions between cause and effect, need and implementation.

The whole picture is yet to unfold, and these articles are just one part of that process. What can be said is that the history of RADAR, an acronym for 'RAdio Detection And Ranging', was initially associated with the development of radio communication, and it is in this field that we must start our story.

In 1820, at The University of Copenhagen, Professor Oersted showed that a magnetic compass needle could be deflected if brought near enough to a wire carrying sufficient electric current. In doing so founded the science of electromagnetism.

Maxwell's prediction

It had to wait until 1855 before John Clerk Maxwell, a scientist working at Cambridge University, developed the theory of electromagnetism and used this to predict that an electromagnetic field could travel across space in the form of a wave at the speed of light. This prediction was brilliantly confirmed by Heinrich Hertz in 1888, who also demonstrated the reflecting properties of radio waves using metal plates, even suggesting that they could be used to detect a ship.

Nikola Tesla postulated that radio waves could be used to locate objects in 1900 and again in 1917, but no known experimental work was carried out. In 1904, a German Engineer, Christian Hulsmeyer, was to propose and construct a rudimentary collision avoidance system for ships at sea; but the technology to develop an effective workable system was lacking, and interest rapidly waned.

It was 1895 before Guglielmo Marconi had the inspiration of adding aerial and earth wires to the crude transmitters and receivers of the day, and in one simple step increased their ranges dramatically. Marconi went on to demonstrate the feasibility of long-range radio communication in his famous experiment of 1901, when a simple message was successfully transmitted across the Atlantic.

Marconi and others were also involved in parallel developments, particularly in the Naval sphere, where ship-to-shore and ship-to-ship communications were required for both commercial and military operations.

These early transmitters and receivers were relatively crude affairs, but the introduction of the diode and triode valves, tuned circuits and reasonably effective modulation and demodulation systems entrenched radio as a practical communications medium — including crude direction finding — prior to the commencement of the Great War of 1914-18.

With the cessation of hostilities, radio (commonly called 'wireless') broadcasting boomed. Most homes in the Western world had receivers. Improvement in the supporting technology saw the introduction of tetrode and pentode valves, the superheterodyne principle, improved modulation and demodulation systems and supporting components.

Commercially available cathode ray tubes suitable for domestic use made their appearance, and with other associated developments led to the introduction of a fledgling television service in London. Relatively sophisticated test equipment became available, and the knowledge of the theoretical concepts of audio and radio improved immensely. And, with the backing of a vibrant manufacturing industry, the stage was set to accommodate other advances outside of simple domestic and general commercial communications.

A Short History Of Early Radar - 1

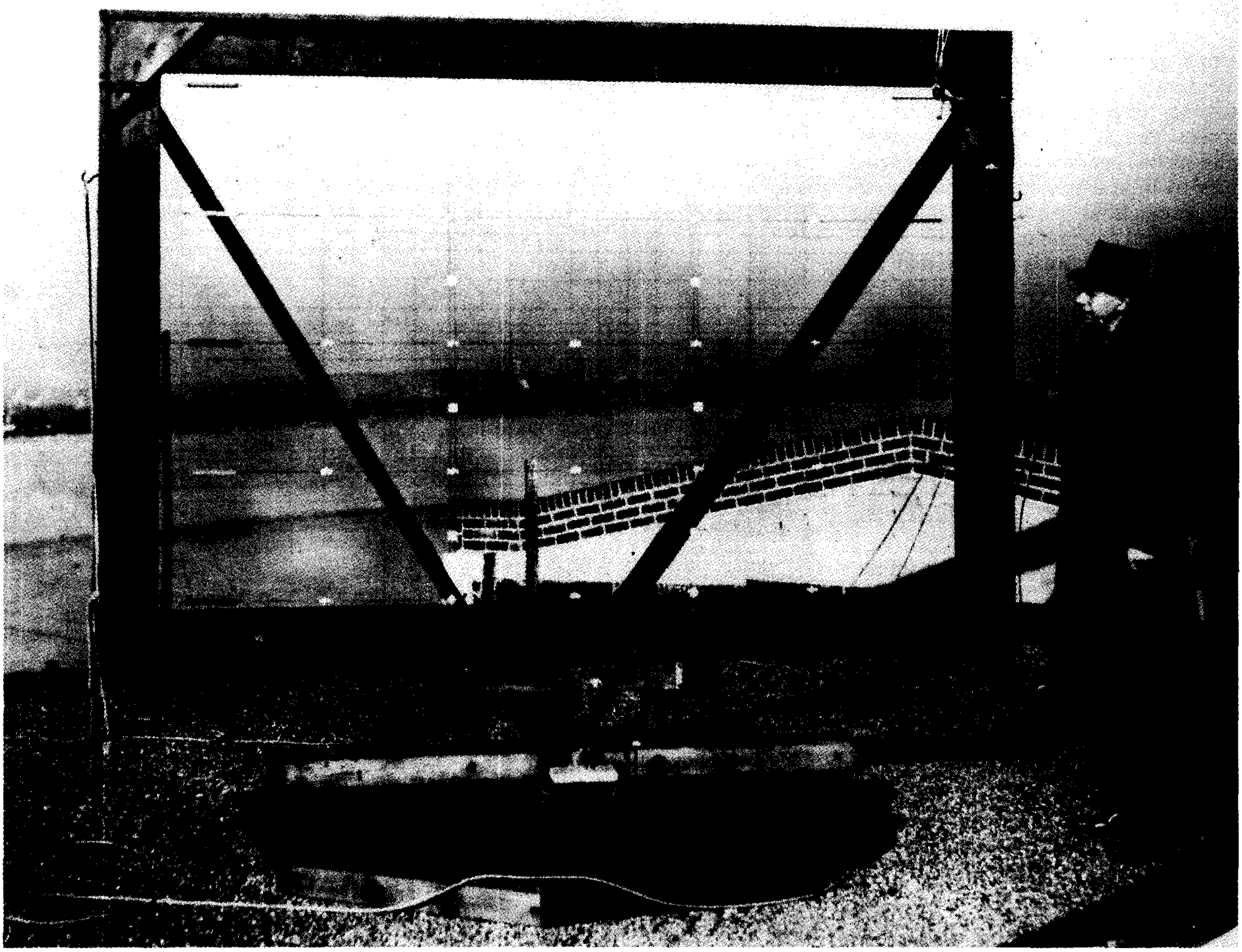


Fig.1.3: Dr Robert E. Page of NRL is seen examining the planar antenna later used with the experimental 200MHz radar installed on USS Leary in April 1937. (Photo courtesy NRL)

Detection by radio

In 1922, Marconi had spoken to the American Institute of Electrical Engineers on the subject of the possible detection of ships in fog using radio techniques. It was also in this year that Albert Hoyt Taylor and Leo Young of the US Naval Research Laboratory (NRL) detected a wooden ship — probably the first deliberate use of radio (for it was not then called radar) to detect such an object.

In 1930, whist checking out an aircraft HF system, an observant Lawrence Hyland noted that modulation of the signal between two points was occurring when aircraft passed overhead. This pertinent observation was to set in train serious research at NRL in aircraft detection, closely followed by parallel research by the US Army.

By 1932, Taylor and Hyland had developed prototype equipment capable of detecting an aircraft at about 80km. The system they used is today called *bistatic* radar and involved a physically separate transmitter and receiver. Elsewhere, other experiments were being conducted using similar techniques, for instance in probing the characteristics of the ionosphere.

The technology which was later to be used in radar was advancing, albeit slowly, with most interest being centred around improving commercially viable broadcasting and communications systems — plus developing television. However, these commercial pressures led to solid advances in general communications and electronics, and to the establishment of a viable manufacturing infrastructure which was later able to accommodate the design and production of the more sophisticated radar systems.

Meanwhile, the dark clouds of war were gathering again in Europe and it was recognised that there appeared to be no effective means of countering the bomber, now seen as a formidable weapon of mass destruction. It was thought that the bomber would always get through, a view seemingly reflected by the then awesome destruction of defenceless cities during the Spanish Civil War. In the Basque city of Guernica, for instance, some 1600 civilians had been killed.

This horrific matter was not long lost on many political and military leaders throughout the world, with the result that innovative research work to counteract the perceived airborne threat was in progress in the USA, France, Japan, Russia, Holland, Germany, Italy and the UK during the mid-1930s. (The use of sound-locating equipment, infrared and other techniques were assessed and discarded, some to reappear many years later.)

It will be seen that the major initial drive was to develop a method of marshalling ground, sea and air defences against hostile aircraft. Another, and at the time a lesser matter which also needed attention, was the possibility of counteracting radio controlled aircraft and flying bombs — for both the USA and the UK had carried out limited experiments in these fields.

Unknown to them, Germany was well ahead in this technology and, although such developments turned out to have only limited military value during World War II, the subsequent development of the radar-guided or inter-continental missile was to be another matter.

Clearly the history of radar is inextricably bound up with the history of the modern air war, commencing some 55 years ago.

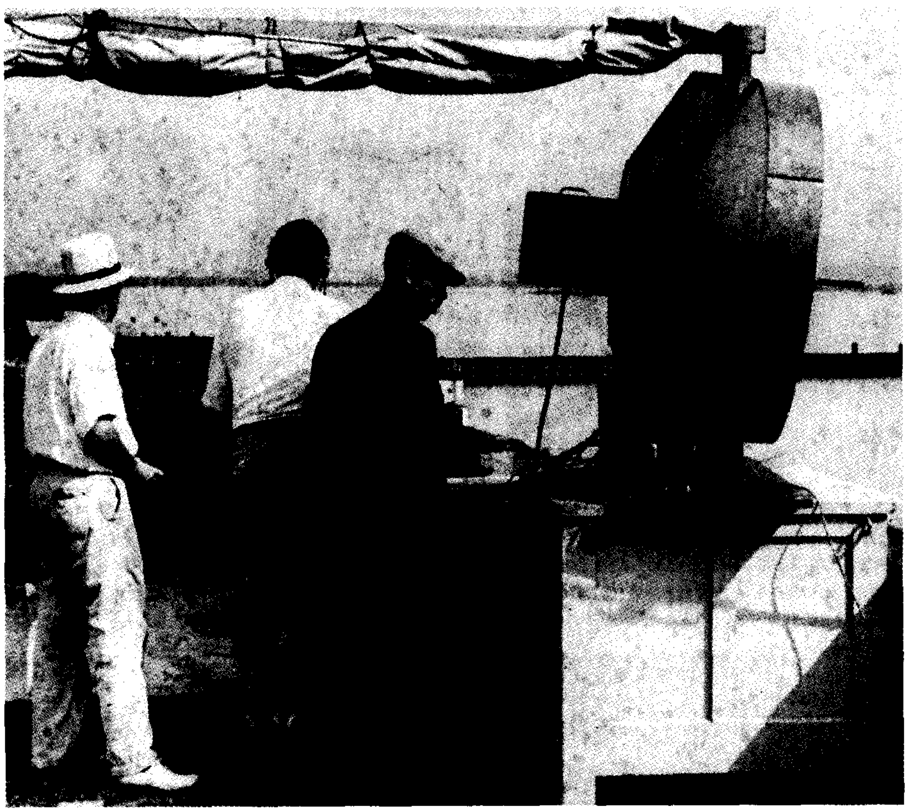


Fig.1.4: Dr A. Hoyt Taylor, Dr C. Cleeton and Mr J.P. Hagen of NRL in 1937 with the experimental centimetric wave radar. (Photo courtesy NRL)

Differing priorities

Although they were subsequently to meld somewhat, there were differing initial priorities determined by perceived threats and operations. Broadly speaking Britain's initial major preoccupation was in the protection of its cities from bombers. With no such threat to its mainland, the US concentrated on Navy and Army support, for instance in aircraft detection and gun-laying operations in this new field. It was to be 1939 before serious attention was to be given to the defence of their mainland.

Likewise Japan, with Pacific operations in mind, was interested in seaborne operations rather than in home defence. Germany split her efforts between the control of her bomber streams and the development of radar for air defence and navy operations. The cacophony of war was soon to change many of these earlier priorities.

Due to the normal secrecy surrounding military developments, and one suspects the day-to-day pressures of wartime activities, much of the pioneering work conducted up to and during World War II went unpublished — a notable exception being the MIT Radiation Laboratory Series[1].

In the UK, H.E. Wimperis, Director of Scientific Research at the Air Ministry and his assistant A.P. Rowe initiated action in 1934 to inquire how it might be possible to counter the perceived threat posed by bombers. This resulted in the formation of a special Air Ministerial committee under the Chairmanship of Henry Tizard.

One of the first actions of Tizard's committee was to contact Robert Watson Watt, later (but probably incorrectly) to be known as the 'Father of Radar', for advice. All sorts of ideas had been put forward[2], including sound detection, infrared techniques and the concept of a 'Death Ray' — for it was envisaged that such a ray might be able to disable a bomber's engines or crew[3].

In January 1935, Watson-Watt asked Arnold Wilkins of the Radio Research Station at Slough to evaluate this latter concept. But 'Skip' Wilkins easily demolished the idea by pointing out that there was no suitable power source available — added to which certain geometric and physical limitations would need to be overcome too. However, he proposed that it would be technically feasible to detect aircraft by using appropriately situated transmitters and receivers, for the effect of aircraft induced 'flutter' on radio transmissions had already been observed.

Historic experiment

Accordingly an experiment was mounted using the powerful shortwave 49-metre BBC transmitter at Daventry, and a receiver mounted in a van some kilometres away. As an Heyford bomber flew through the continuous signal, it was seen that the direct and indirect signals reflected from the aircraft interfered with each other in phase, so moving a spot on a CRT — thus radar in the UK was born on 26 February 1935 (see Fig.1.2).

The type of radio aircraft detection used in the Daventry experiment, using a well-separated transmitter and receiver, and as noted earlier is today known as bistatic radar. By and large such elementary bistatic systems soon tended to fall into disuse, because the bistatic system with geographically well-separated antenna systems (ideally many kilometres apart) is unsuitable for most situations, certainly so when mobility and tight-knit control are required.

Many years later, particularly after World War II, they were to find favour again, particularly in the long-range surveillance role, when HF transmissions are able to use ionospheric effects to see over the horizon — the so-called 'over-the-horizon' radar. So, after the Daventry experiment, the move in the UK was therefore directed towards designing *monostatic* radar systems — in which the transmit and receive antennas were co-located or used the same antenna.

Bound by the same physical laws and the state-of-the-art of the general electronics industry, it is no surprise that independent research and development in the

Early Radar...

countries concerned followed remarkably similar patterns. Indeed, the advantages of monostatic pulse radar systems was recognised quite independently in many countries, with the result that work on continuous wave and bistatic radar systems tended to languish — though France and Russia were to be exceptions.

Although Robert Watson-Watt and his co-workers have been regarded as leaders in the development of radar, it is unwise to claim that any country or person was first in the field. We have already noted that in the USA successful experiments to detect ships had commenced as early as 1922, and by the time that the Daventry experiment was conducted aircraft could be detected at about 80km.

In 1937 NRL had an experimental 200MHz radar installed on the *USS Leary* (see Fig.1.3) and experiments were being conducted in centimetric wave radar (Fig.1.4). In 1939 their prototype XAF radar was installed on the *USS New York* (see Fig.1.5) and was being tested in Fleet operations.

Clearly, by the mid-1930s, the possible use of advanced radio techniques to assist in the detection and engagement of hostile targets was well recognised and supported by many forward thinking military planners. It was a technology whose time had come, and its further development will be explored in succeeding articles.

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2. Burns R.W., '*A Prehistory of Radar*', IEE Review, April 1992, pp 143-146.
3. Jones R.V., *Most Secret War*, Hamish Hamilton, London, 1978. ◆

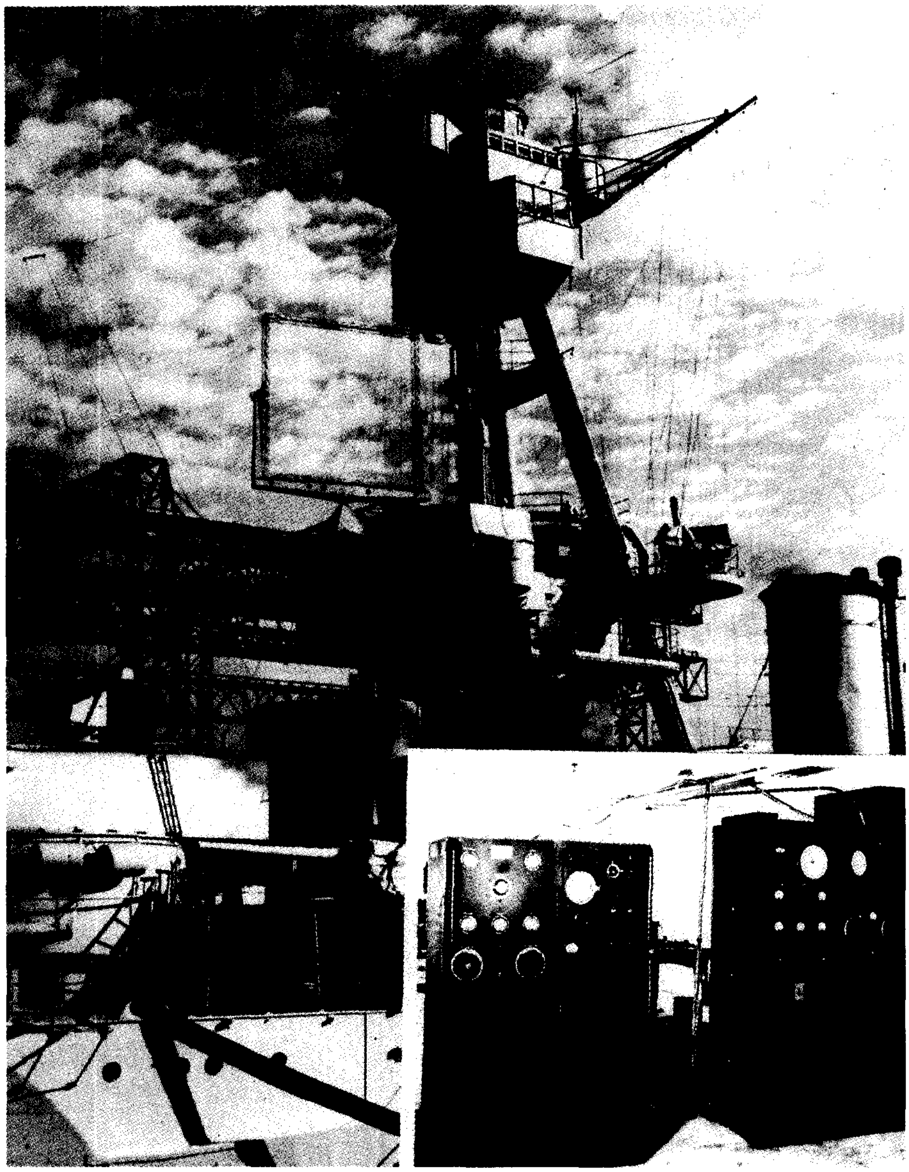


Fig.1.5: The model XAF radar, developed by NRL and installed on USS New York, was the first known radar to be used in fleet operations. The transceiver is shown on the left of the insert (lower right). The model CXAM shown in the right of the insert was the updated version, manufactured by RCA and was the radar with which the US Navy entered the war. (Photo courtesy NRL)

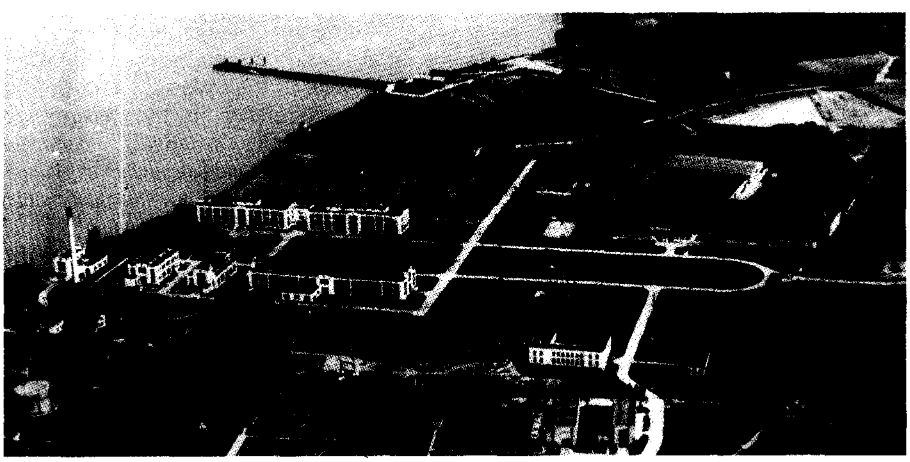


Fig.1.6: An aerial view of the Naval Research Laboratories in 1939. It was soon to expand rapidly. (Photo courtesy NRL)

About the author

After graduating in Radio and Electrical Engineering, John Bell was involved in the instrumentation of military aircraft and the design of aircraft and missile guidance systems.

He left the UK in 1961 to join the Australian Department of Defence where he became involved in the testing of military systems, Operational Research, Anti-Submarine Warfare, Signal Processing, Science Adviser to Army Training Command and Electronic Warfare before retiring to become a consultant.

NEW BOOKS

Collector's guide

SINCLAIR ARCHEOLOGY — The Complete Photo Guide to Collectable Models, by Enrico Tedeschi. Published by Hove Books, 1996. Soft covers (comb binding), 297 x 210mm, 130 pages. Price £10.00 plus £2.00 P&P.

For anyone who has been involved in the electronics industry for a good few decades, like myself, the name Clive Sinclair is likely to conjure up many memories and impressions. I think the first of his products that I came across personally was one of the early class-D (switch mode) audio amplifier modules, triumphantly advertised as having 'unmeasureable distortion'. That turned out to be quite true — simply because a distortion meter would 'go berserk' if you brought it within a couple of metres of the amplifier when operating!

There were of course a host of products from this highly prolific British inventor and entrepreneur — amplifiers, tiny radios, calculators, watches, pocket TV receivers, test instruments, computers and of course his ill-fated C5 electric tricycle. All embodying highly innovative concepts, but many of them rather poorly manufacturered and generally rather disappointing in terms of either performance or reliability (or both). All of which earned 'Uncle Clive' a knighthood from his grateful country, and almost equal proportions of fame and notoriety everywhere else.

The author of this interesting self-published book is a radio historian, writer and collector of Sinclair products, and has written it to help others interested in the man and his products. It doesn't provide a great deal of text, but there's a surprising amount of information nonetheless — reproduced from advertisements, sales brochures, kit instructions, reviews and so on. There's also a chronological listing of Sinclair's publications and products, and a bibliography.

In short, an informative reference on this rather eccentric icon of British electronics, which should be of interest to many collectors and historians.

It's available from the author at Hove Books, 54 Easthill Drive, Portslade, Brighton BN41 2FD, UK; or phone/fax ++441273 410749. (J.R.)

Satellite comms

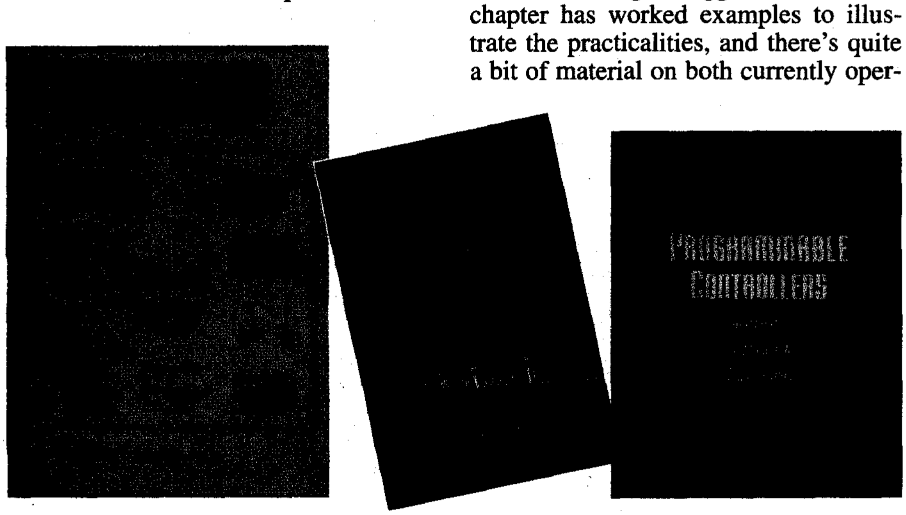
SATELLITE COMMUNICATIONS, by Dennis Roddy. Second edition 1996, published by McGraw-Hill. Hard covers, 235 x 160mm, 516 pages. ISBN 0-07-053370-9. RRP $150.

The second edition, updated and expanded, of a textbook first published in 1989. The author is a Professor of Electrical Engineering at Lakehead University in Canada, with over 40 years of experience in industrial and technical education.

Basically it's an introduction to the field of satellite communications systems and concepts, for the senior technical college student and university undergraduate. The emphasis is on developing a clear understanding of the fundamentals, with enough theory and maths to allow this to occur but not enough for the reader to get bogged down. Each chapter has worked examples to illustrate the practicalities, and there's quite a bit of material on both currently operational systems and those in the process of implementation (like Iridium).

The text is written in a clear and consistent style, and there are around 200 illustrations. The content also seems reasonably up to date — or as much so as any textbook is likely to be, in such a fast-moving field. In short, then, it seems quite a sound and accessible introduction to this somewhat specialised field.

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



Logic controllers

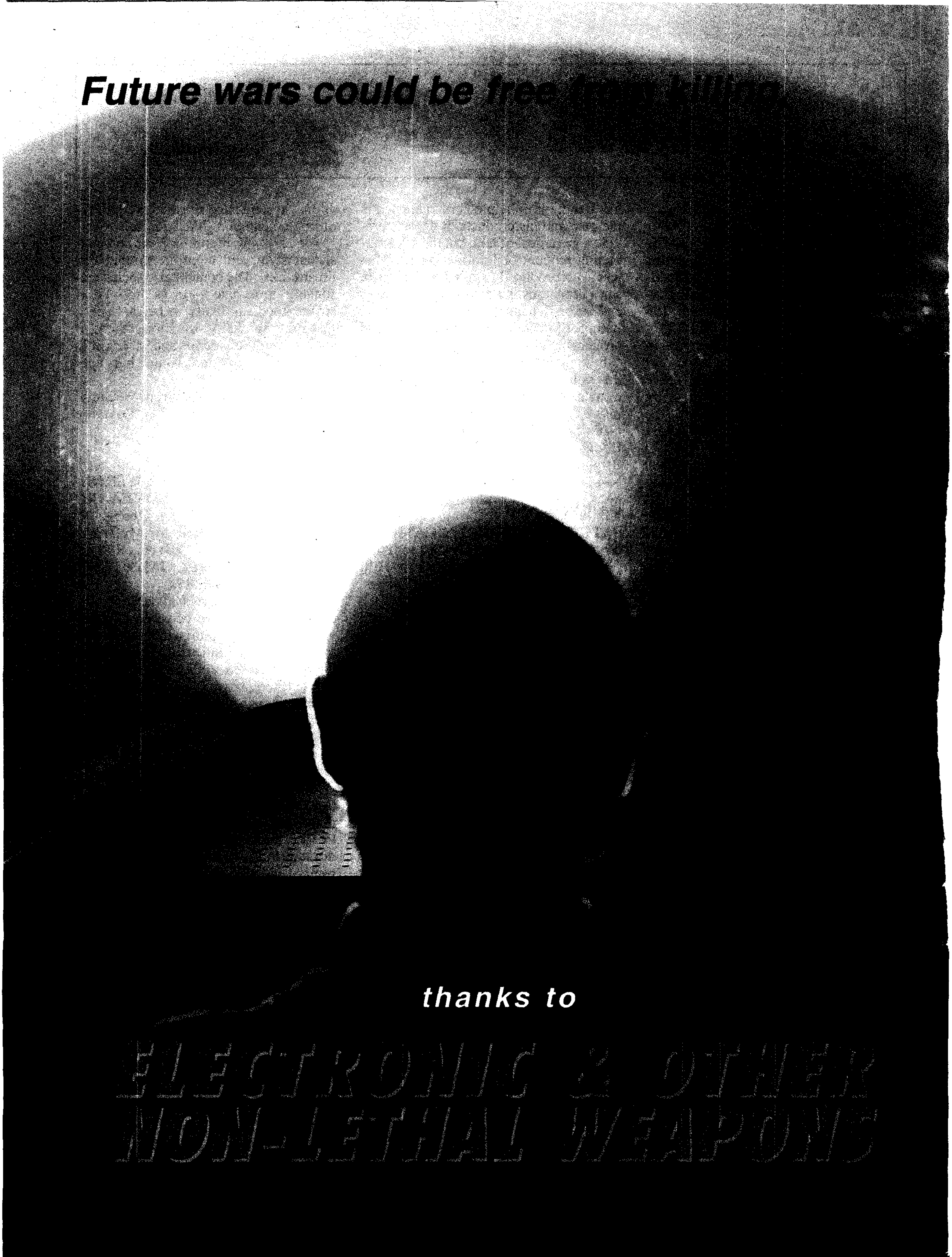
PROGRAMMABLE CONTROLLERS, HARDWARE, SOFTWARE & APPLICATIONS, by George L. Batten, Jr. Published by McGraw-Hill, 1994. Hard cover, 190 x 240mm, 281 pages. ISBN 0-07-004214-4. RRP $99.95.

Like its closely related relative, the computer, there have been many books written about programmable logic controllers (PLCs). Interestingly, many of these books see a PLC as something quiet different from a computer, or at least ignore the similarities. This book takes the opposite approach and relates the two devices. Another difference is its overview approach, which means it is not about a particular brand of PLC.

It's aimed at giving a solid introduction to PLC concepts and the latest technologies. About half the book is devoted to PLC fundamentals; the rest, appendices A to G, contains lists of US suppliers, manufacturers data, and the instruction set of the StepLadder PLC.

The instructional part of the book covers basic digital logic (as you'd find in any digital textbook), relays and relay logic, and the basics of the CPU in a PLC. Also included are chapters on input/output devices, peripherals, software (ladder diagrams, Boolean, high-level) and PLC applications. There's also a chapter on interconnecting PLCs, including a description of LANs.

The level is appropriate to TAFE courses and higher, but the book's focus on US companies could be a limitation. The review copy came from McGraw-Hill, PO Box 239, Roseville 2069. It should be available from technical and larger bookshops. (P.P.) ◆


Future wars could be free from killing
thanks to
ELECTRONIC & OTHER
NON-LETHAL WEAPONS

During a visit back to his home town of Albuquerque, New Mexico last year, Tom Moffat was able to visit the Los Alamos National Laboratory — where research is being carried out into electronic and other non-lethal weapons of war. He was even able to interview the research team leader, former Green Beret commander Dr John Alexander. Here's his report on what he learned from the visit and interview.

by TOM MOFFAT

There will always be conflicts between groups of people. Such is human nature. On a small scale, one person wants someone else's car, so he takes it; that is theft. On a large scale, one group of people wants another group of people's country, so they take it; that is war. On a small scale, one man wants another man's wife, so he kills her husband; that is murder. On a large scale, one army massacres another army while invading its country; that is war.

Under international convention, war is legal. The logical conclusion, then, is that war is legalised theft and murder. Would anyone dispute this?

Given that, with human nature like it is, war and conflict will always occur, surely it would be desirable to make war as least horrible as possible. One big advance would be to eliminate the murder part of war, and this is exactly what is being done in a research project being done at the Los Alamos National Laboratory in New Mexico, USA.

Los Alamos may seem a strange place for this to happen, since it was originally established to develop the atomic bomb — the most powerful killing machine ever made. After I wrote about Los Alamos and the bomb a couple of years ago, I received quite a few letters saying "How dare you glorify war!"

Well, maybe non-lethal weapons research is some kind of compensation for the horror unleashed 50 years ago. In fact both Los Alamos and its sister organization Sandia National Labs in Albuquerque are working on some highly advanced projects that will aid humanity instead of blowing it to smithereens. You'll be hearing about some of these in future articles.

The Los Alamos non-lethal weapons research is being led by Dr John Alexander. He seems a bit of a contradiction for this work because his history is not that of a pacifist; in fact just the opposite. Dr Alexander spent 10 years commanding A-Teams of the Green Berets. These were the commandos, the elite United States Army Special Forces. But contrary to the popular view of them as killing machines of death and destruction, Green Berets were deployed to take part in 'direct action missions' such as very precise sabotage of military targets while not harming nearby human life. Thus were sewn the seeds of non-lethal warfare.

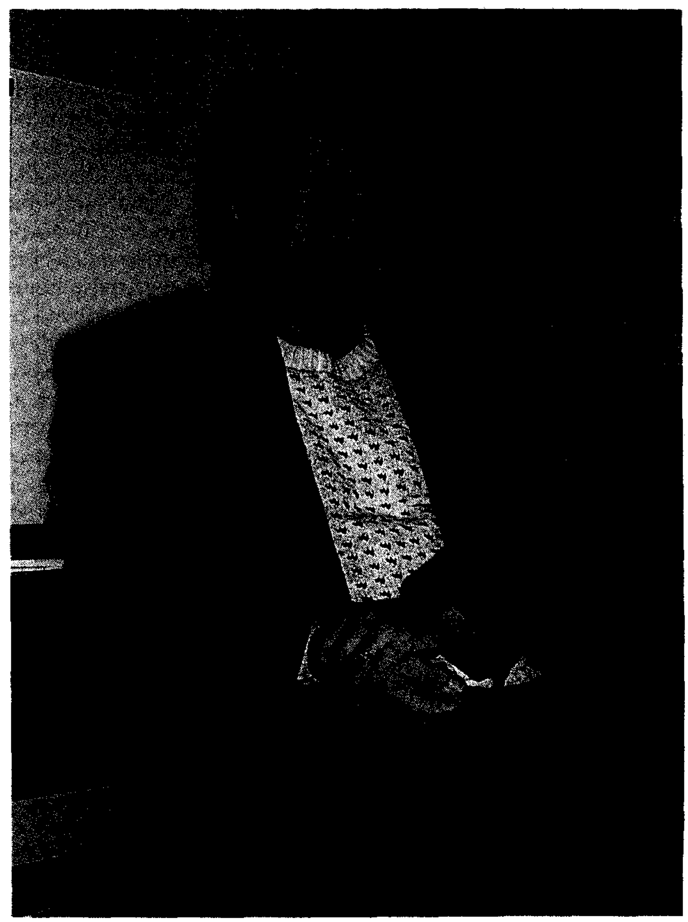
But Dr Alexander does not advocate the winding-down of traditional armies; instead he calls for the "maintaining of a highly mobile and extremely lethal force". Non-lethal weapons are to be used in the first instance, in an attempt to prevent the need for more serious measures. But should non-lethal methods fail, he feels that armies should be able to defend themselves and their territories, with lethal measures if necessary, to the bitter end.

Non-lethal technology came into the public eye a few months ago during the withdrawal from 'peace-keeping' duty in Somalia. As they tried to leave there were further threats of violence from the locals, who were apparently subdued by squirting them with a sticky foam. We saw television pictures of protestors with their feet firmly glued to the street, as their arms thrashed about in rage.

The point is that no lasting harm was done to these people; they were simply put out of action for a while. Another sprayed agent is being developed which has such a terrible stink that opposing forces have no choice but to leave the area. Other non-lethal weapons are in regular use by police forces, for instance rubber bullets and the stun gun.

Although it might be irreverent to say so, I can't help comparing non-lethal weaponry to those old Roadrunner cartoons. There we had a constant conflict between the Roadrunner and Wile E. Coyote. When the Roadrunner's demise was imminent he opened up his box marked 'Acme' and withdrew one of the many dirty tricks contained therein. The Coyote was always foiled, but never permanently harmed. It's interesting to note that the roadrunner is the state bird of New Mexico, where both Los Alamos and Sandia Labs are located.

Now let's open up that Acme box and look at some real-world developments taking place in non-lethal technology:



Above: Dr John Alexander, manager of non-lethal weapons research at the Los Alamos National Laboratory. He spent 10 years commanding A-Teams in the Green Berets, the elite US Army Special Forces.
Facing page: The visual effect produced by the 'Dazzle Gun' being developed at Los Alamos, in a cockpit mock-up. (Photo courtesy Los Alamos National Labs.)

Electronic & Other Non-Lethal Weapons

Optical measures

Much non-lethal technology concentrates on optical effects. One very successful project done at Los Alamos is a real Bobby-dazzler — in fact, that's its purpose. The weapon looks like a rifle, although there is a laser where the barrel should be. The laser can be pointed at the cockpit of a flying aircraft, even from the ground. When the light hits the window of the aircraft it diffuses in such a way that the pilot can't see where he's going (see photo). As well, it wipes out his head-up display, which projects vital aircraft instrument readings onto the cockpit's 'windscreen'.

So the pilot has no option other than to turn around and go back the way he came, abandoning any bombing run or other offensive maneuvre he may be engaged in. Once he turns away from the laser light, the pilot's vision is fully restored, his head-up display is operational again, and he can fly safely back to base.

We are all aware of the dangers of looking directly into a laser beam; blindness can result. This is because lasers are normally pulsed, with a high peak power than can permanently damage the retina. But the laser dazzler uses a blue coloured argon continuous-wave laser of fairly low power, something like one tenth of the maximum level considered safe. It disrupts vision nicely, but causes no permanent damage.

Dr Alexander suggests that, as well as military applications, the laser dazzler could be useful to police. One situation might be a siege where a sniper is behind a window, holding people at bay. The laser gun fired at the window could disrupt the sniper's vision long enough to allow police to storm the place.

Along the same lines is a 40mm grenade launcher shell that shoots light instead of a projectile. It is shaped much like the traditional shell, and it contains an explosive charge. But forward of the charge is a rod of laser material. When the explosive goes off it 'pumps' the laser with an enormous burst of energy, causing it to emit one big burst of laser light before the laser rod is destroyed by the explosion.

The light shoots out the end of the barrel and hits whatever the gun is pointed at, a bit like the photon torpedo from Star Trek. It's likely the target is another gun pointed at you, aimed by a night-vision gunsight. The laser burst blinds the night-vision sight, instantly and permanently.

The beauty of the laser shell is that it fits into a standard gun, it doesn't need any sophisticated electronics to make it work, and it's disposable. A couple of laser shells can be issued to each grenade-launcher crew, to be fitted into the breach instead of a projectile round whenever required.

Also being looked at is a special smoke screen to prevent the enemy seeing what troops are doing. But the smoke has a spectral 'window' tailored into it, so that the good guys can see the enemy using a special optical system which is tuned to the wavelength at which the smoke is transparent.

Acoustic measures

Sound waves have the potential for disrupting military operations in a big way. The technology dates way back to the Second World War, when amplifiers and speakers were used by one side to harang troops on the other. The trick was to run the amplifiers in Class C, as used in many radio-frequency transmitters. Amplifier stages were biased to cutoff, resulting in very high efficiency and enormous output power — combined with unbearable distortion.

This is the same technique used today in guitar amplifiers which deliberately introduce distortion to make a rough, blasting sound. Imagine singing through one of these amps; that was exactly the effect produced by the Class C military amplifiers of 50 years ago. The idea was to get the troops so sick of the racket that they would turn around and go home...

Still on the subject of radio frequencies, a bit of antenna theory: to direct a lot of RF energy into a given area (produce gain), it is common to use a phased array in which several antennas work in concert, reinforcing each other, to push out energy in one direction.

We must also mention the pulse jet. This was a very early jet engine design that did not use turbines and compressors. Instead the pulse jet had a simple one-way flapper valve within a pipe, so that air could flow one way, but if it tried to go the other way the valve would slam shut.

The engine was also equipped with a nozzle that could inject petrol or some other fuel into it. If you then ignited the end of the pipe containing the fuel it would explode, shooting a great burst of flame and expanding gasses out of the pipe. The outrush would create a partial vacuum within the pipe, but then the flapper valve would open, allowing in more air from the forward end. At the same time more fuel was being injected, and the heat from the previous explosion was enough to ignite the new mixture, resulting in another explosion.

These reactions settled down to a continuous process, a string of explosions, timed pretty much to the resonant frequency of the pipe. Gasses blasting out the end of the pipe produced enough energy to propel the jet engine along. As I remember this was the technique behind the World War II 'buzz bombs'.

Since the pulse jet worked on a series of explosions instead of the continuous burning of fuel, it made an enormous amount of noise. I remember when I was in high school, as part of a touring science show in the school auditorium, there was a tiny model pulse jet engine mounted on a small trolley. Someone lit a match to it and the thing scooted across the floor, accompanied by the most excruciating buzzing noise. Everyone instantly clapped their hands to their ears.

Back to Los Alamos: Take a propane-powered device capable of generating a series of explosions at an audio rate. Although Dr Alexander didn't say so, it is very likely this device is a stationary pulse jet. Couple it with a series of baffles which form an acoustic phased array at the design frequency, and you have a system which can focus a beam of very powerful sound energy toward a desired target.

It is intended that this device be used for defence only, installed at some sensitive site to repel invaders. Its amplitude is variable, so that the baddies can be given a 'small' dose initially. Should they refuse to turn back, the power can be turned up until it becomes painful to the hearing. If this still doesn't work, further power can be applied until, as Dr Alexander says, "substantial physical damage results, because you're moving air. You can set up internal vibrations and start vibrating organs, so as somebody gets closer you can crank this up where, if they happen to be impervious to pain, like if they're high on something, they will physically be knocked down."

"What you're really doing is providing the intruder options. If you're dealing with a rational person, as they hit some pain threshold of sound, the logical person will go in a different direction and get away from the sound. And that's the intent — the intent is not to incapacitate or to permanently damage the person. However, if they come inside of that, they will start to experience some internal hemorrhaging and things..."

Another area of interest is infrasound,

A few days after interviewing Dr Alexander for this story, Tom Moffat spotted this interesting structure and sign in the desert behind Sandia Labs. The sign says "Advanced Research EMP Simulator"...

frequencies of 30Hz or less, below the range of human hearing. Dr Alexander says there is a lot of mythology in this area, such as stories of some frequencies that are "psychoactive" — disrupting the target's ability to think rationally.

Other sound topics have almost taken on the status of urban myths; for instance this account that appeared many years ago of an experiment at Dartmouth University. It seems a group of students was assembled in a large hall in which there was a substantial public address system. According to the story, someone applied an audio oscillator to the input of the PA, tuned to exactly 70Hz. They cranked up the PA and within seconds the entire audience found it necessary to immediately visit the toilet, of which there was only one. Instant diarrhea, and quite a mess it was.

It was suggested that this effect might have military applications, with a powerful 70Hz sound source directed at an invading army. The idea was that the troops would lose the will to fight, if their pants were filled with poop...

Dr Alexander says he is familiar with this story, but "the evidence is very contradictory. It turns out that the Saturn Five rocket vibrates at that frequency, and so NASA did a lot of studies early on, knowing that — we're sending our astronauts up on those things, we need to understand it. And they did not find any deleterious effect in those frequencies."

So there are doubts, but there must have been some basis for the Dartmouth report. It wouldn't be too hard to reproduce that experiment and find out once and for all if it was legitimate. All you need is a room full of people, and a decent PA system, and a simple audio oscillator. Come to think of it, I find myself in that situation from time to time, playing in a band in some pub or other. If I took along my own little oscillator some night... No, only joking (I think).

Information technology

Dr Alexander says this is an area of considerable sensitivity. The entire world now relies on computers in some fashion, and we are all aware of computer viruses such as the Michaelangelo virus. So it's necessary to develop measures to handle computer sabotage from both a defensive and offensive point of view.

"We know that there are people around the world now who know how to develop malicious code and are doing so. It's technology that's available to anybody with money."

I asked, would it be fair to say then that you are developing military uses of the computer virus? Dr Alexander's reply: "I have no comment on that." Are you learning to defend against them, for military purposes? "Yes".

So is the US military capable of unleashing a virus against some potential enemy's computers? The answer to that is quite obviously "classified information". Only time will tell.

Electronic warfare

I've heard it said that the easiest way to conquer a country is, number one, disable the power system, and number two, disable their communications. So I asked Dr Alexander: Have you studied those possibilities as part of your work?

His reply: "Let me even broaden it and talk about the Air Force concept they call strategic paralysis, where they're bringing down a nation-state. What we're trying to do is look for ways to do it without hard bombs. Many of the scenarios in the future are ones in which the battle is over relatively quickly — hours to days, as opposed to weeks to months or years. Therefore if I want do deny someone electrical power for hours to days, as opposed to weeks or months, it is to my advantage to find ways to do that without destroying the hardware."

Question: Would one of the tools you use perhaps be electromagnetic pulse (EMP)?

Answer: (A), not in that scenario, and (B), I have no other comment."

This is an interesting answer, because EMP has been a subject of considerable concern to military forces all over the world. EMP is a short, sharp pulse of electrical energy that is generated when a nuclear weapon explodes. It's like a lightning strike, but it's far more

Continued on page 45

When I Think Back...

by Neville Williams

Arthur Spring - 2: Hands-on engineer, manufacturer and electronic organ enthusiast

Having traced Arthur Spring's progress from an admittedly casual student to a resourceful technician at the Breville Radio factory, we now encounter a bewildering series of events which recast him as chief engineer of a successful TV receiver factory. He went on to become a specialist transformer manufacturer in his later years, an electronic organ enthusiast — and currently, a welfare worker introducing fellow senior citizens to the computer age.

Perhaps at this point I should concede that to detail the Arthur Spring story in full would require a book, rather than a couple of articles in a magazine. It would also call for protracted question-and-answer sessions, to catalog a lifetime of memories and ensure that the story flows logically from one to another without awkward gaps.

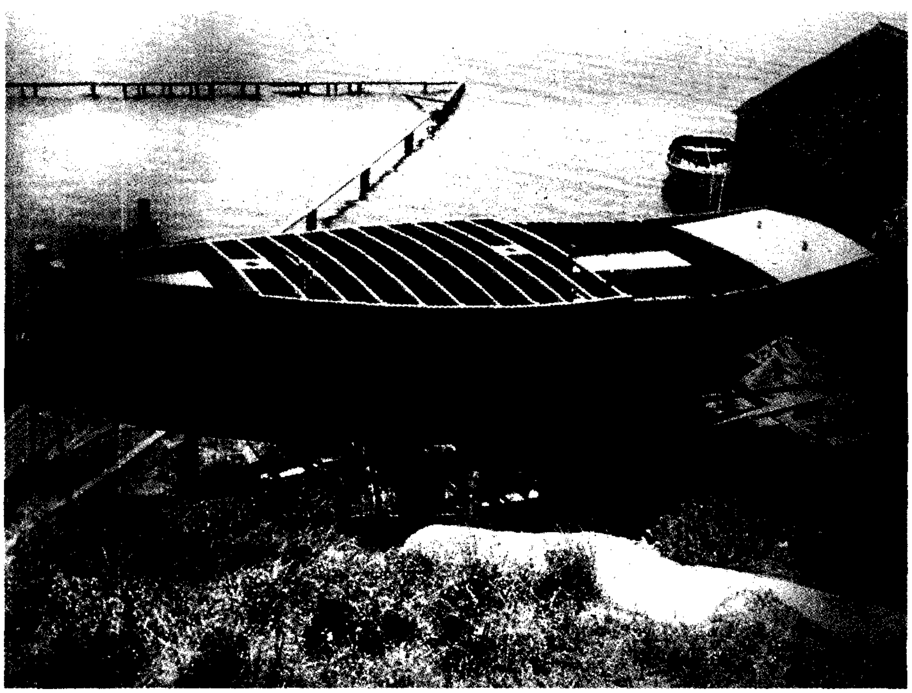
As it turned out, we had to make do with the exchanges that were practical between two old timers, in-or-around their eighties! Helpfully, though, Arthur did post me a simple chart to help clarify what happened to whom in the radio industry, affecting his career...

In the first of these articles, we left Arthur as a handyman/technician in the Breville factory at Camperdown, Sydney — near the Royal Prince Alfred Hospital. He had been involved in the production of pre-war Breville radio receivers and been active in the Company's wartime war effort, notably in the production of mine detectors for use in the African desert campaign and, later, in the Pacific island encounters.

He emerged from that era not as a recognised engineer but, as he put it: Breville's 'Mister Fixit' or their 'Get-things-done-Bloke'! As such, one might have found him conferring with management, engineers in the lab, operators in the workplace, and clients in the field.

In his spare time, he had an interest in the ARP organisation — citizens concerned with air raid precautions. Observing their activities, he realised that they were completely dependent on the telephone system, which was both stressed and vulnerable under wartime conditions. Could they be provided with a simple and hopefully inexpensive radio net operating on 33MHz, which the Department was prepared to authorise?

The (unofficial) radio 'ham' in Arthur came up with simple prototype transceiver, fabricated from available bits and pieces, in a plywood and leatherette box measuring about 18(w) x 12(h) x 9(d) inches. The transmitter, using frequency modulation, called for a single 33MHz crystal, while the receiver used phase-locked loop circuitry, an adjustment knob and a centre-zero meter to ensure that it stayed on the net frequency. The loudspeaker doubled as a microphone.



The Spring brothers' schooner takes shape. Arthur still lives on the waterfront, but his preoccupation with electronics leaves him no time for maritime pursuits!

Simple, but effective

The ultimate in operator simplicity, the transceiver had an off-on switch and a press-to-talk switch. Being an FM system, the receiver would automatically lock onto the strongest network signal at any one time. It would be up to the common sense of the operator, if and when to break in.

Tested from the Camperdown factory

to a vehicle under the mass of tramway cables that encircled Central Railway station in those days, a pair of Arthur's prototypes provided clear communication free from hash. In another mobile test along the Pacific Highway, contact was maintained from Camperdown to as far north as Mount White, except when the vehicle was overshadowed by local topography.

As it turned out, the ARP lacked the will or the money to take up Arthur's suggestion; but word of the novel noise-free FM system reached the armed forces via Breville. They would be interested in a portable 'man-pack' version that could be set up wherever necessary and operate either from mains power or available vehicle batteries. This involved prototypes, rendered more bulky by the dual power supply and rolled-up power cables. They would also favour a proper microphone to provide better speech quality in a noisy environment.

In Melbourne, the RAAF set up a test with a 'base' unit on the roof of the Manchester Unity Building and a mobile station in a 'crash' boat on Port Phillip Bay. They obtained good coverage of the entire Bay area, extending to the Rip.

In Sydney, the Navy set up a base station in the Garden Island area and despatched a mobile on a boat headed inland along the Parramatta River. The system clearly outperformed the available Navy AM system but, says Arthur, "I made myself distinctly unpopular with the VIP observers by ridiculing the Navy equipment".

Don't shoot now!

But the most spectacular situation concerned the Army Unit manning the heavy calibre guns on Sydney Harbour's South Head. One of the Unit's regular exercises involved landing shells suitably close to a target on a moving barge out near the horizon. The barge was towed by a tug, which was supposed to keep in touch with the gunners via a radio link.

The trouble was that the tug was powered by two powerful Thornicroft petrol engines, whose ignition systems interfered seriously with the two-way AM talk channel. If the towline parted, the tug obviously could not venture back to recover it unless they were sure that the gun crews were completely aware of what they were doing...

Army radio techs knew that ignition suppressors would improve communication, but as sure as they fitted them, so surely would the tug captain remove them — because they allegedly compromised the performance of his beloved Thornicrofts.

A typical bobbin wound power transformer. Using high temperature Rola wire and a high stability bobbin, such transformers contributed markedly to the success of Precedent TV receivers.

The two-way FM system overcame the impasse by ignoring the ignition hash, although the acoustic noise from the engines aboard the tow vessel still rendered it less than ideal for either reception or transmission.

The demonstrations alerted the military to the potential of FM communication systems. But by that time, American equipment was to hand and there was less urgency for local initiative. Breville filled an order for a half-dozen or so prototypes, but that's about where the story ended.

At a purely personal level, post-war, Arthur joined forces with his brother and built a small schooner to take advantage of the nearby waterways. Presumably, it was a more successful venture than his abortive effort to build an electric car!

This was followed by a new house in 1952 — a clear indication that his salary was no longer only a few dollars per week, as it had been as a youth at Radiokes and Crown!

The industry, postwar

Australian radio manufacturers, meanwhile, were busily trying to come to grips with the postwar era. Government orders had been curtailed or cancelled, former employees had to be accommodated, along with new technology and new production methods; and beyond the immediate future lay the challenge of television, pencilled in for the mid 1950s.

Down in Melbourne, Harold Coles, a cousin of THE Coles family, was contemplating the future of Eclipse Radio, which he owned. As Arthur mentioned, and I as personally recall, Eclipse had a reputation for quantity rather than quality. Rather than attempt a revolution, I gather, Harold Coles sold out to Sir Arthur Warner's Radio Corporation — the Astor Group.

With the capital so available, Harold Coles turned to Sydney and decided, with a partner, to set up a new company with the intention of producing radio sets and black & white TV receivers for the mass market. Borrowing his partner's name, it was registered as A.W. Jackson Industries. Where and how it would be set up remained open questions.

In the meantime, Breville was also trying to reorganise its affairs, conscious that they had no overseas links with major TV companies to whom they might turn for guidance. Bill O'Brien had split the company into two — the manufacturing arm and Breville Wholesalers — presumably to gain a tax or trading advantage. There was also vague talk of reorganising the manufacturing arm as a cooperative, involving staff.

Looking back, Arthur recalls a climate of instability, which wasn't helped when Noel Smith resigned as chief engineer to accept a position with Philips. There were rumours of Bill O'Brien also quitting. Finally, following the Christmas holiday period in 1955, came the news that Breville Radio had been taken over by A.W. Jackson Industries under Harold Coles.

Jackson Industries

Under the new management, Breville personnel continued to produce radio chasses to current designs. Some were marketed as Breville and others supplied interstate to be installed in cabinets carrying other brandnames. But dominating the scene was the big question: what about television?

At about that stage, Harold Coles posed this question to 'Mister Fixit', Arthur Spring. Whether he was ready for it or not, Arthur realised that effectively, he was being re-cast into the role of Chief Engineer.

On the tape, Arthur confessed that at the time, he had no 'hands-on' experience with television or TV sets. He had read about them in technical magazines, of course, and he had picked up reactions and opinions from fellow technicians. But as with the old Breville set-up, Jackson Industries had no overseas affiliates on whom they could rely for background information.

Nevertheless, on one memorable day,

Arthur was summoned to the management office to meet a group of VIPs from Pye (UK) who were interested in A.W. Jackson's plans. Since the Australian TV system would have much in common with the British, Pye might be able to offer advice, supply key components, etc.

A sticking point was reached when the Pye group made it clear that they regarded the use of a conventional power transformer as wasteful. They were bulky, heavy, expensive and an unnecessary source of heat in the cabinet.

Said Arthur: "Having produced my share of transformerless AC/DC radio sets in my day, I knew how unpopular they were in Australia. The potentially 'hot' (live) chassis had to be totally enclosed to prevent possible contact; spindles had to be isolated, as also did external connections (aerial, earth, pick-up, loudspeaker, etc. Servicemen and testers hated them!"

Mains transformers

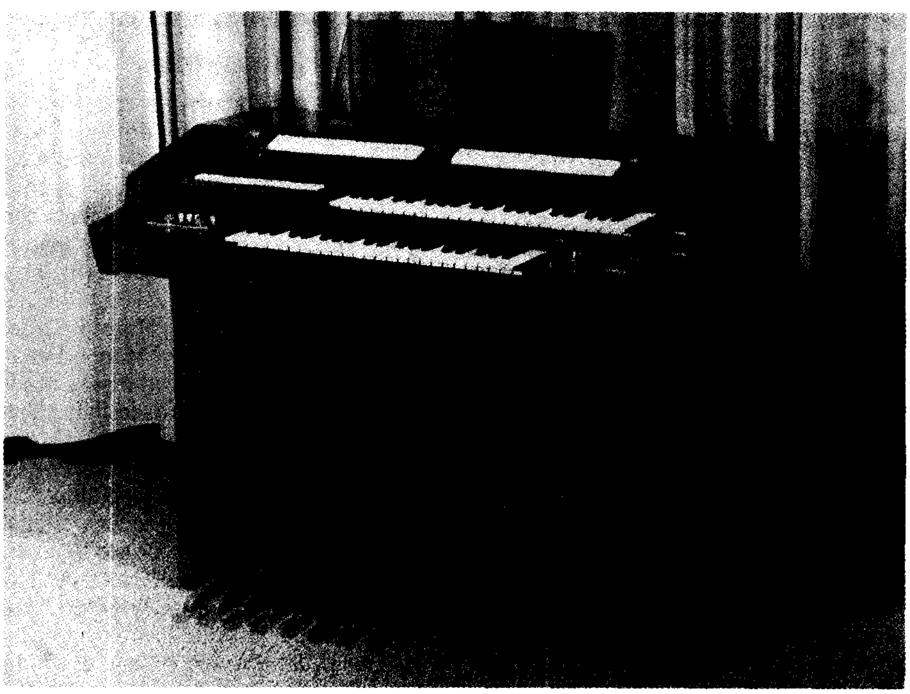
"We finally had to agree to differ, but the visit did prompt me to take a closer look at the question of power transformers. Rather brashly, perhaps, I insisted that I'd rather live with a physically hot transformer than an electrically hot chassis!"

To date, the factory had relied mainly on Henderson transformers and while they were reliable, they were certainly bulky and relatively expensive. But as it happened, Rola Australia chose that critical moment to announce the release of Rola high temperature enamelled winding wire, featuring a much higher temperature tolerance with much less risk of inter-layer breakdown. Arthur checked and found that the ratings were genuine, as distinct from over-zealous advertising.

No less to the point, news arrived of a product called 'Black Grylon', which was an opaque grey mouldable nylon with an unusually high temperature stability— good for moulding bobbins.

Now promoted to Chief Engineer, Arthur set about designing a transformer bobbin which could support a layer-wound primary in one section and secondary windings in the other — all wound with high temperature Rola wire. The result was a relatively compact transformer, easy and cheap to make and with ratings adequate for a B&W TV set.

Yes, it ran 'too hot to touch', but well within ratings for the wire and bobbin. It was, in fact, subjected to deliberate overload but without trauma. Conscious of the irony, Arthur recalled that, some time later, Jackson Industries supplied similar transformers to Pye Australia!



One of the pre-production prototypes, this 'Vernus II" organ still stands in the Spring music room. Having acquired a controlling interest in Jackson Industries, Philips decided against proceeding with production.

Obviously proud of his 'baby', Arthur mentioned that a couple of his competitors later tried to copy the design for their own TV sets — but not very successfully. One omitted to use high temperature wire; the other tried to cut costs by winding the layers at blinding speed. Both ran into problems, whereas the original Jackson transformers 'just never failed'.

Screen size debate

One other area where Jacksons encountered difficulty was in relation to the size of the picture tube. Suppliers, and particularly Philips in Holland, were well stocked with 17-inch (diagonal) types, along with the relevant scanning components. As a result they were doing their level best to persuade Australian manufacturers to launch in this format.

Admiral, on the other hand, was determined to go for a 21-inch picture and Arthur Spring was one of those who foresaw — correctly — that they would dominate the market if they did so. He accordingly prevailed on Jacksons to follow suit. Contrary to dire warnings, they managed to get all the 21-inch tubes they needed, some being imported and others manufactured locally.

As far as the circuit configuration was concerned, most of the early developmental work was handled by two people — Arthur himself as Chief Engineer and a backup technician/wirer (the late) Reg Carroll.

Three-metre 'breadboard'

In the absence of an overseas affiliate, Arthur pored over as many circuits as he had access to in magazines and company literature. One of the things that intrigued him was the number of elaborations in the various designs that seemed to be superficial, but still adding to the valve count.

Arthur's own philosophy was that valves tended to deteriorate from the day they were switched on, and that every valve included in a design was a potential source of ultimate failure — and a potential reason for a service call. Since Jackson Industries' receivers were intended to be both price-competitive in their own right and sold as 'other-brand' chasses, they simply could not afford to be trouble-prone.

Arthur's work plan involved a prototype which was a string of modules ranged along a table in the lab, adding up to a complete TV receiver. It was three-odd metres long, with a tuner at one end, picture tube and loudspeaker at the other and power supply somewhere in the middle...

When they came across an interesting circuit, they had the option of building it up and lashing it into the prototype on the table. Arthur's lasting impression from this exercise was that American companies were more practical than their European counterparts in balancing performance against complexity.

In his taped interview with the ABC's Stephen Rapley, Arthur said that the above research was culminated when Jackson's three-metre long 'breadboard' prototype was compressed onto a flip-up chassis in a cabinet that was commensurate with the overall dimensions of the picture tube and loudspeaker...

In the process, Jacksons had to come to grips with printed circuit technology based on photographic rather then silk screen printing, and complemented with precision punching.

They deliberately avoided using valve type rectifiers in the power supply, because of limited life, and opted instead for Westingouse selenium flat packs. These proved relatively reliable — although, if and when they *did* break down, they produced an abominable odour.

A few months down the track, Noel Smith made an important contribution to the project. Noel had been transferred by Philips to Eindhoven in Holland, but had kept in touch with Arthur Spring at a personal level.

In a letter, he mentioned that Philips had 40-gallon drums full of the newer silicon rectifiers, surplus to their needs. Within their ratings, they were fine but, used in European transformerless designs, they were vulnerable to spikes on the power mains. In Jacksons' receivers with their transformer-fed voltage doubling power supply, they would probably be trouble-free. Such, indeed, proved to be the case.

Another exercise in caution paid off when Arthur realised that their horizontal oscillator stage was sensitive to any hint of grid/cathode leakage in the oscillator valve. Since the manufacturer could not take adequate precautionary measures, Arthur arranged to check all batches on receipt with the option of returning any that were suspect.

Jackson Industries ultimately outgrew the original Breville premises and moved into a new factory erected on a former Dunlop rubber site in the Crescent, Annandale.

Extremely reliable

Marketed mainly under the brand name 'Precedent', Arthur claims that the receivers had a reputation for reliability, attributable in large degree to their uncomplicated circuitry and their limited parts count. Servicemen liked them for the same reasons and for their ease of access. They were widely used in cabinets carrying store brands.

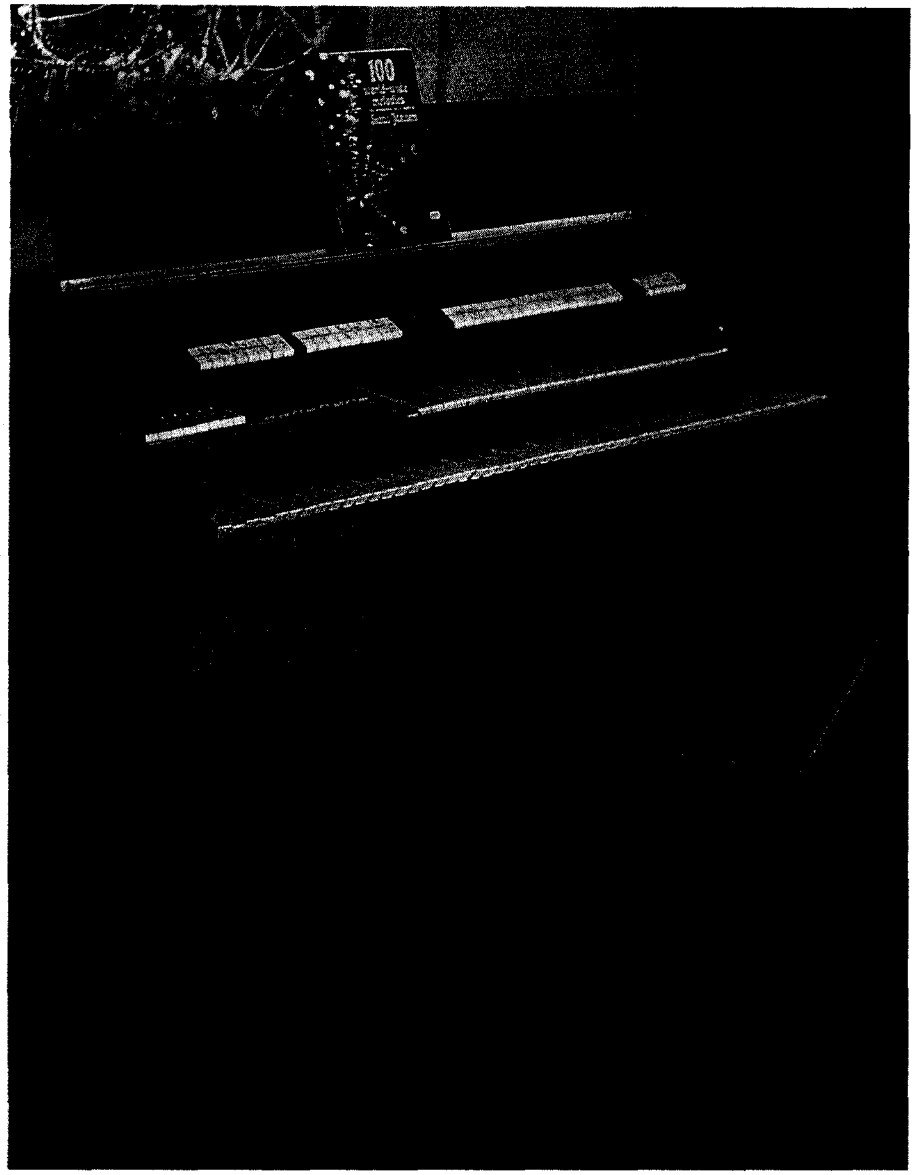
(*Editor's Note: I can confirm this. In the 1960s and early 70s I had a second job in TV servicing, and just about every technician I came across was full of praise for Arthur Spring and his Precedent sets — plus scorn for some of the overcomplicated and less reliable competing models!*)

In fringe areas, Arthur admitted that the horizontal locking was marginally less positive than that of some more complicated designs. But having checked out many such situations, he was satisfied that, overall, Precedent receivers offered very good value and a good picture by comparison with other brands.

Reflecting on the factory at Annandale, Arthur added the observation: "Much of the success of Jacksons at Annandale was due to the dedication of Alan McKeown as Factory Manager; to the enterprise of Vince Quirk as General Manager, the assistance given me by mechanical engineer Arthur Mears, by draftsman Arthur Nobbs and also George Hughes (a former member of the *EA* staff)."

What happened?

So what happened to Precedent as a brand, and to A.W. Jackson Industries? Black and white television peaked and



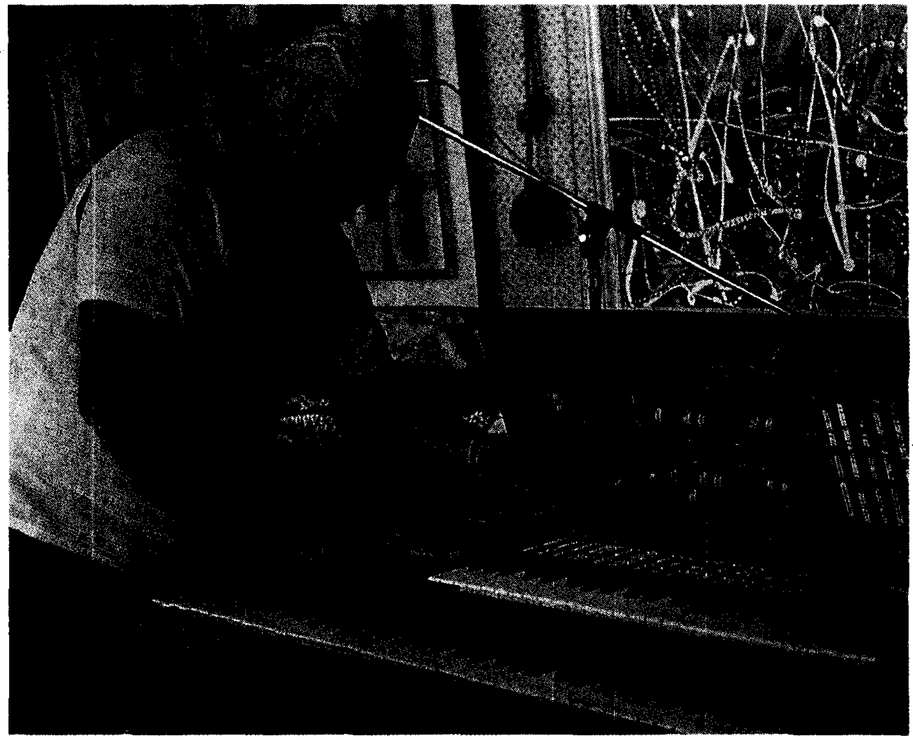
Arthur Spring's experimental organ, tidy but never 'finished'. Because his wife is a trained pianist, it is fitted with a full piano lower keyboard with access to electronic piano as well as organ voices.

reached a stage where TV desperately needed colour to retain its audience appeal. But colour would involve a major technical revolution that could stretch many local manufacturers to their limit.

As Chief Engineer of Precedent, Arthur Spring looked with dismay at the likely valve count and parts list of a colour receiver — and realised that the 'keep it simple' philosophy that had worked so well for B&W TV wouldn't work with colour. His verdict to Harold Coles was that he wouldn't even try to design a colour set until he had access to appropriate solid state devices.

Harold Coles didn't like what he had heard, and repeated history by selling Jackson Industries to Sir Arthur Warner's Radio Corporation in 1968.

But that arrangement didn't last either. In a push to expand, Philips took over Radio Corporation, only to be obliged to rationalise its affairs in 1970. In liquidating its redundant subsidiaries, a number of well known companies disappeared off the register — including Eclipse Radio and A.W. Jackson.



Arthur Spring in his late 70s, still absorbed in electronics. His current ambition is to synthesise organ tones more effectively by adopting digital and computer technology, particularly in the area of sustain and reverberation.

Personal trauma

In the meantime, Arthur Spring had been through his own private hell. In 1964, his wife Myrtle died suddenly of a heart attack. Arthur was devastated, and suddenly the Breville/Jackson story didn't seem to matter quite as much.

Then in 1965, Arthur met and married Liese-Lore, who helped him 'remake his life'. It was not an overstatement, and the two are still sharing life's ups and downs.

In his taped memoirs, Arthur said he could possibly have obtained a position with Philips. But he felt no enthusiasm for moving interstate, nor for the prospect of administration or 'paper shuffling' for the remainder of his career. His interest was still in designing and creating electronic products.

He tells how he arranged with two of his former associates to attend the auction which sold up the equipment from the former Jackson Industries' factory, around 1972. They came away with enough of the machine shop tooling and enough of the transformer winding equipment to set up two small companies: (1) Mayall Metal Manufacturing Co, of Marrickville, under the control of Jackson's former machine shop supervisor; and (2) Jones Transformers Pty Ltd, of Birrong, under his counterpart from the transformer winding section. Arthur was their mentor.

At the very least, they thought, they would be able to offer spares for Jackson/Breville products. In practice, with minimal overheads, their products attracted the attention of Dick Smith Electronics and other component suppliers. Over the next 19 years a very high proportion of their output went straight to the DSE warehouse at North Ryde.

By the end of that time, Arthur was well into his seventies, and he decided that enough was enough — a decision that also placated his doctor. Mayall Metal and Jones Transformers closed in 1990/91. But Arthur Spring himself certainly didn't shut down; the move gave him more time to ponder what had been — almost — a lifetime interest: electronic organs!

Electronic organs

Like the writer, he had been through the stage of using the family vacuum cleaner to 'pump' a vintage reed organ, and sought in vain to win a gratifying sound by way of an amplifier and electrostatic pickup from the reeds. He found, as I found, that the end result was to magnify its imperfections!

Like myself, he had also inspected Ernie Benson's Hammond organ counterpart — but reasoned that 'there must be an easier way'.

He had considered and rejected the master oscillator/divider system, preferring the Conn Company approach of having a separate oscillator for each note. That way, he reasoned, every note in a chord would independent of the others in terms of phase, as happens with a pipe organ.

More recently, he has admitted to being less passionate about the concept than he had been. Like it or not, the use of a crystal locked master oscillator and a solid-state divider chip has so simplified tone generation, while also eliminating the need for tuning, that the method is hard to reject.

In recent years, Arthur has spent countless hours fiddling with phase, attack, decay, reverberation, and so on in the control-amplifier-loudspeaker chain, achieving a commendably Wurlitzer /Christie presence in a domestic music room. For him, now, the agonising question is whether he could do even better by resorting to digital/computer processing.

While Arthur confesses to a personal difficulty in playing an organ with more than one finger at a time, he does claim to have 'a good ear' when it comes to analysing the tonal content of an organ's sound. In casual conversation, the observation provides a lead-in to an anecdote from his primary school days. The young lady teacher, I gather, decided to organise a junior choir for a school function. One by one, the kids were summoned to the front of the class and bidden to sing the opening lines of their favourite song, hymn or nursery rhyme. When Arthur's turn came, she broke in with: "You're no good. You're tone deaf!"

Says Arthur: "I wonder what she'd say if she could know that the tone deaf kid, as an adult, had spent a goodly proportion of his evenings tuning and voicing electronic organs, and experimenting with loudspeaker systems for them?"

Nearly 80, still busy!

Nor was his interest in organs confined to a hobby level. When contemplating areas of possible expansion for Jackson Industries, Arthur had organs very much in mind. In fact, in laying out the new Jackson factory, referred to earlier, he had envisaged how certain areas could be re-allocated to provide the space and environment for evaluating electronic organs and other audio products.

He had also shared his interest with Sir Arthur Warner, who backed him to the point where the Jackson team designed and produced a batch of 25 pre-production 'Vernus' prototypes. One of them currently graces the Spring music room — a typical instrument for the home or suburban churches, with staggered 42-note keyboards and a 13-note pedal clavier.

When Philips took over, they conferred with the Eindhoven Management — who liked the instrument, but decided that it didn't fit in with their worldwide marketing plan. The prototypes were sold and Peter Held was left lamenting. He was the organist who had been nominated to demonstrate the instrument.

(Ironically, engineer Neville Oates of Stromberg-Carlson had a similar dream to bolster *his* ailing Company, but they never got beyond a few factory models and stock of surplus 'bits' — which were sold to hobbyist/readers of this magazine to be used in building up as the *EA* 'Playmaster' Electronic Organ. That left organist Bob Swann similarly out on a limb!)

As for Arthur's own present instrument, he describes it as 'not user friendly'. It has been the testbed for numerous experiments, and has never really been 'finished'. A musician could play it and like what he heard, but might well be taken aback when he/she searches for other voices!

Computers too

Ah yes — computers. Back in the 1980s, Arthur was conscious that he was reasonably well informed about analog circuitry but knew little about digital techniques and even less about computers. For him the way to learn was the practical approach and, issue by issue, he plodded in the footsteps of Jim Rowe culminating in the construction of an elementary computer.

His next step was to buy a small Apple computer, which appears to have been a developmental model immediately preceding the Apple II series — commonly credited as being the world's first commercial personal computer.

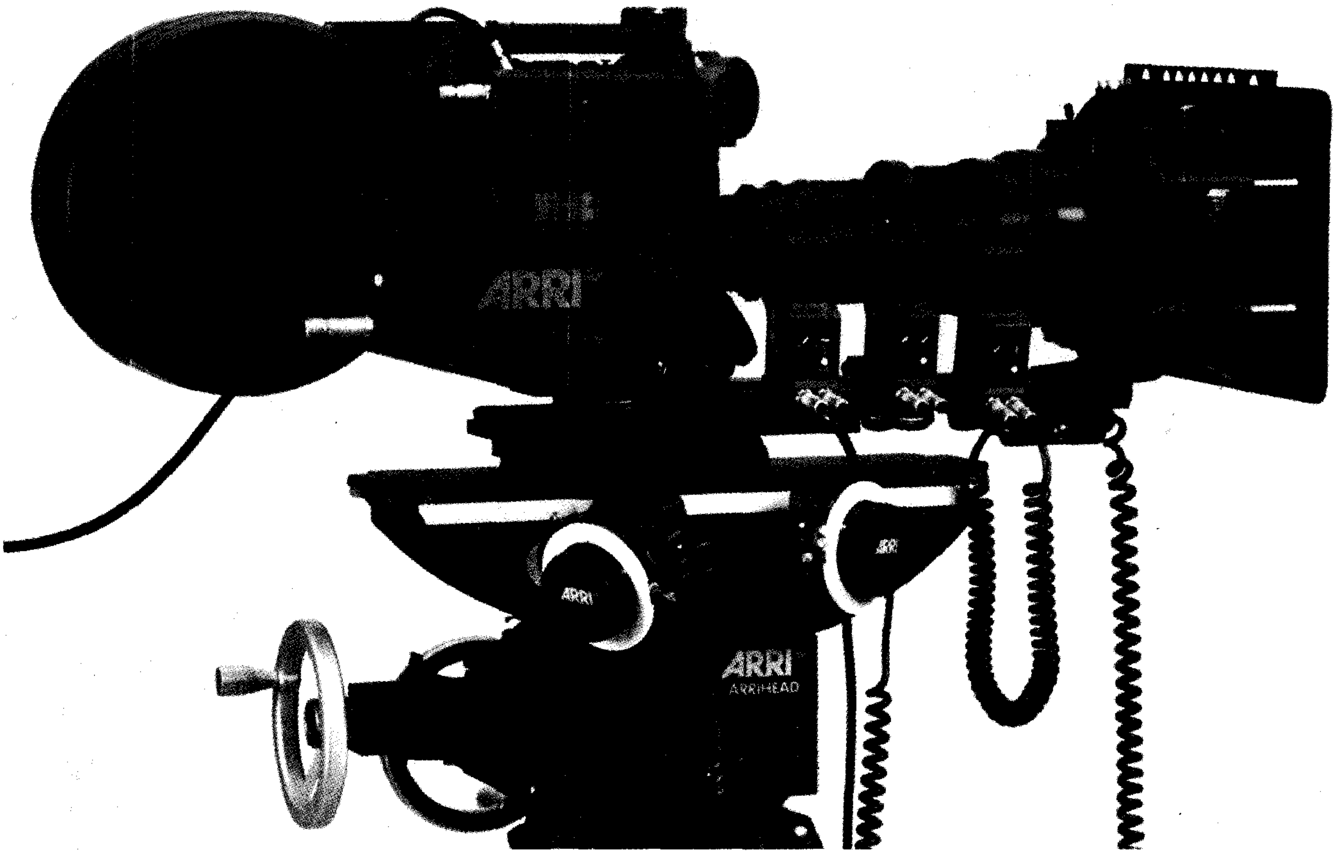
About that same time I myself had bought an Apple IIc with Appleworks software, and I remember chatting with Arthur on the phone one day about our respective Investments. Even then, a different approach was evident. I was using mine principally as a word processor, with database and spreadsheet on call. But Arthur had plunged into programming and I remember switching on my 'BeeModem' to see whether it would translate the characters from Arthur's computer onto my screen. It did.

Much later, the Hunters Hill Council decided that it would be a good idea to set up a facility to introduce interested senior citizens to the computer age. For starters, they provided the space and a '386 PC.

Arthur was a senior citizen, he was certainly interested, and within a short time he became one of the moving spirits behind the initiative. In particular, he discovered that as local business people re-equipped with the latest hardware and software, many were happy to make surplus units available gratis to a 'good cause'.

Arthur didn't pretend to be a computer technician, but he did know enough to couple serviceable units together to make a serviceable whole. So the senior citizens of Hunters Hill now have access to 286, 386 and 486 PCs by courtesy of the Council, local business people — and one of their own number who has been in the 'wireless game' for over 60 years!

FOOTNOTE: Arthur assures me that he is very happy to share thoughts with people of like interests. Readers who are interested in contacting him can do so by writing c/- the Electronics Australia office — but please include a stamped, addressed envelope. ❖



LIGHTS, LAPTOP - ROLL IT!

There's no doubt that digital technology is pushing motion picture production into the 21st century, and bringing with it many benefits — both technical and economic. As an example, there's now a system which allows a laptop PC to control a $500,000 professional movie camera...

by BARRIE SMITH

There are huge differences between the Australian and American way of making movies: local units work tight, fast and hard, with smaller crews and rely on acquired skills and the knack of 'making do'; American film units have the luxury of large reservoirs of technical talent, the latest hardware, bigger budgets — but labour under the immense pressure of a huge production industry that expects quality work on time, on budget.

Our basic equipment levels in Australia are well up with the US and European industries, but we tend to rely more on ingenuity in our deployment of 'no frills' support peripherals — production aids such as immense camera cranes and complex lighting rigs are a rare sight on Australian film sets.

Offering an insight to the direction the way the industry is heading, a new approach to the way the camera itself is controlled and operated has appeared — via innovative software running on a laptop computer.

Rob Draper is an Australian Director of Photography who has been shooting top level TV series and tele-movies since the 1980s. He works at a screaming pace, capturing on film a two-hour TV movie in just 18-20 days of shooting time.

Own cameras

Draper's equipment truck carries his own pair of Arriflex 535 35mm motion picture cameras plus all the bits and pieces. Total value: $1 million. In spite of his major investment, he is convinced that the century old art of film making is due for some mighty changes — in the immediate direction of computer technology.

His prominence in the high velocity, movies-for-TV industry led to Draper's selection as a beta tester on the new LCC software, developed by Marc Shipman-Mueller and now being promoted by the US Arriflex Corporation for use with its highly complex 535 (35mm) and SR3 (16mm) cameras.

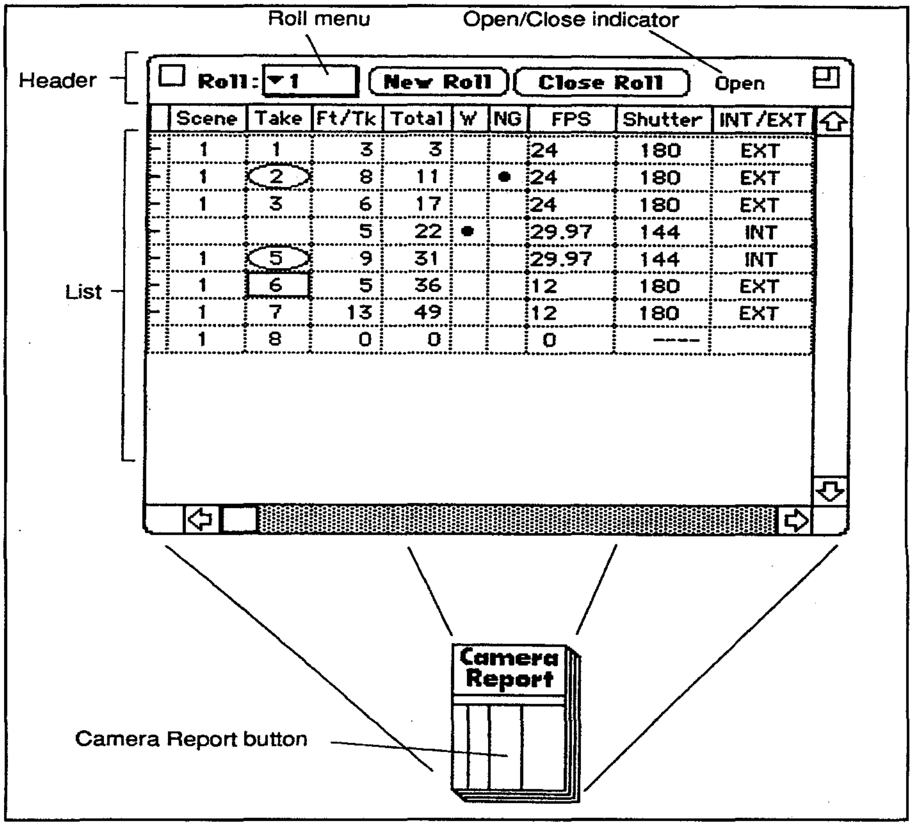
LCC (Laptop Camera Controller) is the first software capable of two way communication between state-of-the-art cameras and a computer. Virtually every control on the camera is duplicated on the laptop's screen — frame speed, reverse or forward film travel, shutter angle, footage count, timecode status, even a diagnostic program. Added to this is the ability to add scene and take data, and keep tab of film stock usage.

In operation at present, the laptop is hard wired to the camera. But it is likely that IR or other transmission links will soon be established.

Draper has used the LCC system every hour of each shooting day for the last two years. One unusual feature he uses occasionally in his telemovies is the 'ramping' effect — where the film frame speed is

(Facing page) The Arriflex Arri 535 35mm motion picture camera- a marvel of 1990s technology, now driven by laptop computer to perform cinematic trickery. Notice the three servos at the top right - for iris, zoom and focus. LCC may well be able to assume these functions as well in future.

(Right) A camera report can be generated by LCC directly from the camera, thus saving the camera assistant from making notations.



changed mid shot, while precise tracking of the shutter angle (to maintain exposure) is adjusted to compensate. (Note: the lens aperture is not altered.) The effect is to alter the speed of on-screen action with no exposure change; ramping can be 'wound' up or down in subtle increments.

Keeping track of film usage is another prime advantage of LCC. Differing from Australian practice, film stock is not as crucial an element in US budgets — American producers demand 'coverage', so that the editor can construct the narrative with total freedom. Some American crews run *two* Panavision Platinum cameras simultaneously, loaded with 2000ft rolls of Mr Eastman's 35mm colour negative, in the hope of catching all the usable action in the shortest possible shooting time.

The average film allocation for a US telemovie is around 120,000ft of 35mm colour (to be cut down to a final length of around 10,000ft!).

Unused stock is anathema to US film makers, so LCC is used to manage the stock so precisely that Draper can usually end a shoot with a surplus of only a few hundred feet or so. On the other hand, running out of stock is a nearly equal hazard, just as preventable with the LCC. Draper cautions: "If you're shooting Sunday night out in the middle of Arizona and you've got no film, (laughs) that would be a bad thing."

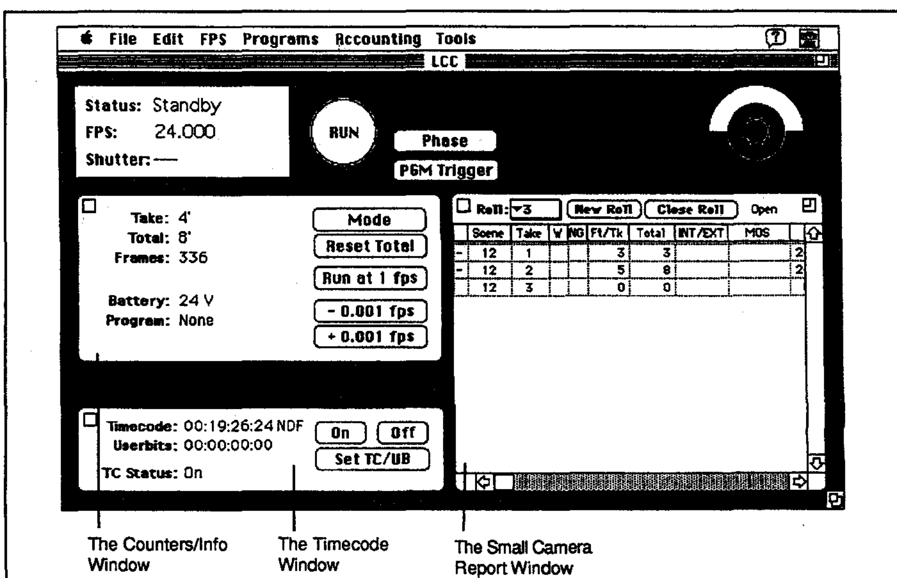
The Australian is convinced we are going to see more and more computer technology in the film business, as already many films now employ digital transfer techniques to alter the screen image. "With the introduction of computers onto the set more and more these days, and with the digitisation of cinematography, I wanted to be as familiar as I could with the use of the computers."

Runs on a Mac

The LCC software, now in its seventh version, runs on any Macintosh series 100, 200 or 500 laptop and is supplied on a 3.5" high density floppy. It is expected that a Windows version will be available this year.

Once loaded, the graphical main screen displays all camera status information including current fps setting and the shutter opening. Clicking on an icon marked RUN will start the camera, while a second click will stop it. Special speed/shutter angle routines can be pre-programmed and activated via a PGM icon. The icon SHUTTER rotates when the camera is running. In contrast, the normal way of doing this would have been to check the status displays on the camera itself and activate the various controls manually.

Draper mentioned to this writer that he delighted one Director on a mini series by a employing a cute trick that relied on the LCC for precise down-to-the-frame camera control. A scene with an actor was shot, then the camera reversed to the precise start frame and a double exposure made as the actor exited frame during the



The main LCC window, showing operational status of camera. Note the window with scene/take data. The button marked RUN will activate the camera to start shooting, while the half circle icon at top right indicates shutter opening. The time code display is at lower left.

Lights, Laptop ...

take; what resulted was a ghostly 'departure' of the character in mid scene. Normally, this type of effect would be achieved in post production on an optical printer. With LCC control the precisely timed superimposition was created in the camera — just as in the days of Méliès!

The camera frame rate for cinema films is 24fps, while any filming for PAL TV countries is made at 25fps — or for NTSC countries at 29.97fps. The LCC application can set this speed exactly and, if needed, hone it by increments of 0.001fps — useful for shooting TV or computer monitors.

As shooting progresses, instead of filling in a camera report notepad with scene/OK-NG take data/fps rate/shutter angle, etc., the LCC system can do it all via keyboard entry. Parallel with this a Daily Film Report is logged, offering a precise correlation. At the end of the day, these reports can be printed out for distribution.

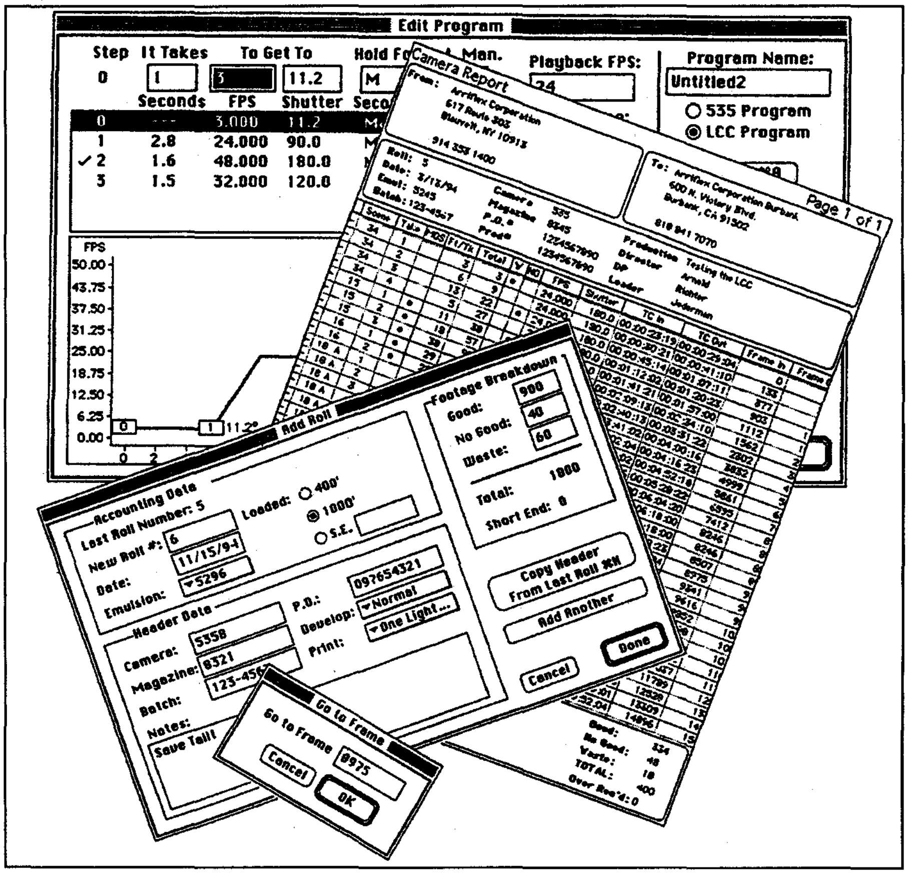
Conclusion

So why go to the bother of hooking up a computer to a movie camera, when the same tasks can be accomplished by making the adjustments manually on the camera itself? One obvious benefit is centrality of operation — everything is displayed on the Mac's LCD screen, with no need to bob and peer around the control areas of a complex piece of hardware. It's much the same as we now accept everyday total control of a laser printer by the host PC.

If the camera is set in a remote location, the laptop host is a unique aid to shooting. Today, there are so many remote peripherals used to drive a camera's functions it is only a matter of time before these could also be incorporated into the LCC application.

Focus changes, lens aperture and zoom settings can currently all be driven by cable linked devices; 'hot heads' allow remote control of a camera's shooting axis in 3D space, along with panning and tilting. Additionally, the video split, whereby a TV monitor displays exactly what the film is recording, is employed on the vast majority of film shoots.

Some US units have now located the editor and his gear on set feeding the video picture, along with time code data, to the edit suite so that an assembly can be done while the shooting is in progress. It would be possible with the new high speed, high capacity fibre-optic links to transmit that video signal to a remote edit suite. One can imagine the glee on the remote producer's face as he calls for a retake, for a recut! And the horror on crew members' faces when they realise they have lost creative control...

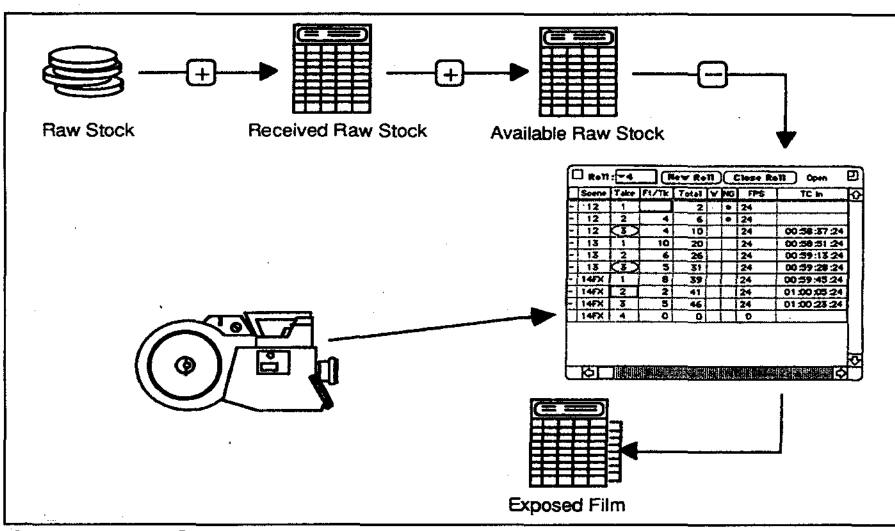


A medley of screen dumps generated by the LCC software.

Rob Draper is looking forward to the day when he can chat (on set) with the grader in a remote laboratory, as they both view clips from the previous day's processed rushes and make creative decisions on colour corrections.

LCC almost completes the circle of total remote control of the filming process. Its only problem is that of the PC-camera umbilical link. As one wit put it, "a great scheme, but what happens when the tea trolley slices the cable?"

Aside from an IR or similar transmission link, one approach under consideration is to fix a Newton (or similar) handheld computer to the side of the camera. A good idea, but this may be forestalled by Arriflex Corp's announcement a new remote control unit for their new 435 camera may soon be available. ❖



A feature of LCC with great attraction to film producers is its stock management facility.

FORUM

Conducted by Jim Rowe

Some delayed comments on Austel and the Telecommunications Act...

There have been a couple of reader missives sitting in my Forum file for a while now, and I'd like to present them finally this month. They're both about a topic that ran fairly hot in these columns for a while: the current *Telecommunications Act*, and the somewhat far-reaching Austel regulations which have been derived from it, applying to almost anything deemed to be 'coupled to' the public switched telephone network (PSTN) via electromagnetic energy.

You may recall that I actually started this discussion myself (foolish me!) in the October column last year. I know that the topic was explored pretty extensively before, in the November and February columns, and that as a result it's already had 'a fair go'. However both of these follow-up missives are from knowledgeable people who have clearly given the matter considerable thought, and as a result they make comments which I believe you'll find quite interesting. I'm only sorry that it has taken a while before I could present them to you.

The first comes from our old friend and contributor Dr Glenn Pure, of Kambah in the ACT. You may recall that Glenn recently responded to Tom Moffat's story about E-M radiation and cancer, clarifying the exact way in which cancer can be produced from damaged cells. We published that letter in the front of the April issue. Anyway, here at last is what he wanted to contribute to the Telecomm Act debate:

I have been following the discussion on Austel and the Telecommunications Act with some interest. Without having studied the Act in detail myself, it would appear from the sections quoted that Jim Rowe is right in suggesting that its coverage may well be excessive and stifling.

I have no desire to defend the Act or its coverage. However, I think it is worth looking at how such apparent aberrations come about.

There is some implication in the discussion that the buck stops with Austel on this issue. While Austel certainly appears to administer the Act and would have almost certainly been involved in its drafting, the responsibility does not end there. In fact, the responsibility ultimately resides with the Minister for Communications and the Parliament.

The process of developing and bringing the Act into force is especially relevant here. This can be influenced very strongly by the political process. By this, I mean the political ideologies of the parties in Government, the influence of lobby and pressure groups and the Parliamentary committees and debates themselves (after all, Acts are finally passed in Parliament).

In the specific case of the amended Telecommunications Act, before this debate goes much further, it would be worth examining the rationale that drove its development, what consultation took place and what pressure, if any, was brought on the political process by the industry (or others) to remove potential problem areas. In the latter area, "if you don't speak up, you can be fairly confident you won't be heard!"

Also a key question needs to be asked: why have an Act that is apparently so broadly restrictive as the Telecommunications Act? There are a few key principles that seem to have come into play in this case:

1. Simplicity can be a great virtue as it makes interpretation simple. Contrast this with our tax laws, which run over many volumes and are chock full of details and exceptions. A situation to be avoided wherever possible! However, simplicity often means blanket coverage with no ifs and buts. But simplicity can also mean the unscrupulous have a hard time finding any loopholes...

2. The aim is ultimately for the public good or public protection. Sometimes, this can run counter to the interests of some individuals' enterprises. No-one likes regulation, but sometimes it's needed for public safety or welfare.

The other area in this debate is interpretation of the Act and its application. This seems to be at the root of a problems highlighted in the February 1996 Forum. There is a strong implication that there is a discrepancy between what the Act says and how Austel applies it. If this is true, it appears Austel's main crime is that it has been inconsistent by erring more in industry's favour than the Act might allow it. If so, the problem is clearly with the drafting of the Act (and any regulations associated with it), for which the Minister and the Parliament must ultimately accept responsibility. They are also the only ones with the power to change the situation.

Putting it another way, Austel may want to do the right thing by industry, but may have an Act that makes it difficult for them to achieve this — it may be the 'meat in the sandwich'.

The preceding comments also relate to another letter on Austel in the February Forum. Ted Baker wrote about problems with a phone line surge protection device that apparently didn't work. The device had an Austel approval, but... Again, the problem might not be with Austel but the rules under which it works.

There is a key question eluded to by Jim Rowe: is Austel charged with ensuring that an approved device works well, or is it simply charged with ensuring the safety of a device connected to the public network?

If public safety is its only concern, then Austel approval does not imply the device is 'fit for the purpose for which it is intended' — only that it won't electrocute someone or be dangerous. As such, Mr Baker would appear to have a valid claim against the manufacturer and could then be entitled to a refund

under trade practices law. Austel's main crime in this situation is a failure to publicise its role properly. It would be interesting to get a bit more enlightenment from Austel.

At the end of the day, the only way to fix the current problems, if a thorough investigation reveals the problems are real, is to fix the Act and any regulations subordinate to it. Gentle pressure on Austel may help, but ultimately, the Minister and Parliament must be convinced to do something about it. All I can suggest is 'sharpen your pencils and get writing...'

Thanks for those comments, Glenn. I for one found them very interesting and thought provoking. In particular I liked your explanation of the possible reasons behind the Act's somewhat simplistic and draconian wording, and the suggestion that Austel may well be the 'meat in the sandwitch'. My argument all along was more with the Act itself than with Austel's interpretation of it — although they do seem to have been a bit inconsistent at times, which probably hasn't helped.

Anyway, your comments are refreshingly calm and objective, and I feel sure that readers will appreciate them as I have done. Perhaps you'll even motivate them to write letters to the Minister about the Act!

Another old friend

Now for the second letter, which came from another of our old friends and contributors: Alan Fowler, of Balwyn in Victoria. Regular readers will know that Alan is a very experienced engineer, who worked in Telecom (now Telstra) for many years, and is very knowledgeable about the PSTN and the ramifications of connecting things to it. This makes his views on the topic of considerable potential interest, as I'm sure you'll agree.

As he explains in his letter, it took him a while to find the time to respond. But then when he did, it has taken a while longer before I could return to this topic. So let's delay no longer — here's his comments:

I haven't written to you for quite a while, so it's about time I stuck my oar in again. I started writing this on 16th September, 1995 after reading the October Forum, and your comments on the wording of the revised Telecommunications Act. I had to put it to one side for more pressing matters. Five weeks later I read the November Forum. The February Forum reminded me that I still hadn't sent the letter, so I'll finish it and post it tonight.

You might not believe it, but there is a reason and logical explanation for all the testing that Austel require. Take the acoustically coupled DTMF dialler that came with your fax machine. Why did that need a permit to connect? Think about it...

What would happen if the acoustic output was too high, too low, or contained excessive energy outside the speech band. What if you had been sold one that used the American frequencies? If it was too loud, it could overload the microphone and/or amplifier causing distortion. If too low, it may not operate the exchange equipment correctly. If there was too much energy out-of-band, it could interfere with other users. And if it used the American frequencies, it would not work at all.

Austel would probably test for the overloud signal and the excessive out-of-band signals, because these could cause problems for the network. It wouldn't test for the rest because these wouldn't affect the network. Those would be your problem, and you would have to take it up with the supplier.

It is likely that there are only a few people still around who know the rea-

sons behind each of the restrictions. Some of the rules were introduced so long ago that they are no longer required. I hope the following will fill some of the blanks in the information you have received from Austel and your readers.

The Act certainly sound like a strong candidate for the year's gobbledegook award. Still, let's leave the Act to the 'experts' and have a look at the reasons behind the restrictions.

You might remember that I worked for PMG's Department and Telecom for nearly 50 years, starting as a Technician-in-Training, then a Clerk, Cadet Engineer and finally as an Engineer in a variety of parts of the organisation. I retired in 1992 as Principal Engineer, Telecommunication Science Branch in the Research Laboratories. Over the years I had a lot to do with equipment connected to the telephone lines.

There are four main requirements that have to be met before it will be accepted for connection to a telephone line:

1. The equipment must not put any voltage/current combination on the telephone line which could cause injury or death to any person.

2. The equipment must not put any voltage/current combination on the telephone line which could cause damage to or destruction of any Telecom equipment or plant.

3. The equipment must be designed and constructed to prevent the user coming into contact with any 'dangerous voltages' which may be present on the telephone line.

4. The equipment must not cause interference to other users of the telephone system.

where 'the equipment' means anything which will be physically and/or electrically connected to a telephone line.

That all looks straightforward, and it seems that it should be a simple matter to design and build equipment that will meet those requirements. In practice it is not so simple.

The first three of these requirements can be met if:

(a) the equipment is isolated from the mains by a power supply that will not let the mains voltage, any spikes or surges on the mains voltage, or any signals superimposed on the mains by the power authorities, get through to the equipment, and thence to the telephone line — in fact, to block almost anything except a direct lightning strike; and

(b) the equipment is connected to the telephone line by an isolating transformer having an adequate breakdown rating to prevent any over voltage or current that is accidentally coupled to the equipment getting through to the telephone line. This isolating transformer must also isolate the equipment from any normal voltages (including test voltages) which are present on the line, and from any extraneous voltages/currents combination induced into the telephone line.

More complex...

The fourth requirement is a lot more complex. Remember that the telephone network was designed to carry speech signals and very little else. Twelve-channel frequency division multiplex (FDM) carrier equipment is used extensively to provide trunk lines throughout Australia. It is being replaced by digital (PCM), but there is still a lot of it in use.

Each of the twelve channels is basically a single sideband suppressed carrier signal with a bandwidth of 3.4kHz and a 4kHz channel spacing. The common equipment, amplifiers, etc, is designed to handle the combined power of twelve channels of speech. This can be lower than for constant level signals because of the statistics of speech, and the silent periods while the other person is talking.

Low speed data modems use a frequency modulated signal while high speed modems use a combination of phase and amplitude modulation. The power level of the modulated data signal has to be controlled within narrow limits. If the level is too high and several channels of the FDM system are carrying data channels, the common amplifier can be overloaded. There will be cross-modulation, and interference to all channels. The data channels can suffer interference as well as the speech channels. If the level of the data signal is too low the signal to noise ratio suffers and the error rate will increase. To protect all users, Telecom set strict limits on the power sent to line by a modem of any sort.

Acoustic modems look as if they could be used without any restrictions. They are electrically isolated so shouldn't pose a threat. But — and a big but — if the sound level into the microphone is too high, the signal will be distorted, particularly with the older carbon microphones, causing errors. If the level is too low, the error rate will be unacceptable. Therefore, the sound pressure range permitted at the microphone is specified very tightly as well as placing limits on the bandwidth.

When acoustically coupled modems were introduced in the mid-60s, the normal telephone used a carbon microphone. These had a very peaky frequency response. One of their worst problems was 'carbon packing'. The microphone is basically two flat carbon electrodes, one attached to the diaphragm, the other to the case. The two electrodes are parallel with a small space between them, and they are immersed in carbon granules. When the microphone is held in a fixed position the granules tend to vibrate and pack together, substantially reducing the sensitivity of the microphone.

This isn't normally a problem because most people move the handset about while they are talking, and that shakes up the granules. But an acoustic modem clamps the handset in a fixed position, often with the microphone horizontal. This is the worst possible position for packing.

Telecom were understandably reluctant to approve the use of acoustically coupled devices. They did not want complaints about the quality of the service. I was the engineer in charge of the work on acoustic couplers and was finally able to convince the management to approve the use of acoustic coupled modems provided that the user clearly understood the limitations. If a call carried data successfully, good. If it didn't, try another phone.

There is a roughly parallel case today where it is recommended that you do not use a modem on a PABX line, only a direct exchange line. Many of the new digital PABXs use an A/D - D/A system that has quite different characteristics to the telephone network, and older PABXs had a high level of noise. If a high speed modem works in either case — good. If not, get a direct exchange line installed.

There is a further complication when designing equipment for connection to a telephone line. Over the years, a large number of signalling tones have been used to pass information about the call between exchanges. I once had to make a list of all the signalling tones used by telephone equipment, and there were pages of them.

The 2VF system was one of the early

approaches, which used combinations of two voice frequency tones (600Hz and 750Hz) for signalling. Another was the 1kHz tone from the 1000/16Hz ringer. This was used on long private lines where the attenuation was too high to use the normal 16Hz ring voltage. The ring signal was sent as a 1kHz tone. At the receiving end a 1kHz tuned circuit detected the tone, and switched the 90V/16Hz signal to the phone.

There was a broadcast line connecting the HF Receiving Station to the ABC Studios in Melbourne. It worked perfectly until the staff decided to check its frequency response. The response was flat except around 1kHz, where the meter went off scale, and a funny buzzing came from the monitor speaker. Disconnecting the 1000/16Hz relay set, which had been installed many years before (and completely forgotten by everybody) fixed the problem.

Now it is not a major operation to design equipment that will meet the four requirements above. On the other hand it is not possible to guarantee that every unit built to that design will meet all the requirements, unless it is built on a production line with rigorously enforced quality standards.

'Wind the wick up'

The average home builder is not likely to have access to the specialised equipment needed to make sure the finished unit meets all the specifications. In addition, many builders will 'have a fiddle' to get the best performance out of the unit. If a particular component is not available it's easy to substitute something else that may well put the unit outside specifications. On top of that there is always the urge to 'wind the wick up' (send a bit more power to the line), to overcome line noise.

So what is wrong with your Off-Hook Alarm? It seems to meet all the requirements, it isn't connected to the mains, doesn't generate or send any signals to the line, and doesn't appear to pose a threat to other users or the telephone network. Why couldn't it be used?

You mentioned that when the battery is being replaced the user could touch the internal circuitry. The authorities are not so much worried that you will feed a nasty voltage/current down the line, as that you will get an electrical shock from some of the nasty voltages that Telecom feeds down the line, then jump back, hit something, injure yourself and sue the socks off Telecom. So it's not a matter of protecting the network, but rather the profits.

Does that sound far fetched? Remember that the ringing voltage is about 90V RMS, of 16.66 or 33.33Hz superimposed on the 50V DC — enough to give you a severe shock in the right circumstances. In effect, it needs the same degree of caution as dealing with the 240VAC mains. Or have you ever been bitten by the inductive kick from the line relay if the two line wires are shorted together, then separated? That too can be nasty. Then there is the voltage used for testing insulation resistance. The current is small, but the cable capacitance can hold a significant charge.

You raised a couple of further points in the February Forum. Firstly, whether other equipment such as computers, printers and monitors connected to a telephone line by a modem had to be tested for approval as permitted attachments. If these devices used an internal plug-in modem, or worse yet, had the modem built into the mother board, I would want to see them thoroughly tested to make sure they complied. Once the telephone line disappears inside the case, anything can happen to it. But if they were being used with an approved external modem, I would argue with Austel, and try to convince them they were wrong.

I've dealt with the need for testing acoustically coupled devices above, but Mr Ted Baker's letter needs some comment. I agree that the Austel Approved Permitted Attachment label must make it clear that the equipment has been tested to make sure it meets Austel requirements only, and this is not an endorsement the unit will work as advertised. That is a matter for the manufacturer and his warranty. In fact, I think Austel should run a campaign to make the public aware of these facts.

Austel seems to have done something about imported modems recently, and I have seen quite a few modems being sold at Swap Meets with a printed sticker saying that they are 'Not Approved by Austel', and that connecting one to the PTSN and using it could result in a fine of up to $12,000. There is a major flaw here — it is legal to import and sell these modems, but not to use them. The Government should prohibit their import into Australia, with confiscation of the modems and a hefty fine. But I don't suppose that is feasible, as it would amount to a restriction of trade.

And as a final thought, blowing a loud whistle into the telephone to scare off nuisance callers could theoretically *land you in trouble, because the whistle is unlikely to have Austel approval for a device acoustically coupled to the telephone.*

Well, there you are — a fairly long letter, but very informative. Thanks for your carefully considered comments, Alan, and as usual they were well worth waiting for. I particularly liked your explanations of the technical background to some of the regulations, and I'm others will find this illuminating too.

I confess I'm still puzzled by the fact that the first IBM PC's had to be tested, approved and fitted with 'Permitted Attachment' labels, while this doesn't seem to apply with newer ones. Your suggestion that it was because of the chance that they'd be fitted with internal modems isn't terribly convincing, Alan, because from memory internal 'card' modems weren't available for quite a while after that. In fact they're much more commonly used now, so that would be a good argument for requiring the testing and approval of modern PCs, rather than the old ones. Yet the reverse is the case!

The other area that worries me is Alan Fowler's suggestion that the Government *couldn't* prevent the importation and sale of things like modems that don't meet Austel requirements, because this would constitute a 'restriction of trade'. If this is so, then surely the trade regulations concerned are against the public interest.

I don't know about you, but it has always seemed quite crazy to me that certain products can be legally imported and sold, but using them as intended can be illegal and result in a $12,000 fine. I really can't understand why the Government can't pass laws stopping the products concerned from being imported legally in the first place, can you? Surely that's just common sense.

A final comment. It's interesting that both Glenn Pure and Alan Fowler make the point that Austel probably hasn't made its position clear enough, as yet, regarding the real significance of its approval of equipment as a 'Permitted Attachment'. There certainly still seems to be a fair bit of confusion in this area, with many people still assuming it constitutes some sort of endorsement that the product meets all of its advertised claims.

Mind you, the situation which Ted Baker was describing in the February column was one where some products like fax machines seemed to be inadequately protected against damage from 'spikes' on the incoming telephone line — which is very definitely part of the PSTN. So I think the point Mr Baker was making was that although Austel seems to be very sensitive to the possibility of user equipment causing damage to the PSTN, or presenting the risk of shocks to either the user or technical people working on the PSTN, they apparently have little concern about damage to the user equipment itself. That's purely the user's problem, it seems, and one that must be taken up with the manufacturer...

That's all for this month. See you again next time, I hope. ❖

NEW KITS FOR EA PROJECTS

FROM DICK SMITH ELECTRONICS:

Stroboscopic Tuner Mk3 (May 1996): The DSE kit is complete as described, with case front panel pre-punched and silk screened. Cat. number K-5102, it is priced at $64.95.

Electronic Steam Whistle (June 1996): The DSE kit consists of the PCB and all components, plus a speaker. Cat. number K-3021, it is priced at $12.95

Remote Volume Control (July 1996): The DSE kit is complete as described, but with a deluxe transmitter case and silk-screened front panel. Cat. number K-5407, it is priced at $69.95.

Mains Filter/Conditioner (July 1996): The DSE kit is complete as described, with pre-punched front and rear panels — plus a four-way overload protected power board. Cat. number K-3088, it is priced at $59.95.

FROM JAYCAR ELECTRONICS:

Subwoofer Bridge Adaptor (March 1996): The Jaycar kit is complete as described, with a silk screened front panel. Cat. number KA-1784, it is priced at $22.95.

Remote Volume Control (July 1996): The Jaycar kit has both PCBs and all components, but comes complete with a metal case to house the receiver unit. Cat. number KA-1785, it is priced at $49.95.

Mains Filter/Conditioner (July 1996): The Jaycar kit includes PCB and all components, and is complete with a sturdy ABS plastic case. Cat. number KA-1786, it is priced at $45.00.

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Electronic & Other Non-Lethal Weapons

(Continued from page 29)

wide ranging. A burst of EMP has the ability to instantly destroy solid state devices. Because of the fear of EMP, much American military electronic equipment still uses valves, which are highly resistant to EMP.

Dr Alexander is a straight talker, and instead of denying government research into EMP he simply declined to confirm it, with a "no further comment".

However, a few days later during some rambles about the test range in the desert behind Sandia Labs, I noticed an interesting structure of odd poles and wires, a kind of net supported high above the ground. Closer inspection revealed a sign at the entrance to the facility: 'ADVANCED RESEARCH EMP SIMULATOR'. (See photo) It's amazing what you can find with some intelligent snooping around...

The bottom line

Non-lethal weapons, then, are becoming a practical option to massive force and wholesale death in fighting the world's many battles.

Certainly it would be nice if war and fighting could be eliminated altogether. But realistically, there will always be disputes as long as more than one person still exists on earth. At least, with non-lethal battle now becoming a reality, war will hopefully be more civilized and many lives that would have been lost will now be spared. ❖

EA's READER SERVICE BBS

As part of its service to readers, *Electronics Australia* operates a Reader Information Service Bulletin Board System (BBS), which makes available a wide range of useful information for convenient access and rapid downloading. Contributions can also be left for Forum, Information Centre and Letters to the Editor.
The BBS is ANSI compatible and is currently operational for virtually 24 hours a day, seven days a week, on (02) 9353 0627 (Note new number). Use any standard speed to 28.8kb/s.

THE SERVICEMAN

The microwave oven that 'let itself go', and a bingo machine that didn't like microphones!

I have three interesting tales for you this month. The first concerns a microwave oven which gradually became less and less functional, until it finally stopped altogether — but was resurrected in a surprisingly simple manner. There's also a horror story about a colleague's problem with an AWA colour TV using the ML chassis, and an intriguing tale about an electronic bingo machine that didn't like being near a microphone...

This month our Serviceman column takes a big (technological) step forward. It's the first time that I have not had to manually retype a contributor's story. All the stories in these pages have been scanned into the computer using a hand scanner and an OCR (optical character recognition) programme.

In the past, it would take me half an hour or more to enter in a single A4 sheet of close typed copy — half a day to enter a month's worth of contributions. With the scanner, three quick swipes across the page and a minute or so of computing time, and the story is entered, ready for editing.

I've never been a very good typist. I'm slow and inaccurate, so OCR technology is a great boon. It works well on all good, clean typewritten pages. The typeface seems to make no difference, nor does single or double spacing. The programme doesn't like material typed with a worn out ribbon, but it can cope with it, albeit with more than the usual number of mistakes.

One thing that a scanner and OCR *can't* manage is handwriting. I scanned a page of a hand written story and the programme could find only four letters! So unfortunately, any handwritten contributions must still be laboriously typed in, letter by letter and word by word...

And with that small salute to modern technology, we'll go straight into the first story. It comes from Alan Renton of George Town, in Tasmania. Alan's story relates the successful outcome to what might have been the sad demise of a quite useful piece of domestic equipment. Alan calls it 'Washing the Microwave' and he describes an unusual but often effective treatment for suspect circuit boards. Here is his story:

"Dad, I've something here that you might like to play with." It was a microwave oven, a large, very sophisticated top-of-the-range older model with microwave, convection and combination facilities (National 'Dimension 3').

My son mentioned that for some time the touchplate and LCD display had gone on the blink, after cooking dishes where a lot of steam was produced. Sometimes only part of the display would come on and sometimes nothing at all would work. They would have to wait for some hours or even half a day, until it would work again. Then it would come good — until the next time!

When finally nothing would bring it to life again, it was taken back to the agents. They investigated and reported that the problem was in the touch plate. They had tried to get a replacement part, but found that it was no longer available. Reluctantly son and daughter-in-law purchased a new oven.

As may be imagined, my wife was aghast at MORE junk around the place. However I duly installed it on the workbench and turned it on. Sure enough the only sign of life was a blank LCD display that lit up. After that nothing worked! There was absolutely no response from the touch plate, display or the 'works'.

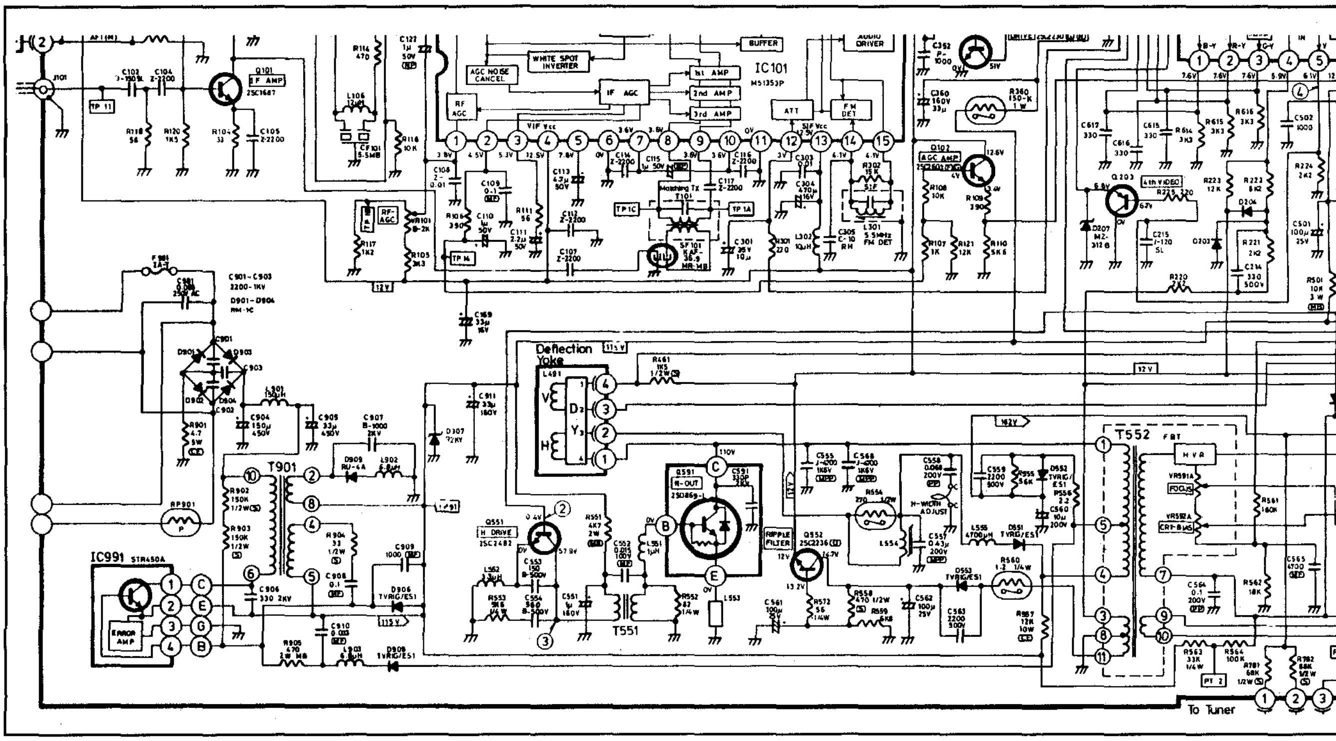
I removed the touchplate and the associated circuit board and examined them carefully. There was no obvious damage. The circuit board had a large number of discrete transistors, a couple of ICs and a microprocessor. I wondered about the output power transistor, since this was a common link between the touchplate, the LCD and the other parts of the microwave.

In bright sunlight, an inspection showed a dark mark, considerably smaller than a pinhead between two terminals of the transistor. The solder of the terminals was very close together. I decided to run a fine knife blade between the suspect terminals, in case moisture was making a particle of dust conductive and shorting them.

Then I thoroughly washed the whole circuit board in warm water and a mild detergent, to remove any other dust particles. (I remembered that on occasions transistor radios which had been accidentally soaked had dried out OK). A couple of days in bright sunlight on the window sill dried it out thoroughly.

After putting it all back together and turning on the power, everything was 100% and working well. It has continued to work and cook to perfection...

How many times in these pages have we read of a piece of equipment, destined for the council tip, having been resurrected with just a little tender loving care? And how often has that TLC called for nothing more than



The power supply and line output section of an AWA set very similar to the model C6345 which forms the subject of Colin Leonelli's story. Finding why it wouldn't go involved a great deal of frustration — especially when the circuit has somewhat misleading component markings.

a close examination or the replacement of an obviously faulty component? I'm afraid that the 'Throw Away Economy' disgusts me, at times.

Then Alan's treatment of the suspect board, with warm water and a mild detergent, is one that sounds rather drastic. Yet it's a very effective way of cleaning a board, and quite harmless provided that the board assembly is given time to dry out thoroughly before being powered up again. In fact, water washing of new boards is becoming common in the industry these days, now that CFC solvents have been banned.

Thanks for that story, Alan, and I hope you go on enjoying many more meals cooked in the rejuvenated microwave.

Colin's pet hate

Our next contributor is Colin Leonelli, of Ingham in Queensland. Colin opens his story with comments that strike close to the hearts of most servicemen — 'pet hates'. I don't think anybody who has been in the servicing industry more than a year or two could escape without running foul of at least one model that they feel should never have been released.

Here is what Colin has to say on the subject...

I have been an avid reader of EA for more years now than I care to remember. I am a technician running my own repair business in the small town of Ingham in north Queensland, and No — this is NOT where the chickens come from!

Have you ever noticed how every tech has a particular .model they loves to HATE? Everyone has a different choice, so it is not a problem with isolated sets. And it is not only CTVs or VCRs. There is a whole range of consumer equipment that comes under this category.

You might be wondering what all this rhetoric is leading up to. Well, it's about my pet HATE. This set is an AWA colour TV which generally has a very good reputation for reliability. But every time one lands on my bench, I shudder in fear of what it has in store for me.

The CTV I'm talking about is any AWA model fitted with the ML chassis. This particular one bore the model number C6345T. As I said previously, I have never had an easy time with this chassis, and this one was to be no different.

The customer's complaint was simply 'no go'. It just stopped, for no apparent reason and refused to operate at all. "Beauty!" I thought. "An easy one for a change." But those words were to haunt me for quite a while, after that...

The first thing to look for in this situation is blown mains fuses and the like. Alas, no luck there as they were intact. Next step was to measure the voltage on the regulator IC, which in these sets is an STR450, a T03 four-pin device (IC991). Voltage is supplied to it from the bridge rectifier via a winding of T901 to pin 1 of the IC.

I found the expected 350 or so volts on this pin, so the next thing was to check the start up resistors R902 and R903, both 250k. As you might have guessed by now, the story would not be worth writing if it was going to be that simple. And it got a lot harder and more frustrating from here.

The next thing to suspect is the horizontal output stage, and lifting the collector lead from the output transistor will give an indication of the state of the horizontal stage. With this done the voltage from the power supply into a dummy load was only about 80V, rather than the 115V I was hoping for.

I wondered whether this cleared the horizontal stage, or did it complicate matters. I spent the next couple of hours trying to find why the power supply would not regulate or deliver the correct voltage. I had lifted off all the loads, yet as far as I could tell, this supply would not produce anything like 115V. Was it the IC, or had I missed something?

The only answer would be a replacement chip, so an order went out that day and the part turned up in due course. With the new IC fitted I turned the set on gingerly, waiting for the triumphant sound of EHT. There was no such luck, so it wasn't the IC.

This left the line output trans-

former/high voltage unit as the only item I hadn't tested. Unlike older sets, these functions cannot be separated for individual tests. So I lifted the transformer to eliminate it from the calculations.

With this done and a dummy load fitted I switched on, again expecting to see some 'light'. (My dummy load is a pair of 60 watt lamps in parallel, with leads and clips attached.)

Again there was no luck and the voltage was still low. This was turning into a nightmare, as is so common with this chassis. I sat down with the circuit again and had a really good ponder as to what it could be...

I had eliminated the power supply IC and associated components by checking or replacing them. Some of you who know the circuit may be thinking '...what about D947, the over voltage protection diode?' But I had lifted it earlier, and to no avail. This was getting ridiculous. What WAS wrong, that I couldn't see?

The power supply would only deliver about 80V which varied slightly with the load — i.e., with only one bulb it was 89V. I had eliminated the line output transformer unit by removal and checked every possible angle I could think of.

I had also done a resistance check on the transformer to see if any of the windings were shorted. This is not an infallible method, as they could break down under voltage. However my megger produces 1000 volts, which should be enough for a fairly reliable test, and all seemed OK. But I finally gave up and ordered a new transformer unit, out of sheer frustration.

You might have guessed that this was the cure (and the old IC worked as well). With hindsight, I have seen my mistake.

If you look carefully at the circuit, you will notice a connection between pin 2 of the regulator IC and the line transformer pin 4, via a resistor R557. This is a feedback loop to keep the supply going. Without the line pulses from the transformer, the IC would not regulate, which caused me to suspect the power supply.

The catch was that on my circuit, the resistor is marked 12 megohms — so I naturally thought there is no way this could load down the supply or be a feedback path. But on checking the actual circuit this resistor is 12 ohms — a much more likely value to find in a feedback loop. Oh well! We live and learn.

I can remember spending hours trying to solve an intermittent colour problem with this chassis, only to have to blanket change all the ceramic caps in the chroma circuit. And the time I spent trying to fix a vertical collapse, with no sound and no video due to a corroded connection (from that rotten glue AWA used) in the power supply.

My heart bleeds for you, Colin. I know exactly how you feel about that model. My own pet hate is the Sharp 1831X, with the AWA 4KA running a close second. Fortunately, both of these models are almost extinct, so they don't bother me too much nowadays. But in their time they have given me more agro than you could shake a stick at.

By a strange coincidence, I have a similar AWA model on the bench at the moment and it, too, has a duff line output transformer. I am waiting for the owner to decide if he wants to spend the price of a new transformer to resurrect the old set. I feel that the set is worth more than the cost of a transformer but then, that's customers for you. Thanks anyway for your story, Colin. And I hope you have less trouble with ML's in future.

Bung bingo box

Our next story is something quite different. It's not really a servicing story, and it's not from a serviceman. But it *is* about fixing electronic equipment, or at least about getting the gear to work until a proper fix can be organised.

It comes from a contributor in Queensland, who gave us his address but not his name! You'll see from his story that his first name is Colin (another one) but that's all I can tell you about him.

(If you are sending in a contribution, please be sure to include your full name

— a cheque made out to 'Colin' might not be honoured by the bank!)

Anyway, it's over to Colin, for his story of the Bingo Game that almost wasn't...

I recently experienced a situation that I found quite unusual, and I thought I would write in case the events might be of interest to readers.

I am now retired from a teaching job, but my interest in 'wireless' began in my Grammar School days with construction of crystal sets, and I have been a keen hobbyist ever since. I've worked on home project development as well as servicing a wide range of items in my spare time. Your column in EA is one of the first things that I read each month.

My story hinges round the fact that I assist each week with the bingo session that is played in the bowls club where I am a member. One of my tasks is to set up the electronic bingo system on the stage and check that it is operational. On the day in question, there had been a delay in clearing the room where the bingo was to be played, and the players were getting restless as I wheeled out the bingo board and connected up the console.

This houses the electronics, and externally there were some seven-segment number displays, three microswitch action buttons and a chrome plated knob that acted as a touch plate. I did a quick lamp test to check that all numbers would light up on the display board and then the caller — my wife on this occasion — announced her welcome to the players and offered her apologies for the delay.

There was a period of silence from the caller then as she poked around at the touch knob which was followed by a plaintive plea of "Colin, would you come up here?" She explained that the numbers would not come up as she touched the knob. So what do you think I did? That's right. I touched the knob as if to verify her statement, and saw the first number come up on the board!

So, to prove it was no coincidence, I repeated the operation a number of times with no hitch. She tried again, but not a thing happened, no matter how many times she touched the knob.

Of course, we went through the same process again and whenever I touched it, the numbers cycled through — but when she did, nothing happened. I queried whether she was still among the living, as the machine would not react to her touch, but she assured me she was with us!

I tried switching the machine off for a few seconds and powering up again, but there was no difference. So with the players getting impatient, we conjectured two courses of action.

The first was for me to press the knob while she called the numbers. But there was no guarantee that the machine would continue to operate reliably. We wouldn't want it give up the ghost in the middle of a game.

The second option was to use the old stand-by system whereby the caller pulled numbered chips from a dish and placed them on a numbered grid as she called the numbers. It was decidedly low-tech, but we settled on the second course of action.

While she went on with the game, I lifted the console down to the stage floor to be more out of sight, and played around with the machine which still worked perfectly for me. Maybe she would be able to sit on the floor and call from there!

But it wasn't very comfortable, so I moved over and sat with my legs over the edge of the stage and placed the console into position beside me. You wouldn't believe it, but now there was no response at all as I touched the knob again and again. I tried the earlier position on the floor, once more with success. "What is going on?" I wondered, as I switched the system off for further investigation at half time.

At the break, the machine's operation was faultless. I tried to imagine what was different now from before. My first thought was that this time it had been switched off for some time, so the previous powering down had maybe not been long enough to allow some residual voltage to bleed off and reset a critical circuit component.

After a comprehensive test, I gave it the all clear and returned the wired microphone to the caller's table from where it had been temporarily removed. One final test and it was off to a welcome cuppa. But Murphy was present, as again there was no action.

What was different this time? "Don't be stupid" I told myself. "It couldn't be the microphone".

Sure enough, when the microphone was moved away, my wife could get the numbers to come up — but place it near her in the normal position to her left, and nothing would happen.

In the earlier situation when I sat beside her, I was to her right and at a distance from the microphone and the numbers came up whenever I touched the knob. The instances on the stage floor, too, can now be related to the microphone cables. These are routed round under the edge of the stage, and might explain why the machine was not operational when I sat with legs over the side of the stage.

The use of a radio mic with the system seemed to cause no problems, so it was used during the second half of the bingo session with no hiccups in the system.

I had discovered a temporary fix for the problem by removing the offending mic and attached cable a few feet away, but why should their proximity cause a no-go situation only for my wife and not for me?

My humble but somewhat ridiculous sounding diagnosis of the fault in the console was that there was some problem with the sensitivity of the circuitry detecting the touch, when an operator was near to some 'earthed' cable. I have no valid explanation to back up my theory, and the final repair was left to a specialist repairer.

I left a note attached to the machine explaining the situation for the serviceman, for which he later said he was most thankful. He fitted a microswitch in place of the touch knob, and made suitable connections to the internal circuitry to match.

He said that our machine is one of the older type and the touch knob is connected to an oscillator. Touching the oscillator dampened the amplitude below a preset point, at which the appropriate switching circuitry would be triggered.

But he's not absolutely sure of why the proximity of the wired microphone produced the effect that it did. Maybe the cabling was picking up some energy that

(Continued on page 94)

Circuit & Design Ideas

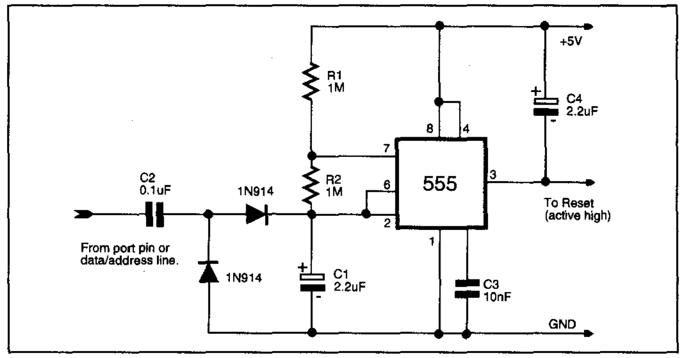
Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide any further information.

One dollar watchdog

This circuit was designed to provide a simple and inexpensive watchdog for the 8051 family of microcontrollers. The recommended power-up reset according to the 80C51 databook is to connect the reset pin to Vcc through a 10uF capacitor, and to ground through an optional 8.2k resistor. This is fine for most applications, but if the power comes on, and off, and on again (for example, if used in a car while starting), then the 10uF capacitor won't fully discharge. The result is an unreliable reset which causes the microcontroller to lock up.

A simple solution is to use the trusty old 555 timer in astable mode. It is set up for around 0.2Hz via R1, R2, and C1. The output is fed to the reset pin (active high reset), and an optional 2.2uF capacitor to Vcc guarantees reliability.

One of the micro output ports is used (or an address/data line), which can source or sink small currents. By toggling this pin (using an interrupt), at a minimum of 20Hz depending on the value of C2, C1 is constantly topped up and the output of the 555 remains low. However if the micro freezes up with the port pin either high or low, the 555 kicks in and causes a reset. The interrupt will then need to be re-enabled soon after reset to keep the 555 dormant again.



S. Kay
Chatswood, NSW **$30**

Off-air alarm

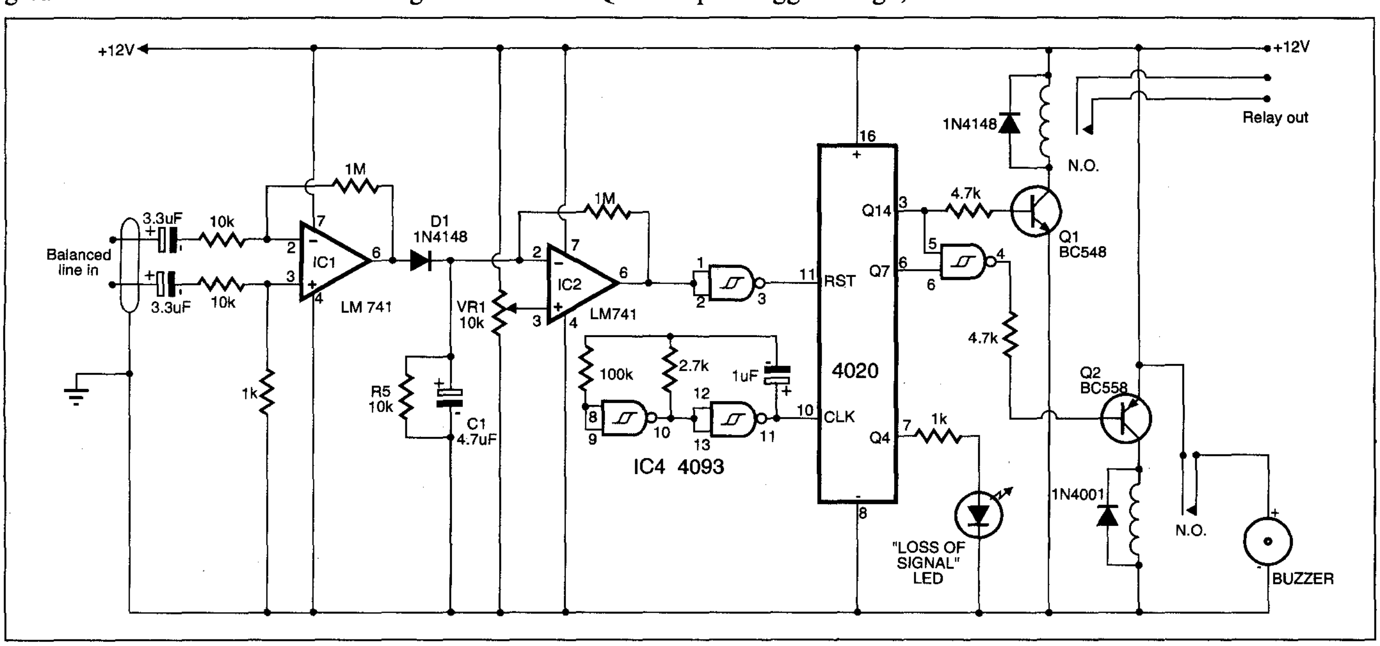
This circuit was designed for use in a radio station to monitor the station's signal to the transmitter, and to sound an alarm if the program from the studios were to fail for more than 30 seconds.

IC1 provides a balanced line input, and its output charges C1 via D1, integrating the half-wave rectified signal from the op-amp. The voltage on C1 keeps IC2's output low as long as it is greater than the threshold voltage applied to IC2's positive input via VR1.

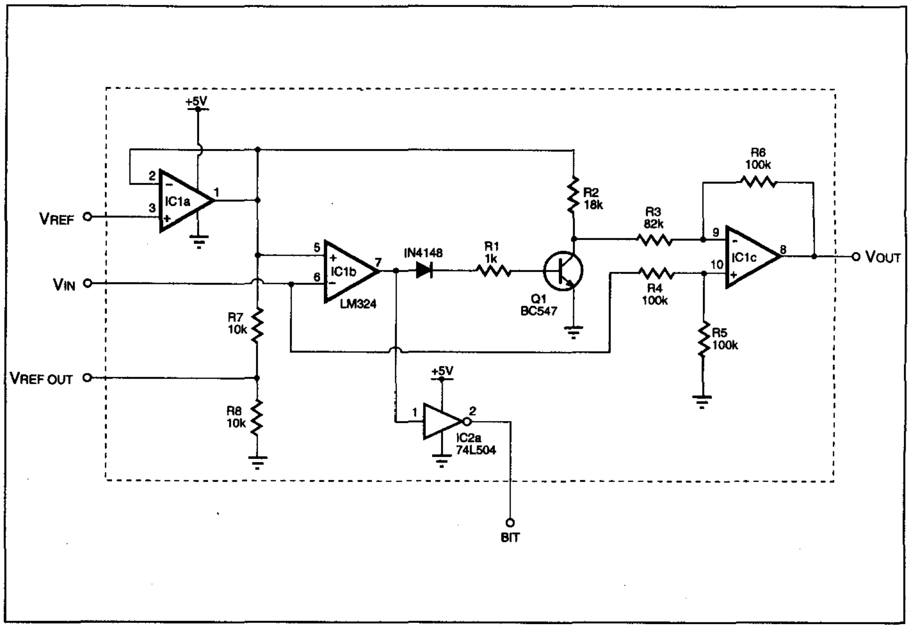
If the signal fails, C1 discharges through R5, and as the voltage falls below that set by VR1. IC2's output swings high, pulling the reset line of the 4020 binary counter low due to the inverting action of IC4a. The counter, clocked by the oscillator formed around IC4c and d, is now allowed to count, flashing a warning LED connected to its Q4 output.

After approximately 30 seconds, the counter's Q14 output toggles high, pulling in a relay driven by Q1. This was used to turn on a warning lamp in the studio, while the relay switched by Q2 and IC4b pulses a buzzer up in the workshop, galvanizing the technical staff into action. The circuit was later used to monitor the station's signal received by an FM tuner, so that a problem anywhere in the studio-relay-transmitting chain could be quickly discovered.

G. Cattley
EA Technical Staff



Expandable ADCs



ADC's are expensive, slow or both, especially when resolutions greater than eight bits are needed. The circuit shown is for a single-bit ADC, which although not sounding very impressive, does have the advantage of being very fast, having no need for a clock, and having no encoding circuitry.

The major advantage of this ADC is that it can be cascaded and placed on top of an existing ADC to add extra bits of resolution. For example, an 8-bit ADC can be increased to a 10-bit ADC by connecting two of these modules to produce the two most significant bits, and feeding the voltage output and reference output to the 8-bit ADC to produce the eight less significant bits.

Four of these modules were cascaded to add an extra four bits to an 8-bit ADC, with an input voltage of 2.51V, and a reference voltage of 2V.

This gave a full-scale input of 4V. The first module compares the input voltage (2.51V) with the reference voltage (2V) and because the input voltage is higher, the bit output is high. This causes the differential amplifier IC1c to subtract the reference voltage from the input voltage and send the result to the second module.

The second module in turn compares its input voltage (510mV) with its reference voltage (1V). Because the input voltage is lower, the bit output swings low, and the differential amp subtracts 0V from the output voltage, and passes it on to the next module.

This process continues through all four modules, subtracting 0V if the bit is low, and subtracting the reference voltage if the bit is high, and the final output voltage is fed to the ADC, which needed to be expanded along with a reference voltage of 125mV as this is now the full scale input to the ADC.

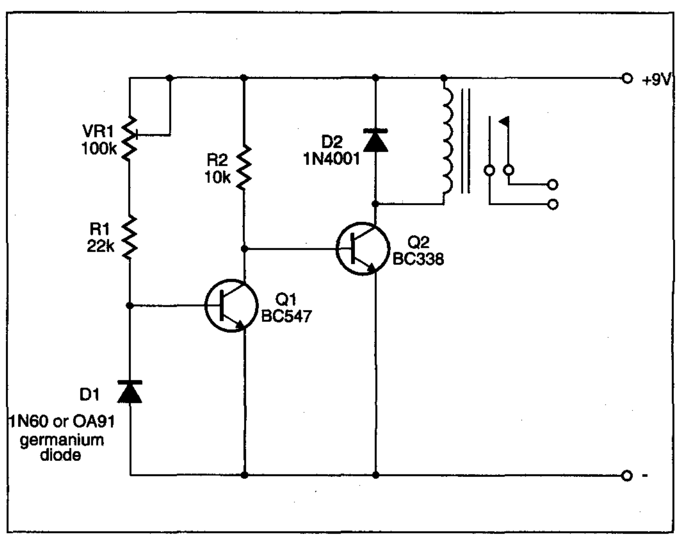
The heart of the circuit consists of op-amps IC1b and c, performing the analog calculations needed. IC1a acts as a buffer, so that the switching of Q1, which will be explained later, does not upset the voltage divider network. IC1b compares the input voltage to the reference voltage.

If Vin is lower than Vref, the op-amp output swings high, turning the bit output low via inverter IC2a. IC2a also serves to provide a clean +5V or 0V at the bit output. If Vin is higher than Vref, then the op-amp output swings low, turning the bit output high via IC2a.The subtracting of Vref from Vin is done by IC1c, set up as a differential amplifier. Vref is subtracted from Vin only if Vin is higher than Vref. This is achieved by Q1. If Vin is less than Vref, then Q1 will turn on via the output from IC2b, D1 and R1. This holds the negative differential input of IC1c to 0V, so that the output is Vin - 0V, or simply Vin. If Vin is greater than Vref, then Q1 will turn off, setting the negative input to Vref via R2 and R3, thus the output voltage is Vin - Vref, which is then fed to the next module or ADC.

In practice, I found that the output from IC1b did not swing quite to 0V, but sat at around 0.6V, which was just enough to turn Q1 on. So I placed D1 in series with R1 so that a least 1.4V is needed to turn Q1 on.

M. Victor
Kenwick WA **$50**

Simple temperature switch



A germanium diode is used here as an effective temperature sensor, in a circuit that pulls in a relay if the diode's temperature rises above 80°.

At room temperature (i.e., below 35°), the reverse resistance of the germanium diode is high — around 10k. This causes Q1's base voltage to rise, turning on Q1, and in turn turning off Q2. If the diode temperature rises above 80°, its reverse resistance falls to less than 1k. This pulls Q1's base low enough to turn it off, allowing Q2 to turn on, operating the relay.

D1 prevents the back EMF from the relay from damaging Q2, while VR1 allows you to set the temperature at which the circuit will operate. This circuit can find application in many non-critical areas, including monitoring heatsink temperature in a power supply or amplifier, or any part of a circuit that you think may overheat.

Pradeep G.
Alappuzha, S.India **($30)** ◆

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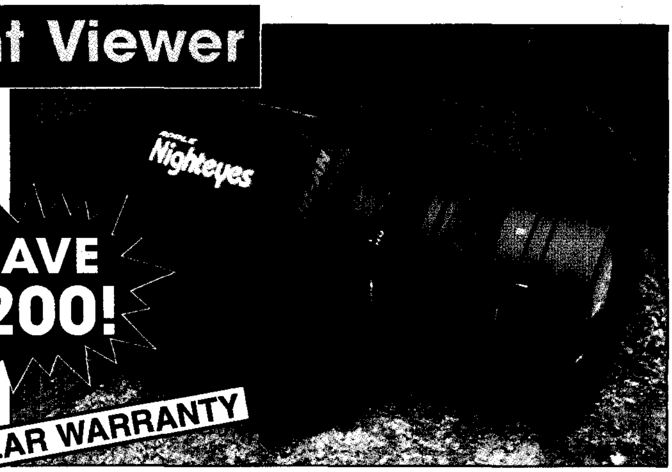
Apple Nighteyes Night Viewer



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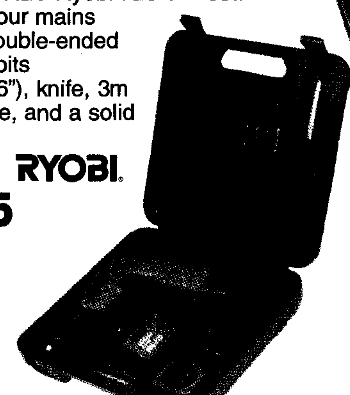
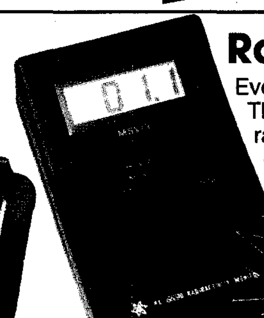


Radioactivity Monitor



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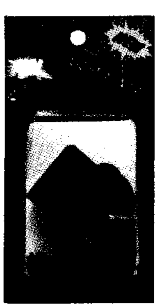

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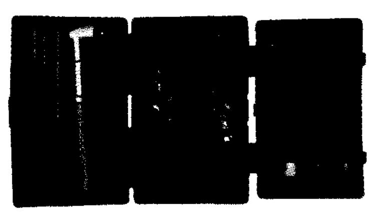

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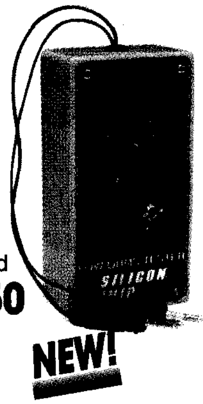
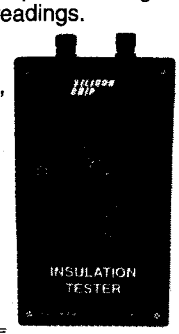


Insulation Tester

This high voltage insulation tester measures leakage resistance for a range of test voltages & features a 10-step LED bargraph display. Offers a 3-position range switch to select x1, x10, or x100 scale readings. Measures resistance from 1Gohms to 2200Gohms. Kit is supplied in full form with components, PCB, hardware, case, test leads and pre-punched screened front panel.

Specifications

Test Voltages:	100, 250, 500, 600 & 1000V
Charging Impedance:	9.4Mohms
Current Drain 50mA:	@ 1000V out



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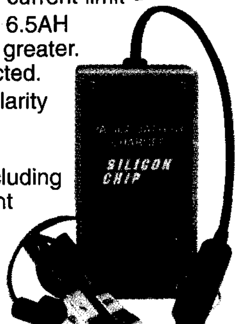

Cat K-3211 **$49.50**

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EA Jul '96

Specifications:

Output

Single channel:	54W RMS
Both channels:	46W RMS

Input Sensitivity

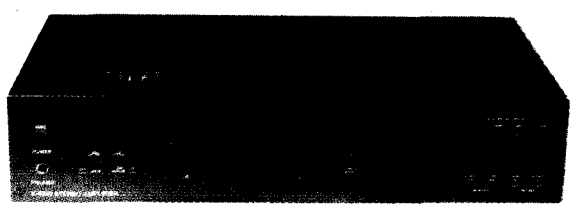
Power Amp:	1V RMS

Frequency Response

Power Amp Input:	+0/-0.5dB 20Hz to 30kHz

NEW!

Cat K-5590 **$299**



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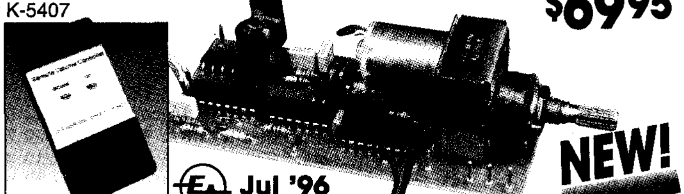

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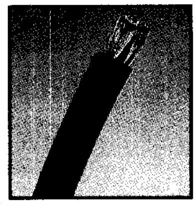

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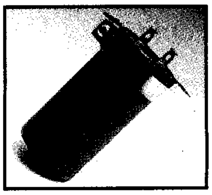

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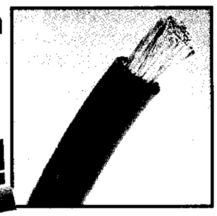

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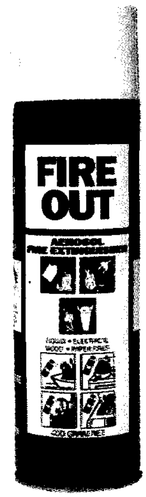

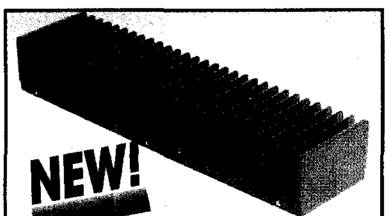
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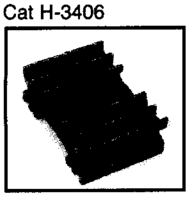

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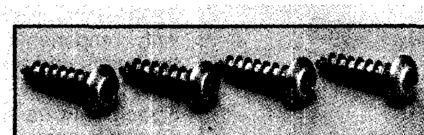

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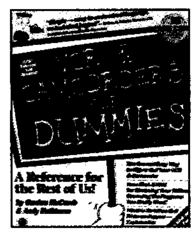

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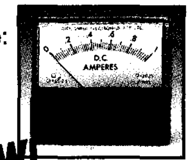

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Panel Meter 0-3A DC

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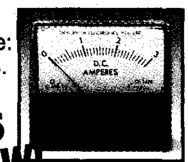

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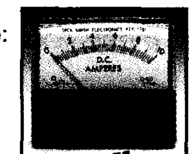

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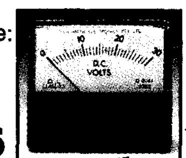

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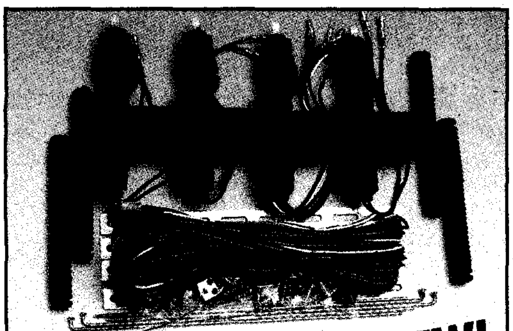

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Cat D-3910

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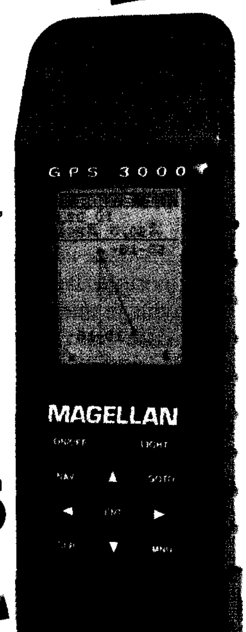

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*** STORES IN RED ARE OPEN SUNDAYS.** **STORES ACROSS AUSTRALIA AND NEW ZEALAND**

Construction project:

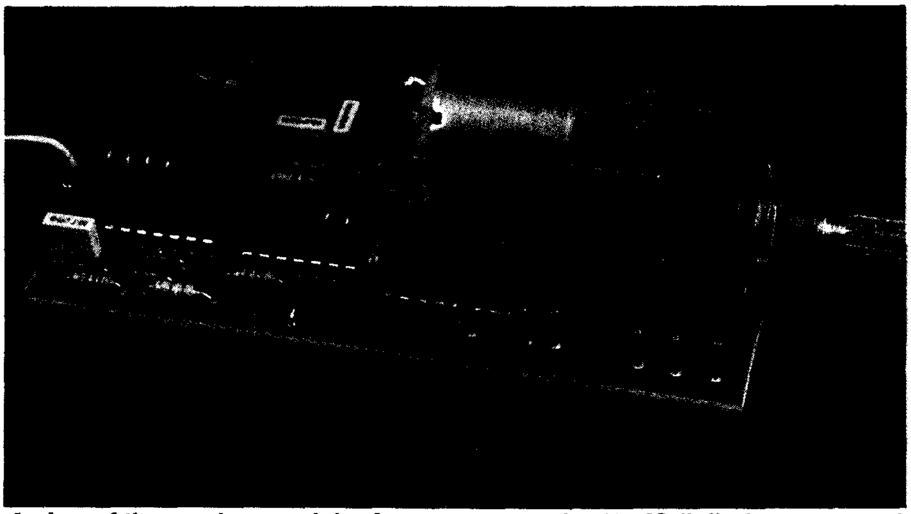
INFRA-RED REMOTE VOLUME CONTROLLER

Based on a neat little motor-driven potentiometer unit, this compact infrared control system can be installed in an existing amplifier, or housed in its own case and used as an external control unit. It uses common low cost parts in both the transmitter and receiver circuits to process the infrared data codes, and as a bonus, these codes are compatible with most learning remote controls.

by ROB EVANS

When it comes down to it, the most fundamental and therefore most often used adjustment in a sound system tends to be the volume control. Which is why a method to remotely control this particular setting is of such practical benefit. While the other controls and switches can also be assigned to a remote control system — with a considerable increase in complexity and cost — the ability to control these more peripheral functions from a distance is of a limited advantage during normal use.

With this in mind, we felt that there is a strong case for developing a dedicated *volume-only* remote control system, that would be easy to add to an existing sound setup. And thanks to the relatively simple activity involved (just volume up and volume down), such a control should also be compact and low in cost.



A view of the receiver module. As you can see the 556 IC (U4) sits underneath the pot motor, which in turn, should be mounted hard down on the PCB.

As most readers will be aware though, there are two quite distinctive methods used by remote control systems to alter the signal level in an audio path: the 'passive' method via a motor-driven potentiometer, or an 'active' system which involves electronic processing of the signal itself via some form of voltage (or digitally) controlled amplifier/attenuator stage. While both of these methods offer a number of advantages and disadvantages in this application, we feel that the balance is quite clearly in favour of the so-called passive option.

The merits of the passive, rather than active approach can be summarised as follows:

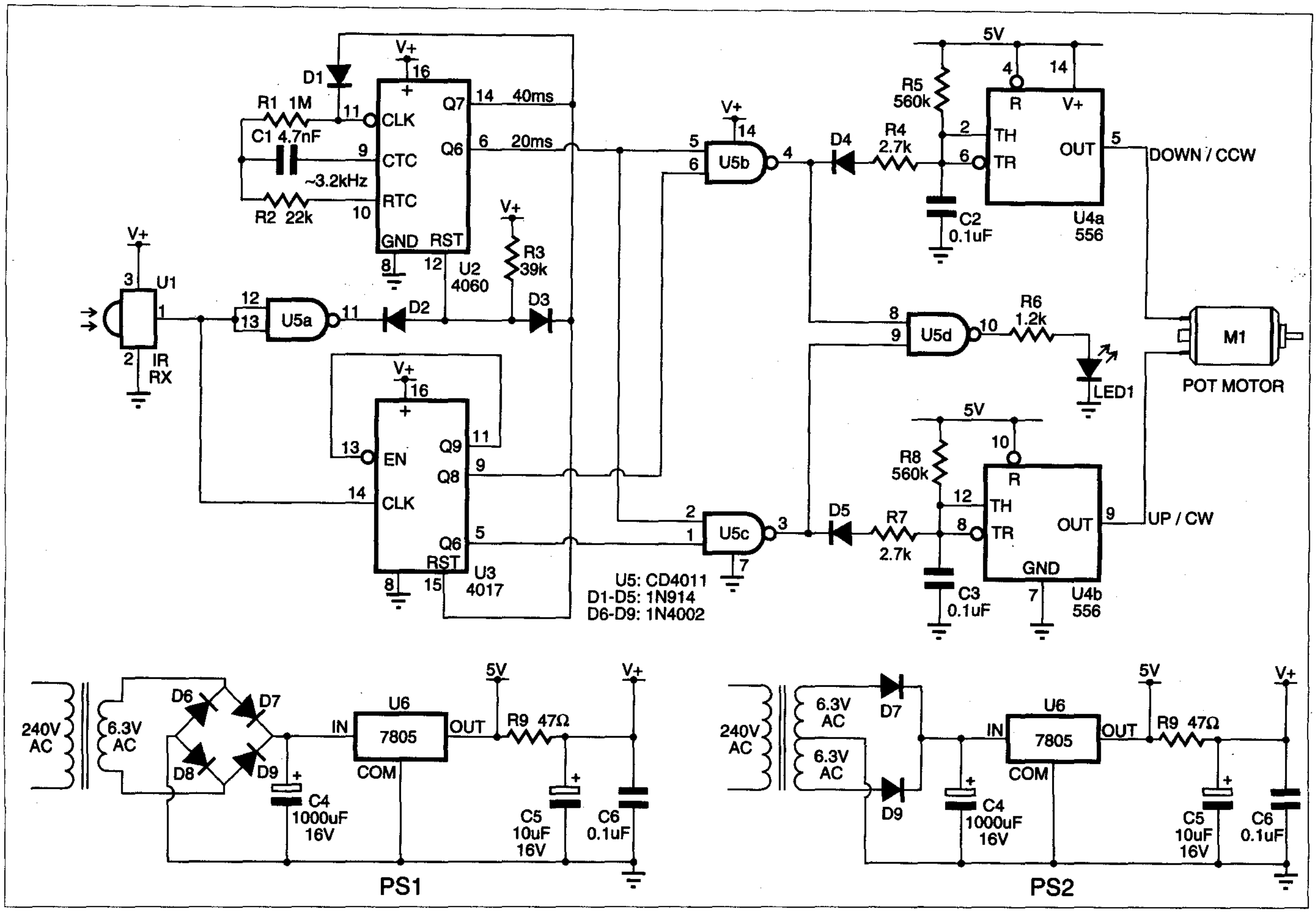
- The purely resistive nature of the audio attenuator (that is, the pot) means that virtually no additional noise and distortion is impressed on the signal as it passes through. Conversely, an active attenuator stage must (by definition) degrade the signal.
- There is no need to include a visual display of the volume setting via a (costly) digital readout or LED bargraph. Just as with a conventional (non-remote controlled) volume pot, the degree of attenuation is indicated by the knob pointer on a motorised version...
- The volume control is easy to use manually, since the motorised pot has a friction clutch between the shaft and motor gearbox. In fact, a user may not even be aware that the volume pot has a remote control capability, thanks to the shaft's low turning resistance. The active approach must have additional front panel buttons (volume up and down) for a non-remote capability, by the way.

So while these points are only really a synopsis of the considerations involved between the two systems, it seems fairly self-evident that the passive motor-driven arrangement is the desirable option. Provided of course, that a suitable motor-driven pot is readily available...

Fortunately, that part of the equation has been neatly solved by the increased availability of the 'Alpha' brand of rotary motor-driven potentiometers, which offer a drive motor, reduction gearbox, friction clutch and a dual-ganged pot in the one compact assembly. The motor itself is rated at 5V and draws less than 100mA while moving the shaft, and the whole unit is surprisingly quiet while doing so — presumably thanks to the plastic-based gearbox cogs and efficient motor design.

With the motorised pot supply resolved, the circuitry to transmit and receive infrared signals (plus drive the 5V motor) was developed using standard low-cost components. While we could have used a number of dedicated infrared (IR) decoding and encoding chips for this job — or perhaps one of the currently-available programmable micros — we in fact elected to use a collection of common CMOS chips, and a rather simple IR command encoding/decoding scheme.

In a nutshell, we feel that for a basic



The receiver circuit showing both alternative power supply configurations, PS1 and PS2 — see text for details. Infrared codes are detected by U1, decoded by U2, U3 and U5, then used to activate the motor drive circuitry based on U4.

two-command IR link, this simple approach has a clear cost and longevity advantage over the more sophisticated schemes of creating (at the transmitter unit) and resolving (at the receiver) more complex IR command codes. It works very well for this application, and you won't get caught out trying to track down a dedicated and expensive data processing chip.

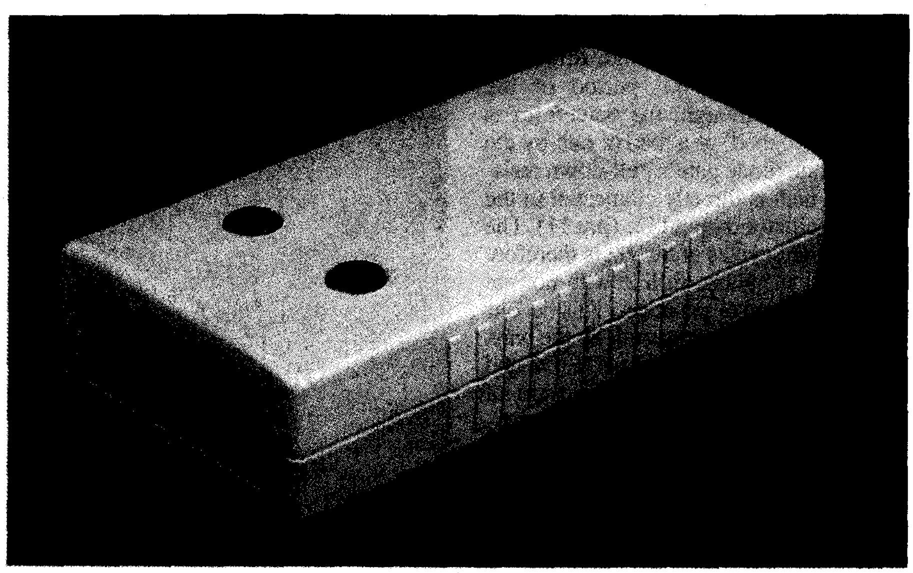
Despite the simplified approach however, we have also taken the effort to make the codes compatible with *learning* IR remote controls. So if you use one of these devices with your general audio-visual setup (or perhaps need an excuse to buy one), our new remote volume control system will smoothly integrate into this arrangement.

Transmitter circuit

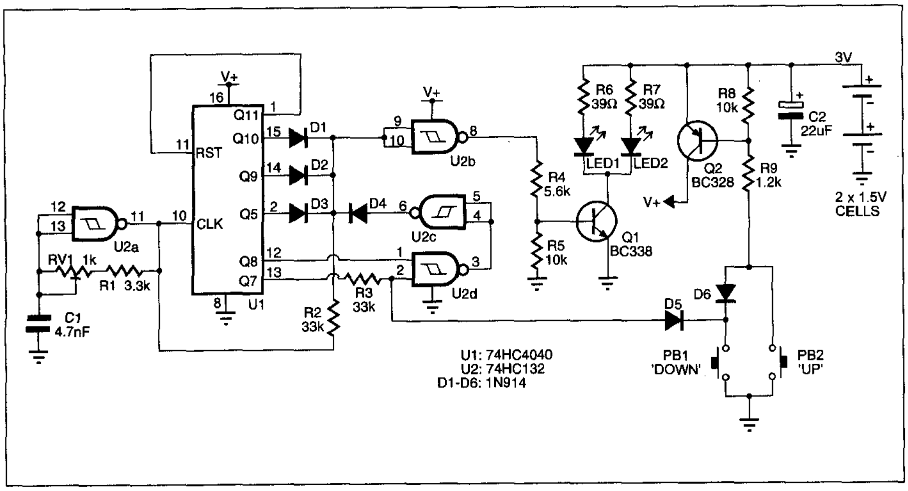
As you can see from the transmitter schematic, the circuit uses just two standard HCMOS ICs and a couple of transistors to generate the IR codes needed for the receiver's volume up and down functions. In short, U1 and U2 plus diodes D1 to D4 produce a series of pulses which are modulated at 38kHz, and these in turn drive IR transmitting diodes LED1 and LED2 via Q1. Other than that, Q2 simply applies power to the circuit when the 'down' or 'up' buttons (PB1 and PB2) are activated.

Working through the circuit now in more detail, Schmitt NAND gate U2a is arranged as a simple RC oscillator set to run at 38kHz by components C1, R1 and trimpot RV1. This 'master' oscillator signal then drives the clock input of the 74HC4040 binary counter U1 (at pin 10), which performs the main timing functions.

Diodes D1, D2 and D3 act as an OR gate on U1's Q10, Q9 and Q5 outputs respectively (ignore D4 for the moment), and this allows a string of 594Hz pulses (the Q5 output) to pass to inverting gate



Infra-Red Remote Volume Controller



The transmitter circuit is surprisingly simple, and uses a small number of low cost components. U2a acts as a 38kHz master oscillator, while the IR command codes are generated by the 4040 counter U1 plus diode gates D1 to D4.

U2b. If you consider R2 as a simple pull-down resistor at this stage, the signal at Q5 will be passed until a count of 512 (after about 13.5ms, or *eight* cycles at Q5), where Q9 forces the gate output high. This situation remains until Q9 falls to a low level at a count of 1024, where Q10 immediately takes over and its now high level is passed to the gate output.

The signal at U2b's input is therefore eight cycles — or 512 clock pulses worth — of 594Hz (the Q5 output), followed by a continuous high level. The diode gate output remains in this state until a count of 2048 (at around 54ms), where U1 is reset by its Q11 output, which is tied back to the reset input at pin 11. Thus we have a 'burst' of eight cycles at 594Hz, which repeats at an 18.5Hz (54ms) rate.

The inverted output at pin 8 of U2b then drives switching transistor Q1 via R4, which in turn activates IR diodes LED1 and LED2 via their respective current limiting resistors R6 and R7. While this implies that the IR LEDs are driven by 0.8ms pulses (the 'on' period of the 594Hz signal) though, the waveform is actually 'chopped' at a 38kHz rate by the action of the diode gate's pull-down resistor R2, which is directly connected to the master oscillator output U2a (pin 11). The burst of eight cycles at 594Hz is therefore modulated at 38kHz, in line with normal IR remote control practice. This is our 'volume down' IR command, by the way.

While the basic diode gate (D1, D2 and D3) resolves U1's outputs to a train of eight pulses as described above, the additional gate diode D4 is used in conjunction with NAND gates U2c and U2d to produce an alternate *six* pulse code for the 'volume up' (rather than down) command. Here, the NAND action of U2d means that its output will go low when both Q7 and Q8 are at a high level, or in practice, at a count of 384 or after roughly 10ms.

This output is then inverted by U2c and the resulting high level (at count 384) applied to gate diode D4, which in turn drives the diode OR gate output high after *six* rather than eight of the 594Hz (Q5) pulses. If the junction of isolating resistor R3 and pin 2 of U2d is pulled to a low level via D5 and PB1 however, U2d's output is then held at a high level and this part of the circuit is disabled.

Since PB1 is designated as the 'down' button then, closing its contacts will cause the circuit to transmit a stream of eight pulses, while the 'up' pushbutton (PB2) will leave U2d in an active state thanks to isolating diode D6, and six pulses will be transmitted as described above.

As well as setting the transmit code to either eight or six pulses, PB1 and PB2 also turn transistor Q2 hard on via base resistor R9, and this in turn passes the main 3V battery voltage to the supply pins of U1 and U2 (the V+ rail), thereby enabling the circuit. Other than that, C3 provides a degree of smoothing for the 3V supply, and since both Q1 and Q2 are off until either pushbutton is pressed, the circuit draws virtually no current from the batteries when the transmitter unit is inactive.

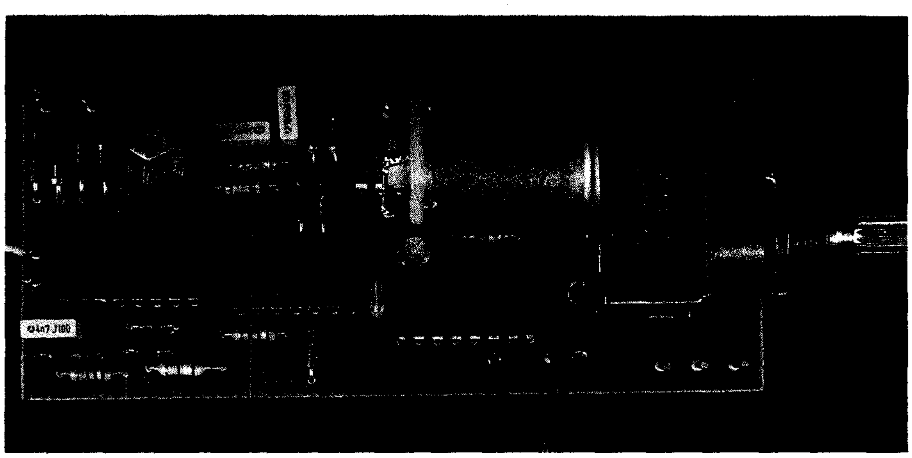
Receiver circuit

Referring now to the receiver's schematic, this again uses a modest number of garden variety IC's, with the exception of the three terminal infrared 'front-end' chip U1. This remarkable little device incorporates a filter lens, IR photodiode, amplifier and AGC/limiter stage, demodulator and output buffer all in one package, and is now available at a number of electronic stores for quite a reasonable price.

In practice, the demodulated infra-red data — that is, with the 38kHz carrier removed — simply appears at its output (pin 1) in a TTL-compatible form, and this can be passed directly to the following decoding circuitry.

The remaining receiver components are used to decode the 'up' and 'down' instructions from U1's data stream (U2, U3 and U5), and provide a push-pull driver stage (U4) to control the 5V motor-driven potentiometer. Note that there are *two* alternative power supply configurations shown in the schematic: PS1 suits a power transformer with a single 6.3V secondary winding, while PS2 is compatible with transformers equipped with dual 6.3V or a center-tapped 12.6V winding.

To follow through the operation of the receiver circuit, we first need to consider its steady state conditions *before* an IR data stream picked up by U1. As the data actually appears in an inverted state at pin 1 of U1, this can be considered as a normally high output, which when inverted



By using a compact motor-driven potentiometer unit, the receiver module is small enough to fit inside an existing amplifier or a modestly-sized instrument case.

by the following gate U5a will hold the reset pin of U2 at a low level via D2 — therefore, U2 is enabled at this stage.

U2 is a 4060 12-stage binary counter with a built in clock oscillator circuit, which in this case is set to around 3.2kHz by R1, R2 and C1. As the counter is enabled by U5a at this time, it will initially count clock pulses until Q7 goes high after a delay of around 40ms (128 clocks), where the high level applied to pin 11 via isolating diode D1 inhibits the oscillator action.

The counter will then 'freeze' in this condition; that is, enabled, at a count of 128 (Q7 high), but without further clock pulses to count. Note that the Q7 output is also connected to the reset line of the 4017 decade counter U3, so this will be held in a reset state at this stage.

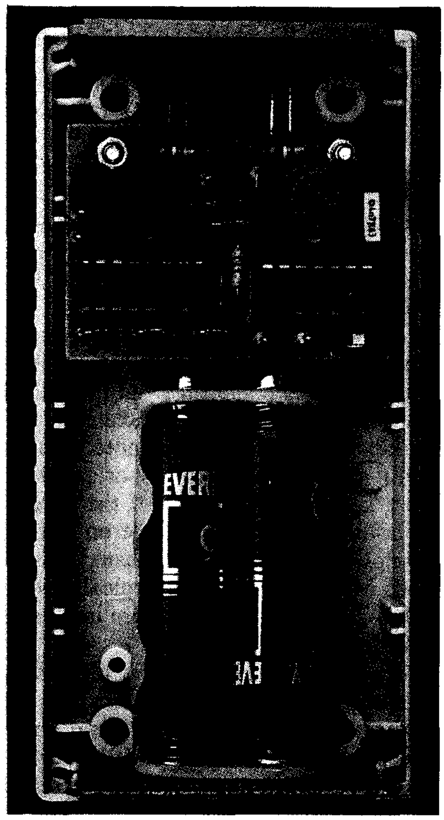
When U1 then picks up a valid IR transmission however, the series of data pulses produced by its output will appear at the output of U5a as positive-going pulses. The first of these will reverse-bias D2, allowing R3 to pull U2's reset line high; which resets the counter and causes the Q7 output to fall.

The now low level at Q7 re-enables U2's clock circuit (via D1), pulls its own reset line low again via D3, and removes the reset from U3 (at pin 15). As U2 is now fully enabled, it will commence counting clock pulses while ignoring further data pulses at the output of U5a, since until around 40ms has elapsed (128 clock pulses) the reset line will be held low by the Q7 output via D3.

When Q7 does eventually go high, the circuit is returned to its standby state with the clock disabled via D1. And since D3 is no longer forward biased by Q7, the next IR data pulse at U5a will again 'trigger' this timing cycle by resetting the counter via D2. In effect, U2 and its associated circuitry — including the OR gate action of D2 and D3 — behaves as a *non-retriggerable* monostable with an 'on' time of 40ms.

Since the output of the timing circuit at Q7 also controls the reset line of U3 (as mentioned above), the 4017 counter will only be enabled for a 40ms period from the beginning of an IR data stream. As a result, the decade counter will count the number of data pulses appearing at the output of U1 during that period, and its Q outputs will effectively store the result.

By the way, note that U2's timing sequence is instigated on the falling (leading) edge of the first input pulse from U1, while the 4017 counter (U3) has a positive-edge triggered clock input. This means that U3 will be enabled at the very beginning of the first data pulse (thanks to Q7 of U2), but will advance its count on the trailing (positive-going) edge of that pulse, plus any that follow.



Our prototype transmitter assembly was installed in a low profile case along with two 'AA' cells and matching holder. It will also fit other types of cases, and smaller 'AAA' cells can be used if space is tight.

When U1 picks up the data stream from the matching IR transmitter described above then, the series of six or eight data pulses — corresponding to a volume up or down instruction, respectively — will cause U3 to count up to that figure, then remain in this state until it's reset by U2, some 40ms after the beginning of the first pulse. Note as that an eight-pulse volume down command takes around 13.5ms to complete, U3 will have reached a 'valid' count in less than half of the 40ms cycle time.

After a delay of only 20ms (64 clock cycles) during this sequence however, the high level at Q6 of U2 will enable NAND gates U5b and U5c, which gate the Q6 and Q8 outputs of the pulse counter U3. So if the receiver has picked up eight pulses (a volume down code) during that first 20ms period for example, the high level at U3's Q8 output of U3 will now cause a low at the output of U5b. This in turn rapidly discharges C2 via R4 and D4, triggering the motor drive circuit based on U4a. U4 is a 556 timer IC, which is effectively two standard 555 timers in one package.

The output of U5b will stay low for a further 20ms until Q7 of U2 terminates the timing/gating sequence (at the 40ms point), as described above. Since U4a's threshold input (pin 6) is held low for this period, its output at pin 5 will apply a high level (5V) to one side of the potentiometer motor M1. And as U4b has not been triggered by U5c (which would require a six pulse code), the low at its output (pin 9) provides a return current path path for M1, which begins to drive the pot in a counter-clockwise (CCW, volume down) direction.

When the output of U5b returns to a high level as the main 40ms timing sequence ends (U3 is reset), C2 begins to charge towards 5V via its associated timing resistor R5. With U4a's high output at pin 5 still driving the motorised pot in a CCW direction, this state continues for about 50ms until C2 reaches a level of 3V (two thirds of the supply rail voltage) where the threshold input (pin 2) resets U4a's internal flipflop, driving the output at pin 5 low — suffice to say, the motor stops.

So for a *single* 'eight' code burst sequence, the motor will be driven in a CCW direction for just 70ms (the 20ms gate period plus C2's 50ms charge time), and as a result, barely gets up to speed due to normal electrical and inertial losses. As covered in the description of the transmitter unit however, the actual codes are repeatedly sent at a 54ms rate for as long as the 'up' or 'down' button is depressed. For our eight-pulse 'volume down' example then, U5b's output will be regularly going low for 20ms (the gating time) at a 54ms rate.

Unlike a conventional 555 monostable circuit where the timing sequence cannot be restarted once it has commenced, our circuit arrangement for U4a (and U4b) behaves as a fully *re-triggerable* monostable, since the timing capacitor C2 can be discharged at any time by a low at the output of U5b. When a repeating eight-pulse code is received then, the 20ms pulses at U5b will discharge C2 before the rising voltage at U4a's threshold input (pin 2) has reset the internal flipflop and forced pin 5 low. Note that U4a has a nominal 'time-out' period of about 70ms, while our continuous code is arriving every 54ms.

In practice, this means that there will be a continuous drive applied to the motor so that it operates smoothly, despite the pulsing nature of the command signals. The motor will continue to run for a further 70ms when the IR signal stops of course, but thanks to the level of gearing between the motor and pot shaft, this translates to a negligible degree of 'overshoot' in the actual volume setting.

The circuit around U4b works in a similar manner, as you would expect. In this case U5c responds to a six-pulse 'up' code registered by U3 (the Q6 output at pin 5), and triggers the clockwise (CW) 70ms monostable (U4b). As the output of U4a (the CCW drive circuit) will be low in this situation, the high level at U4b (pin 9) will then drive the motorised pot in a clockwise or volume up direction.

The remaining part of the main circuit involves gate U5d, which monitors the logic levels at the output of U5b and U5c. In this arrangement U5d acts as an OR gate, where if either of the normally-high inputs fall, its output (pin 10) goes high and thereby energises LED1 via limiting resistor R6. Since the outputs of U5b and U5c will only fall in response to a valid eight or six pulse code, the LED indicates that a valid 'up' or 'down' command has been received.

Finally, the two power supply stages shown at the bottom of the schematic are really the same circuit, except that PS1 uses a diode bridge (D6 to D9) to rectify 6.3V AC from a transformer with a single secondary winding, whereas PS2 uses two diodes (D7 and D9) to deal with a 12.6V AC centre-tapped (or dual 6.3V) winding. In either case, the roughly 9V DC result is filtered by reservoir capacitor C4 and passed to a 7805 regulator U6.

The regulated 5V level is then used to power the motor drive circuit based on U4, and passed through filter components R9 and C5 to create the V+ rail which powers the more sensitive parts of the circuit — C6 simply acts as a high-frequency bypass at this point. And by the way, despite the nominal 6.3V AC input voltage shown in the schematic, the supply should be happy to run from a 6 to 10V AC, or 7 to 15V DC source.

As a last point regarding the circuit operation, it may be prudent to consider the receiver's response to an *invalid* IR data code string — say for example, one produced by another remote control unit. Perhaps the most important point here is that virtually all of the current remote control units operate on a more complex coding system than the one used here, and as a result typically use a 10 to 20 sequential bit pattern in a pulse position coded format.

As our receiver circuit is effectively 'looking' for a sequential pattern of six or eight pulses at counter U3, these larger pulse streams will clock the 4017 beyond the Q6 or Q8 outputs, and are therefore rejected. To prevent a sequential code of say 18 pulses forcing the decade counter 'around the block' and back to a count of eight (Q8 high), we have connected the Q9 output back to the negative-going clock enable line at pin 13.

Since a high level at this pin effectively inhibits the positive-going clock input at pin 14, a count of more than nine input pulses will cause U3 to freeze at the ninth count, and therefore reject all nine-bit and above data codes.

A series of random pulses — say from IR interference — will also be rejected, since six or eight of these must sequentially arrive within the 'gating' time of the receiver circuit, *plus* be of the type accepted by the IR receiver chip U1.

For this latter condition, the IR signal must be modulated at around 38kHz, and pulsed at a roughly 600Hz (or somewhat higher) rate.

In practice we found that that the receiver unit was very hard to 'fool' with stray IR signals and other remote controls, despite the simplicity of both our coding system and the receiver circuitry.

On the odd occasion that we did managed to trip it up, it was a single response and there was no detectable movement in the pot shaft.

Transmitter board

All of the transmitter parts, including the up and down pushbuttons (PB1 and PB2) are held on a small printed circuit board (PCB) coded 96irtx7 and measuring just 50 x 35mm. The assembly process is quite straightforward, with the only slightly unusual aspect being that several resistors must be mounted vertically, rather than in the usual horizontal manner — specifically, these are R1, R2, R4, R5, R8 and R9.

Referring to the component overlay at all times, start by installing all of the lower profile parts such as the horizontally-mounted resistors and diodes, plus the one wire link near R3. Then work through the larger parts, finishing with the trimpot RV1 and pushbuttons PB1 and PB2. During this process, take particular care with the orientation of any polarised components such as the semiconductors and C2 (a 22uF tantalum), while using the overlay diagram as a guide.

Note that the pushbutton switches should be installed with the flat section in their cover molding facing towards the left- or right-hand side of the PCB, so that their internal contacts will join the two PCB tracks when the switch is activated. If you are in any doubt about the correct orientation, use a multimeter to check which pairs of switch pins are joined when it's pressed. Also note that while the two switches would normally be mounted hard down on the PCB surface, they may need to be installed in a slightly elevated position to suit the transmitter case you are planning to use.

Other than that, you will also need to consider how far the two IR LEDs will protrude from the PCB, to match the box dimensions. When you have settled on an appropriate position and are about to sol-

PARTS LIST

Receiver module:

Resistors

(All 1/4W 5%)

R1	1M
R2	22k
R3	39k
R4,7	2.7k
R5,8	560k
R6	1.2k
R9	47 ohms

Semiconductors

U1	IR receiver IC (DSE Z1954, Oatley PIC 12043, etc)
U2	CD4060 14-stage counter/osc.
U3	CD4017 decade counter
U4	556 dual 555 timer
U5	CD4011 quad NAND gate
U6	7805 5V regulator (TO-220)
LED1	5mm LED
D1-5	1N914 signal diodes (or similar)
D6-9	1N4002 power diodes (or similar)

Capacitors

C1	4.7nF MKT
C2,3	0.1uF MKT
C4	1000uF 16VW PCB-mount electro
C5	10uF 16VW PCB-mount electro
C6	0.1uF monolithic ceramic

Miscellaneous

1 x 5V motor drive pot (M1), dual ganged, 20k log (ALPHA), PCB coded 96irrx7 (102 x 43mm), PCB pins (15), hookup wire, etc.

Transmitter Module:

Resistors

(All 1/4W 5%)

R1	3.3k
R2,3	33k
R4	5.6k
R5,8	10k
R6,7	39 ohms
R9	1.2k
RV1	1k vertical mini trimpot

Semiconductors

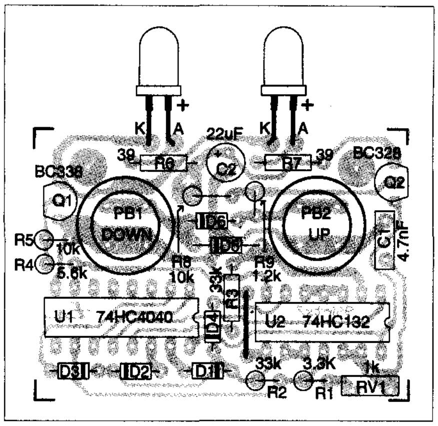
U1	74HC4040 12-stage bin. counter
U2	74HC132 quad NAND Schmitt
Q1	BC338 NPN transistor
Q2	BC328 PNP transistor
D1-6	1N914 signal diodes (or similar)
LED1,2	IR transmitter diodes

Capacitors

C1	4.7nF MKT
C1	4.7nF MKT
C2	22uF 16V Tantalum

Miscellaneous

2 x PC-mount pushbutton switches (round cap)
1 x PCB coded 96irtx7 (50 x 35mm)



The transmitter's overlay diagram. Pushbuttons PB1 and PB2 should be installed with their flat edge facing to the left or right, and the power connections soldered to the copper side of the PCB.

der the LEDs to the PCB though, first double check that their lead orientation is correct — the chamfered or 'flattened' side of the plastic body usually indicates that the nearby lead is the cathode or negative connection.

Keep in mind that the case that you use will need sufficient internal space for two 1.5V cells plus some form of battery holder. As you can see from the shots of our prototype, we have used a modestly sized plastic case (Jaycar catalog number HB-6032) and two AA-type batteries in a matching holder. While we needed to slightly trim the edges of the box support pillars to make sufficient space for the battery holder, this would not be necessary if AAA-type cells were used.

And finally, when wiring the battery (holder) leads to the PCB, note that while the connections aren't actually shown on the component overlay diagram, there are '+' and '-' symbols marked in the copper tracks at the appropriate connection points. The lead ends should be soldered at these locations (with the correct polarity) on the *copper* side of the PCB, and if you are in any doubt as to their position, this should be confirmed by tracing the PCB tracks while referring to the transmitter's schematic.

Receiver module

Like the transmitter unit, the receiver module should be quite easy to put together and is likely to present few complications. All of the components are held on the one PCB (coded 96irrx7, and measuring 102 x 43mm), with the exception of the IR 'front end' chip U1 and the valid transmission indicator LED1. These two parts connect via flying leads, so that they can be installed into the front panel of the receiver case or 'host' unit (amplifier, etc).

As before, proceed through the construction process by installing the low- to high-profile components, while taking particular care with the orientation of polarised parts as shown in the component overlay diagram. Note that C6 is a monolithic bypass type, while C1 to C3 are of the conventional MKT style. D6 to D9 are the larger 1N4002 (rather than 1N914) types, and we have used PCB pins for all of the external connection points.

If you are planning to use the PS2 power supply configuration as shown in the schematic, note that while you only need to install power diodes D7 and D9, you must also connect the transformer's centre-tap lead to the circuit's negative or common line. The best place for this connection would be at the PCB pads where the anode ends of D6 and D8 are otherwise connected, or at the negative pin of the main reservoir electrolytic C4.

The motor-driven volume control unit should be mounted hard down on the PCB and soldered at all eight connections points, since this must support the whole assembly via the pot thread when the receiver is finally mounted on the box panel. Also, don't forget to connect the motor drive connecting wires as indicated in the overlay — the 'CW' lead goes to the *upper* motor terminal.

Setup & testing

Since the transmitter unit can only really be tested once a compatible receiver is available to decode the IR signals, the first step here is to determine that the main functions of the receiver module are working.

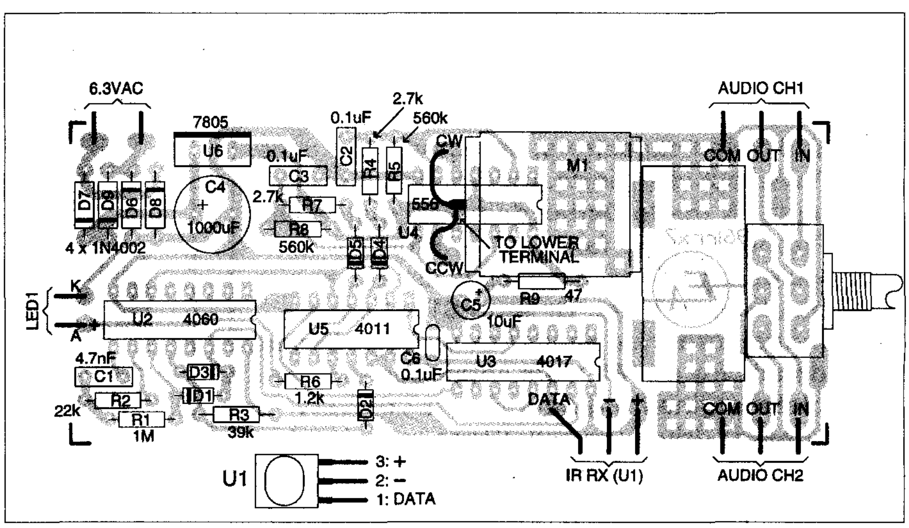
Start by connecting both U1 and LED1 to their respective connections — either directly for now, or via suitable flying leads — then apply power to the unit's AC input pins. The power source can be the transformer you plan to use in the final construction, or perhaps a benchtop power supply during this initial testing stage, since an AC or DC source voltage is suitable.

Immediately check the receiver's main power supply rails and confirm that the 5V rail is close to the mark, and the V+ supply measures a little below 5V. If all is well, then check that pin 1 of U1 (the output) is at around 5V, pin 12 of U2 (reset) measures close to 0V, and pin 15 of U3 (reset) is at a 5V level.

The motor drive stage can then be checked for its basic operation by shorting the junction of D4 (anode end) and R4 to ground, and noting that the motor then drives the pot shaft in a CCW direction (volume down). The CW rotation circuit can also be checked by grounding the junction of D5 and R7, which in this case forces U4b's output to a high level and powers the motor for a clockwise shaft rotation.

With the essential voltages and functions of the receiver module verified, the next step is to check the transmitter's operation. Apply power to the transmitter circuit via a set of batteries or a benchtop supply (take care with the polarity!) and rotate RV1 to the centre of its travel. Then press one of the pushbuttons, while checking that a 3V level appears at the supply pins of U1 and U2 — you may need three hands for this, as the ICs may be damaged if their pins are inadvertently shorted together by the multimeter probes.

If the above voltage test proves a little awkward, don't worry about it at this stage as it's only really necessary if you find that the transmitter does not function. The next test of course is to simply try out the transmitter with the receiver unit,



Use this component overlay diagram when constructing the receiver module. Note the audio input and output connection points, which connect directly to the potentiometer lugs and are isolated from the main circuitry.

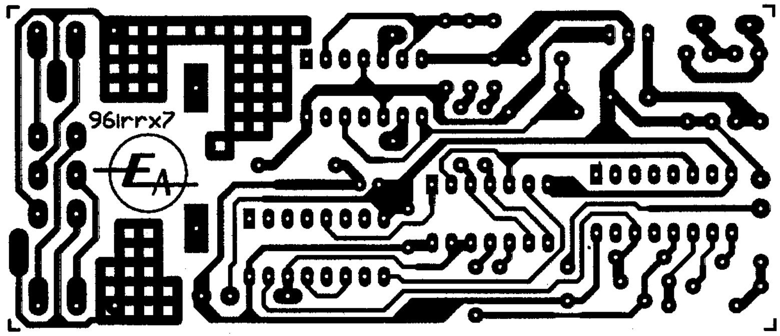
which can be powered up as before.

With the transmitter LEDs facing towards the domed lens of U1 in the receiver, press the up and down buttons while checking for activity in the receiver's acknowledge LED (LED1), and the correct action of motor/pot unit — the up button should cause a clockwise rotation of the pot shaft, as you would expect, and the LED should flash in sympathy with each code burst (that is, at 54ms intervals).

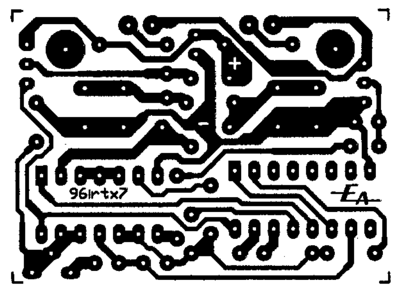
Once you are happy that the overall IR link is working correctly, move the transmitter some distance away from the receiver (say, a few metres) and check that the link still functions reliably. If not, you may need to adjust the transmitter's master clock frequency via trimpot RV1, which can be done on a trial and error basis until the optimum performance is achieved.

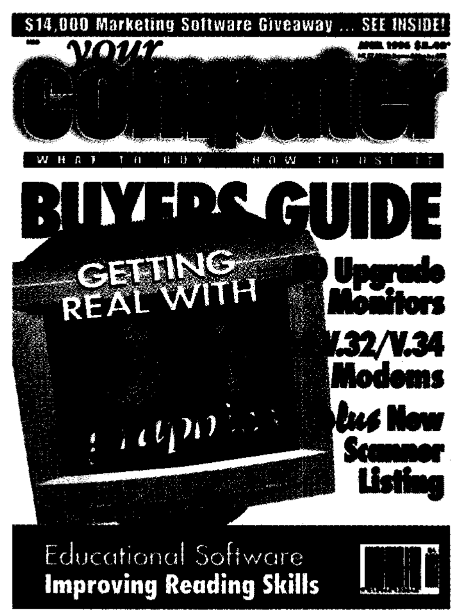
Of course if you have access to a frequency counter, this can be used to adjust RV1 for a clock frequency of 38kHz during the initial testing stage, immediately after construction. In practice though, the receiver unit is really quite tolerant of rate and frequency errors in the incoming IR data stream, and most constructors should find that the default setting of RV1 produces more than acceptable results. Our prototype unit had an effective range of around eight metres, by the way.

And as a final point, when the receiver module is installed in its permanent location, be it in a self-contained unit with audio (RCA) in/out connections or within an existing amplifier, you will need to position the IR receiver chip (U1) so that it can clearly 'see' IR signals through the front panel of the case. The simplest method here is to drill a suitably sized hole through the panel, and just glue the device on the inside surface of the panel so that the domed lens sits in the matching hole, and is therefore exposed to the outside world.❖



The actual size artwork for the receiver module is shown above, while that for the transmitter unit is reproduced below. These patterns can be used by those who wish to etch their own boards.





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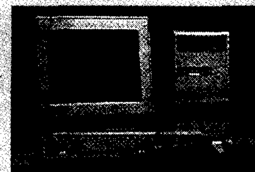

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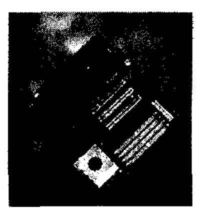

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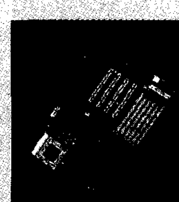

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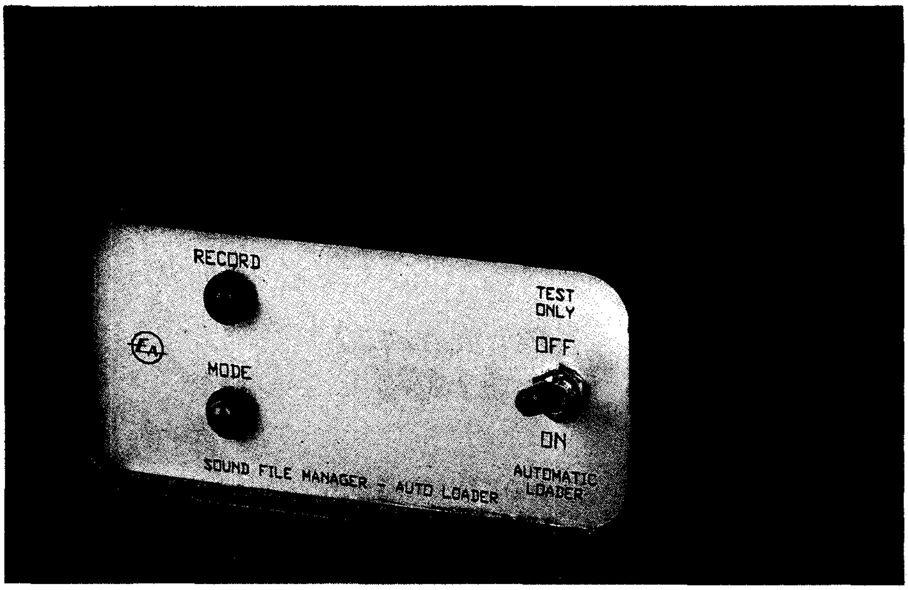
Construction Project:

PC-BASED VMAC SOUND FILE MANAGER

Here's a little project which makes it much easier to prepare sound files for the popular VMAC solid state audio recorder project, described in our February 1995 issue. It allows you to record and assemble 16-second (or 20-second) 'sound file stacks' on a PC fitted with a standard sound card, and then download any desired stack of files into your VMAC's memory when you need it.

by JAMES T. BARKER

Back in the February 1995 issue of *Electronics Australia*, Bob Parker described a very flexible solid state audio recorder based on an ISD1416/1420 audio record/play chip and a Zilog Z86E0408 microcontroller. And the Versatile Multiple Announcement Circuit or 'VMAC' has been very popular, which is not surprising since it allows you to record up to eight short audio messages, for a total of 16 seconds. In a short follow-up article published in the March 1995 issue Mr Parker also gave some ideas for using the VMAC for various jobs in a vehicle, as well as triggering and interface circuits so that it could be hooked up to things like model train layouts and PA systems.



Now the existing VMAC design is great and does a lot of things, but one frustration I found was that it's a bit 'sudden death' as far as recording a 16-second sequence of audio messages. If you make a mistake towards the end of recording a sequence, which is relatively easy to do, you have to go back and do it all over again — even though your earlier messages in the sequence might have been fine.

I found this especially frustrating, because my VMAC is used in a small business, and I like to change its messages regularly. For example I like to have one set of messages during the week, and another one for the weekends. Similarly I like another set of messages when we're away on holidays...

After having to re-do a recording for about the fifth time, recently, I decided there *had* to be a better way. Then I had an idea: my PC has a sound card, and can record and play audio with very near CD quality. Why couldn't I use *it* to record a sequence of messages, and then simply download them into the VMAC when I'm happy with them?

Why — I could even have each of my different sequences of messages recorded and saved on hard disk, and simply call up any desired sequence and download it to the VMAC when needed!

So that's how this little project was born. It consists of two parts: a small hardware box that interfaces between the VMAC board and a PC, and of course some matching software that lets you record sound 'bites' and assemble them in playlist sequences on the PC, save and retrieve them from your hard disk, and then download them into the VMAC as desired.

The hardware box is very simple and straightforward, but it allows complete control of the VMAC recording process from the software running on the PC. The control is achieved by linking it to the PC's printer port, as well as the audio 'line output' from the sound card, and it hooks up to the VMAC via a simple five-way cable.

The matching software is also pretty simple, but it does all of things you need. It lets you record any desired audio bites — as standard 'WAV' files — on the PC, and group the WAV files in timed 16-second sequences or 'stacks'. These can be saved or recalled from your hard disk (or a floppy), and then played and 'downloaded' automatically to the VMAC when you want them.

The software actually consists of two separate programs: WAVSTACK.EXE, which was written in Borland Turbo Basic by my friend Bob Barnes of RCS Radio, and WAVPLAYR.EXE which I wrote myself in Borland Turbo C. And that reminds me that I should thank Bob Barnes for his help with this project — not only by writing WAVSTACK.EXE, but also for agreeing to make the PCBs and his software available to *EA* readers. Thanks, Bob!

The hardware side

The interface box is very simple, as you can see from the schematic. It's based on a low cost printer port interface developed by Bob Barnes late in 1994, capable of driving up to eight relays. In this case we only need two relays, which effectively allow the PC software to operate the VMAC's 'Mode' and 'Record' buttons respectively.

Relay RLY1 acts as the PC-controlled 'Mode' button, and RLY2 as the 'Record' button. These are driven by transistors Q1 and Q2 respectively. Transistor Q1 is turned on and off by the 'bit 0' line of the printer port (pin 2), via base resistor R1, while Q2 is controlled by the 'bit 1' line (pin 3) via resistor R2.

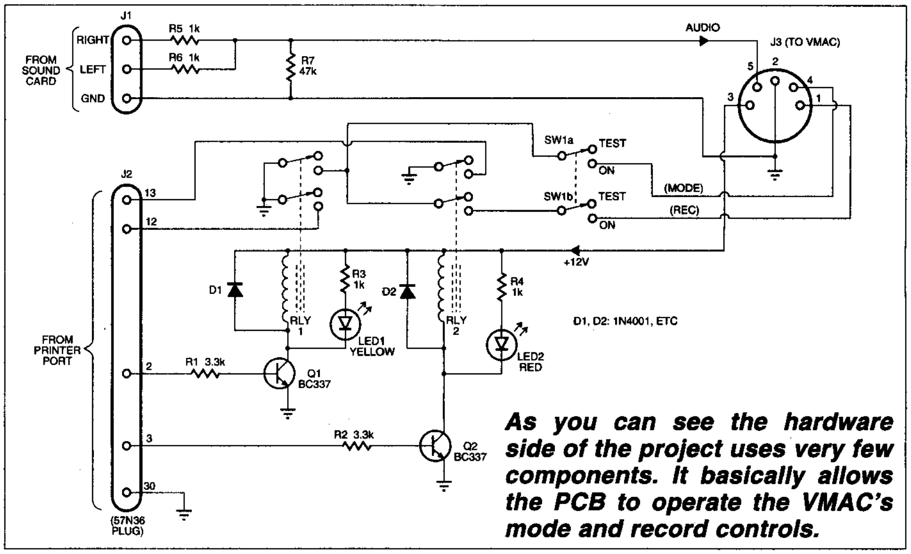
Diodes D1 and D2 are used to protect the transistors from damage due to back-EMF spikes generated in the relay coils, while LED1 (yellow) and LED2 (red) operate in tandem with the relays (via their respective series resistors) and are used to indicate the circuit's operating mode. LED1 glows when the software is holding the VMAC's 'Mode' line active (low), while LED2 indicates when the 'Record' line is being held low.

How can the software be sure that the relays have operated? Glad you asked, because I never trust relays either. That's why one set of (otherwise spare) contacts on each relay is used to provide feedback to the PC, via two of the printer port's status lines. The contacts on RLY1 pull pin 12 of the port down to ground when it operates, while those on RLY2 pull down pin 13. So the software is fully aware of what's happening...

The audio from the Line Output of the PC's sound card is usually in stereo, while the VMAC operates in mono. So our hardware box incorporates a simple mono mixing circuit, using resistors R5, R6 and R7. These operate in conjunction with the 'Line Input' mod circuitry given by Bob Parker on page 70 of the March 1995 issue, to allow convenient adjustment of the recording level to about 150mV peak to peak.

As you can see, the box connects to the VMAC itself via a five-way cable, which has a plug mating with a standard DIN socket fitted to the rear of the VMAC's case. Pin 2 of the DIN connectors is used for ground, while pins 1 and 4 are used for the Mode and Record lines respectively (connected to the 'hot' end of the existing pushbuttons).

Pin 5 of the DIN connectors is used to feed the recording audio to the VMAC, while pin 3 is used to power the interface box from the VMAC's unregulated +12V rail. That way, no external power source is needed, and we don't have the complication of trying to power the interface from the PC's printer port.



As you can see the hardware side of the project uses very few components. It basically allows the PCB to operate the VMAC's mode and record controls.

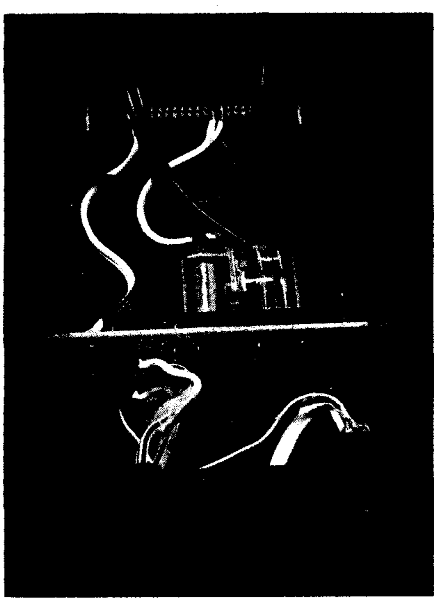
But what's the purpose of toggle switch SW1? Purely to let you test the operation of the interface hardware and software, without actually getting the VMAC to record the downloaded sound files. As you can see, when the switch is in the 'Test' position, the lines to the VMAC 'Mode' and 'Record' lines are broken, preventing the PC from switching it into recording mode. But otherwise everything does what it should — the relays operate, the LEDs glow and the software goes through its paces.

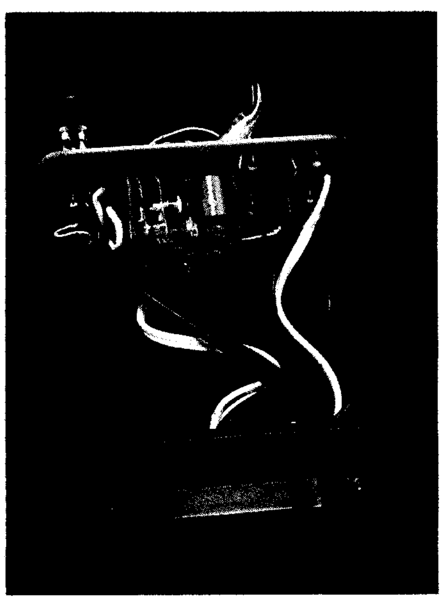
In effect then, SW1 lets you do a complete 'dry run' in the Test position. Then, when you're happy with everything, you can switch it to the On position and perform the *real* downloading...

Apart from SW1, the complete interface circuit fits on a very small PCB, measuring 88 x 42mm and coded 96sf7. The board is designed to fit vertically inside one of the low cost clip-together plastic utility boxes, as sold by Dick Smith Electronics. As the box measures only 93 x 46 x 135mm, this makes for a very compact unit.

SW1 mounts on the front panel of the box, as do the two LEDs. A 57N36 'Centronics plug' is mounted on the rear panel, to allow the interface to be connected to the PC when needed via a standard printer cable. The audio cable from the PC sound card, and the output cable to the VMAC are also taken out of the box via small holes in the rear panel. Hopefully you can see all of this in the various photos.

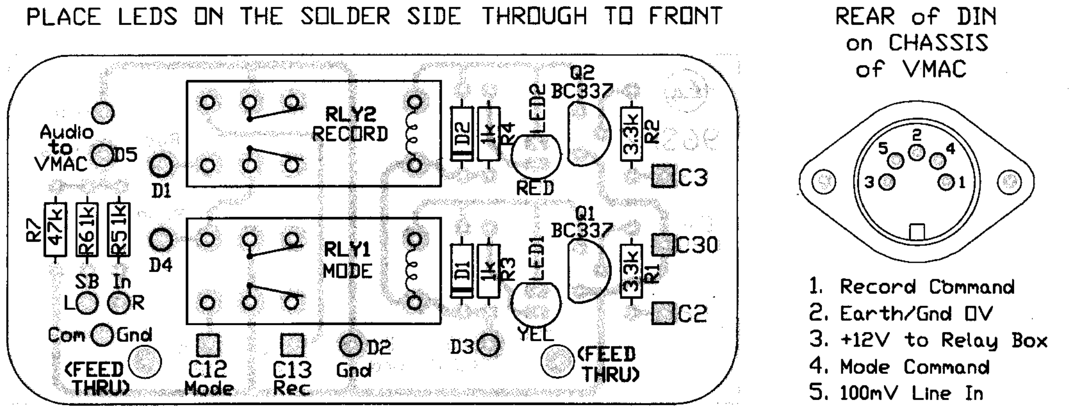
Wiring up the PCB should be quite





At left are two views inside the interface box, showing how most of the parts are supported by a small vertical PCB behind the front panel. The LED indicates Recording mode.

PC-Based VMAC Sound File Manager



Use this overlay diagram as a guide when you're wiring up the interface PCB. Terminal pins with 'CXX' format labels are for connections to the computer port socket, while those with 'DX' labels connect to the VMAC's DIN plug as shown at the far right.

easy if you use the overlay diagram as a guide. It shows where everything goes, viewed from the normal component side. Note, though, that the PCB mounts in the box with its copper track side towards the front. This means that the LEDs are mounted on the *copper* side of the board — either directly, if their leads are long enough, or via short lengths of hookup wire if they're not.

The leads connecting between the PCB and SW1 can also be soldered to the copper side. The two other leads connecting to the switch are from the VMAC's cable, and these can be taken through one of the two 'feed through' holes provided at the bottom of the PCB.

By the way, the interface and software should be compatible with most standard Windows compatible sound cards. It certainly works with the very popular Sound Blaster cards.

PARTS LIST

Resistors

All 1/4W 5% carbon:

R1,R2	3.3k
R3-6	1k
R7	47k

Semiconductors

D1,D2	1N4001 or similar
Q1,Q2	BC337 or similar NPN
LED1	5mm LED, yellow
LED2	5mm LED, red

Miscellaneous

RLY1,2	12V/60mA DPDT relay PCB mount
SW1	DPDT miniature toggle switch
J1	3.5mm stereo plug, with shielded cable
J2	57N36 'Centronics' plug, panel mount
J3	5-pin DIN plug

PCB, 88 x 42mm, code 96sf7; plastic utility case, 93 x 46 x 135mm (DSE Cat. No. H-2503); length of 5-way shielded cable, for VMAC cable; 5-pin DIN socket for VMAC end; hookup wire, etc.

NOTE: Printed circuit boards, and also Dynamark front and rear panels for this project, are available from RCS Radio, of 651 Forest Road, Bexley NSW 2207; phone (02) 587 3491.

The software

There are actually three programs which make up the software side of the project: WAVSTACK.EXE, WAVPLAYR.EXE and WAVSTAKK.COM. WAVSTACK.EXE is the main program, which lets you arrange your WAV files in sequence and controls the VMAC during downloading; WAVPLAYR.EXE is the program it uses to actually 'play' the individual audio WAV files, and turn them into audio via the sound card; and WAVSTAKK.COM is a self-executing documentation/help file, which explains how the other two programs are used.

Note that WAVSTACK.EXE doesn't handle the actual recording of your audio WAV files themselves. This is done using your normal sound card software, as supplied with the sound card. With Sound Blasters it's the Windows-based programs supplied by Creative Technology. This allows you to record the sound files very conveniently, and save them to disk as *.WAV files.

Incidentally since WAVSTACK.EXE and WAVPLAYR.EXE are compatible with standard WAV format files, you're not restricted to recording your own — you can use WAV files from anywhere. Just make sure that they use 8-bit sampling, at a rate of 11kHz, because that's the format expected by my program WAVPLAYR.EXE.

Actually you're not restricted to playing 8-bit/11kHz WAV files, either. If you have some 16-bit WAV files you'd like to use, you can do so by making use of the WAV file player program (DOS based) that comes with your sound card. All you have to do is copy the program over to the same subdirectory that WAVSTACK.EXE is on, and rename it WAVPLAYR.EXE — after first renaming my own WAVPLAYR.EXE, so that it doesn't get clobbered in the process.

Basically WAVSTACK.EXE expects to find a range of WAV files on its subdirectory, along with a WAV file player called WAVPLAYR.EXE. So you need to create a subdirectory on your hard disk, called say WAVEPROG, and save WAVSTACK.EXE and WAVPLAYR.EXE on it, along with WAVSTAKK.COM and all of the WAV files you want to work with. If you record some WAV files of your own, using the sound card's software, these should be copied to the same subdirectory too.

Running WAVSTACK.EXE then lets you assemble sequences of eight WAV files, in any desired order, and save the sequences as 'playlist' files with their own filename — with the common format WAVSTACK.XXX. Here the 'XXX' extension can be almost any combination of numerals, except for the obvious no-no combinations like 'EXE', 'COM', 'BAT' and others used by DOS. Needless to say, this still leaves a very large number of possible names for your WAVSTACK.XXX files.

Because the WAVSTACK.XXX files are essentially just playlists, and don't include the actual WAV files, any particular WAV file can be used in any number of WAVSTACK.XXX files. Similarly a WAV file can be used more than once in a particular WAVSTACK.XXX file, if you really want to.

WAVSTACK.XXX files can be saved and re-opened, and can also be edited — to change either the WAV files they use, the order they're played in, and so on. They can also be 'tested', to check the playing time of either the individual WAV files, or the total of the eight you've selected. And of course when you're happy with them they can be 'run', to download the WAV files they specify down to the VMAC.

We needn't go into all of the in's and out's of using WAVSTACK.EXE here, as this is documented in some detail in the accompanying WAVSTAKK.COM program. And you shouldn't have any problems in getting the software, as Bob Barnes and I have decided to make it freely available, for private use. We're letting *EA* put a copy of the programs on their Computer Bulletin Board, for free downloading via modem. Those without a modem or who prefer a floppy disk copy will alternatively be able to get one by sending a formatted HD floppy (either 3.5" or 5.25") to the EA Reader Information Service, together with the usual $7.50 fee to cover copying and return postage.

Either way you'll get copies of WAVSTACK.EXE, WAVPLAYR.EXE, WAVSTAKK.COM, a sample playlist file called WAVSTACK.RCS, and some corresponding sample WAV files to get you going...

If anyone decides to use the software commercially, Bob Barnes and I would appreciate a note of thanks (care of RCS Radio), plus some interesting WAV sound files on a floppy disk — so we can pass these on to other VMAC users.

For those who want a better idea of the way that the software in WAVSTACK.EXE controls the VMAC unit for recording, via the relays in the interface box, Listing 1 shows the basic command sequence to play one WAV file (XXX.WAV). The sequence is repeated eight times, to download each of the WAV files in your selected sequence, or until you have run out of 'talk time' on the ISDXX chip in your VMAC.

Listing 1

```
Gosub 2000:          'Display Relay Status,
                      return with value 1 or 0
OUT 888,1            'turn the MODE relay
                                          ON
LPTEST = inp(889)    'read the input port
                                        LPT1
If LPTEST = 127      'then all is OK. The
                      MODE Relay has closed
Gosub 2000:          'Display Relay Status,
                                 return with
value 1 or 0
OUT 888,3            'turn ON the RECORD
                                       relay
LPTEST = inp(889)    'read the input port
                                        LPT1
If LPTEST = 79       'then all is OK. The
      MODE & RECORD relays are ON
Gosub 2000:          'Display Relay Status,
                      return with value 1 or 0
WAVPLAYR "xxx.WAV"   'play the WAV
          file out through the sound card,
          'via the autobox to the VMAC's
                                    ISD chip
OUT 888,1            'turn off the RECORD
          relay but leave the MODE ON
Gosub 2000:          'Display Relay Status as
```

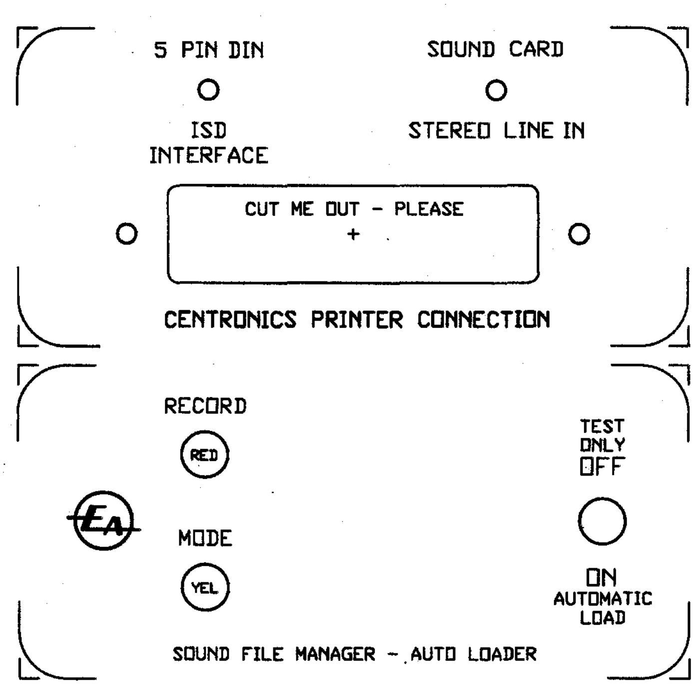
That's about it for the Sound File Manager project. As I mentioned earlier, PC boards for the interface box are available from RCS Radio, as also are Dynamark front and rear panels if you'd like to make your unit look the part.

Feedback can also be sent to me via RCS Radio. If you have problems, send a disk with some sample WAVSTACK files on it, and tell me what's going wrong. Also feel free to suggest any improvements, although replies may take a few weeks. Note that I can't take phone calls as I work in a very sensitive job.

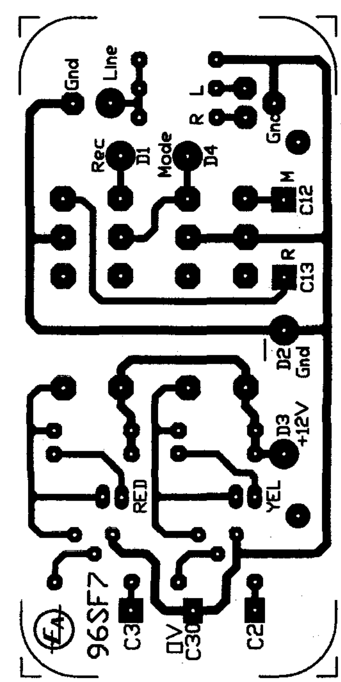
Because Bob Barnes of RCS has helped me with the prototype and the software, it's very likely that he can answer most of your minor queries. But don't call him during the day when he's busy earning a living; leave technical calls until after 8pm at night.

Oh — a final thought. Although this project has been developed for automating the business of downloading sound files into a VMAC, it could also be used to do a similar job in preparing your own customised answering machine tapes. The Mode output line could be used to operate the recorder's power or Play control, while the Record line controls its Record or PTT line.

I hope you find this little project as handy as I have. Getting your PC to control the downloading process certainly removes a huge amount of hassle! ❖



At left are the author's patterns for the front and rear panels of his interface box, while at right is the PCB pattern. All three are reproduced here their actual size, for those who like to make their own panels and PCB.

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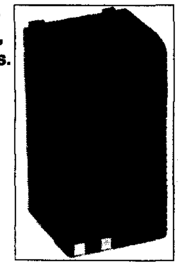

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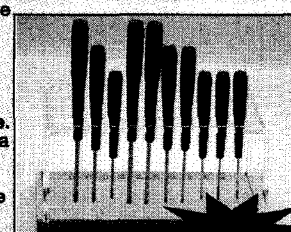

TIP	WIDTH	TOTAL LENGTH
Slotted	1.5mm	118mm
Slotted	1.8mm	118mm
Slotted	2.0mm	118mm
Slotted	2.5mm	144mm
Slotted	3.0mm	144mm
Slotted	3.5mm	167mm
Slotted	4.0mm	167mm
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Phillips	0	144mm
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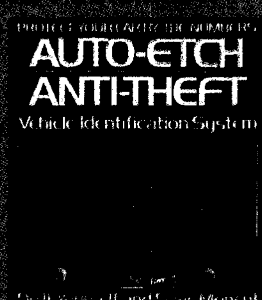

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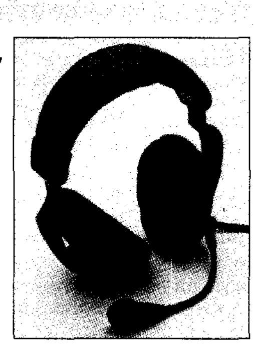

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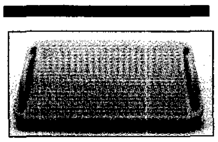

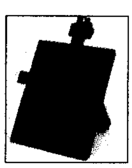

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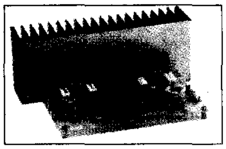
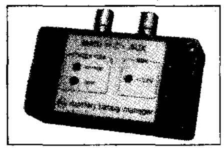

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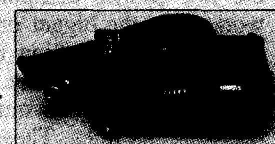

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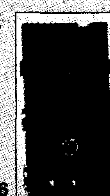

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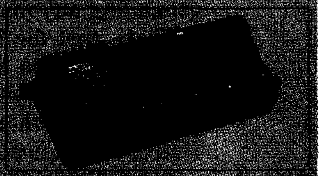

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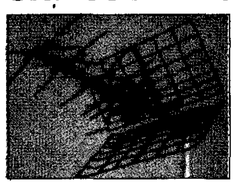

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Construction Project:

50W/CH STEREO CONTROL AMPLIFIER - 2

Here's the second article describing a new low cost, easy to build integrated stereo amplifier with the ability to deliver 50 watts RMS output per channel. This article explains in detail how the amplifier is assembled, and also covers its simple setting-up and testing procedure.

In general, start with the construction of the three PCB modules. Refer to the specific construction details given shortly for each board. As usual, start with the low profile components first, and work up to the bigger or more complex components. Installing the tinned copper wire links should be the first step.

Note that there is much use of '0Ω resistors', as links. These are shown on the PCB overlay as being the same size as a 1/4W resistor, but with LINK written inside. These components are coloured light brown, with a single black stripe around the middle.

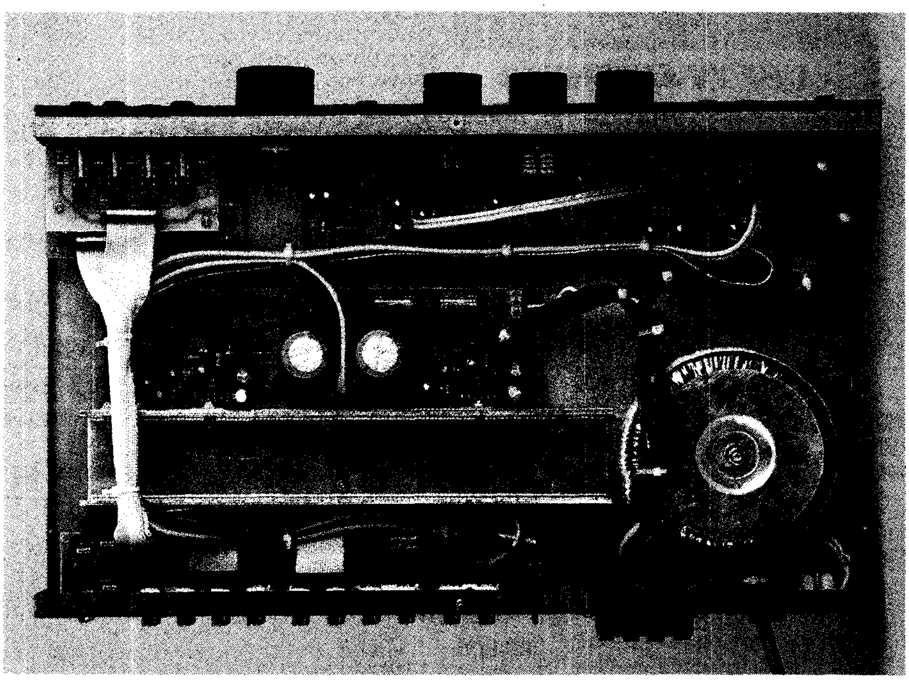
Preamp board

The preamp board (ZA1252) is the largest of the PCBs, and it has a sub-board (ZA1253) mounted onto it (via spacers) to accommodate the source switches.

Note that the pushbutton switches on the sub-board are in a single four-way switch assembly, (i.e., there are four switches joined together by a common bracket), whereas each of the other seven pushbutton switches are individual switches.

Also note the seven separate pushbutton switches, (four tape select, one mono, one tone-defeat and one mute), each come with a small metal mounting bracket. These mounting brackets are unnecessary and need to be removed. To do this, use a pair of side cutters or small pliers, and prise up the tags of the mounting bracket. Once the four tags of each bracket are bent up to clear the switch, the bracket can be pulled away from the switch and discarded.

As the switch sub-board is mounted quite closely above the preamp PCB, the four tape select switches on the main preamp PCB need to have their top solder tags removed, so as to clear the switch sub-board. To trim the tags, use a strong and sharp pair of side cutters, and cut off the top solder tags of these four switches. Cut the tags one by one to ensure a quick clean cut. The source-switch sub-board will now fit comfortably onto the five insulated 15mm spacers, and clear the tape-select switches below. Don't forget the three link resistors between the switch sub-board and and preamp board.



A general view inside the amplifier case. The power amp and supply PCB is in the centre, just in front of the U-shaped heatsink. Many of the interconnections are made using ribbon cable.

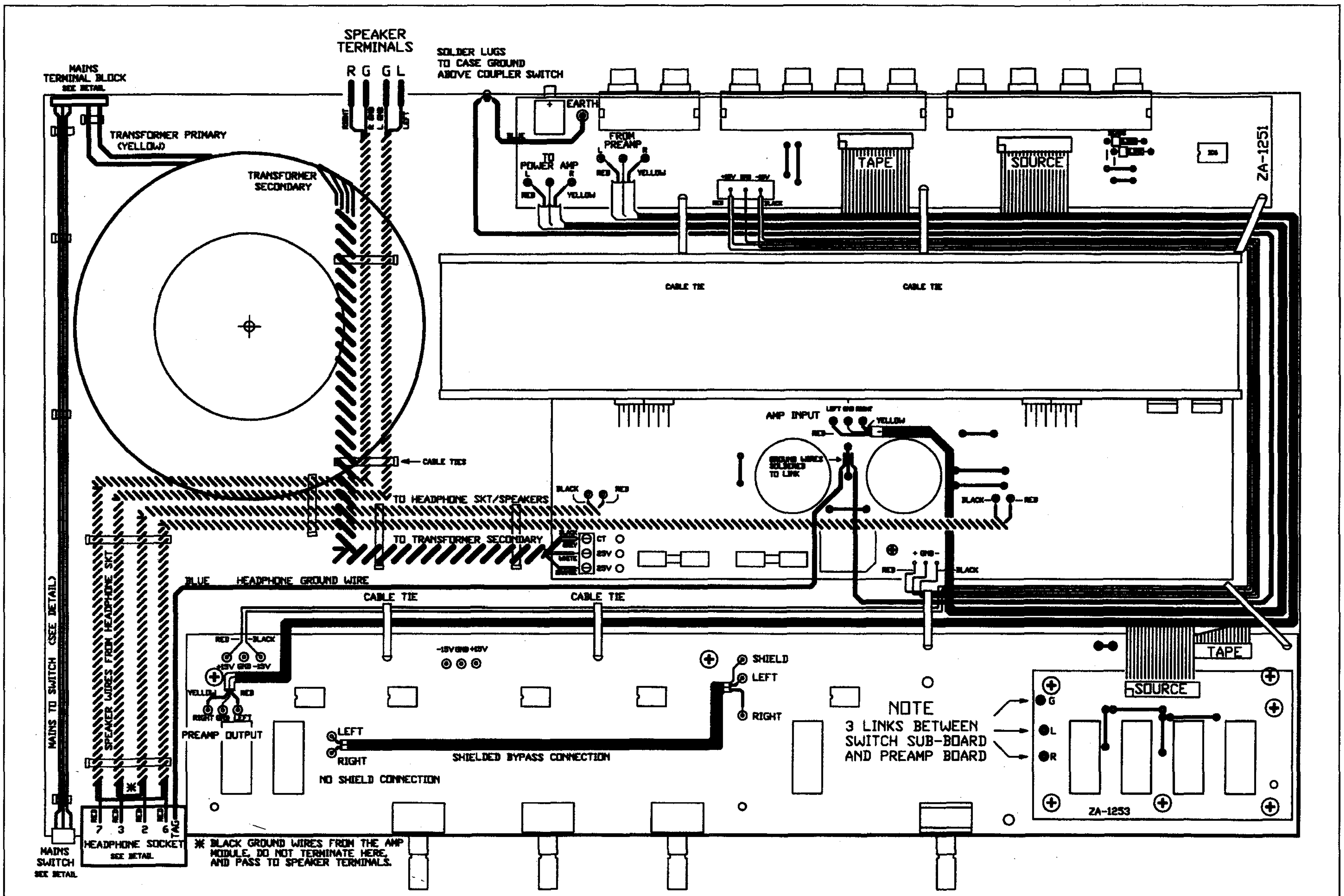
A short run of twin shielded cable is needed for the Tone/Defeat switch. Keep this as short as possible, and run the cable down the centre of the preamp board. The shields of the two cores are joined at the source end, where there is a ground pin for them. There is no ground connection for the shield at the other end, so ensure that the shield wires are neatly terminated or covered with heatshrink, so that there is no chance of them accidently grounding any nearby components.

Check that the left and right signals indeed go to the left and right connections, otherwise you may notice a swapping of the channels whenever the Defeat button is pushed.

When fitting the four potentiometers into the front of the preamp board, check that they are at an accurate 90° to the PCB before soldering in place, to avoid twisting the PCB when the pot nuts are tightened. Also check that the pots and pushbutton switches are firmly pressed into the PCB holes, to ensure that the switches will line up accurately with their respective holes.

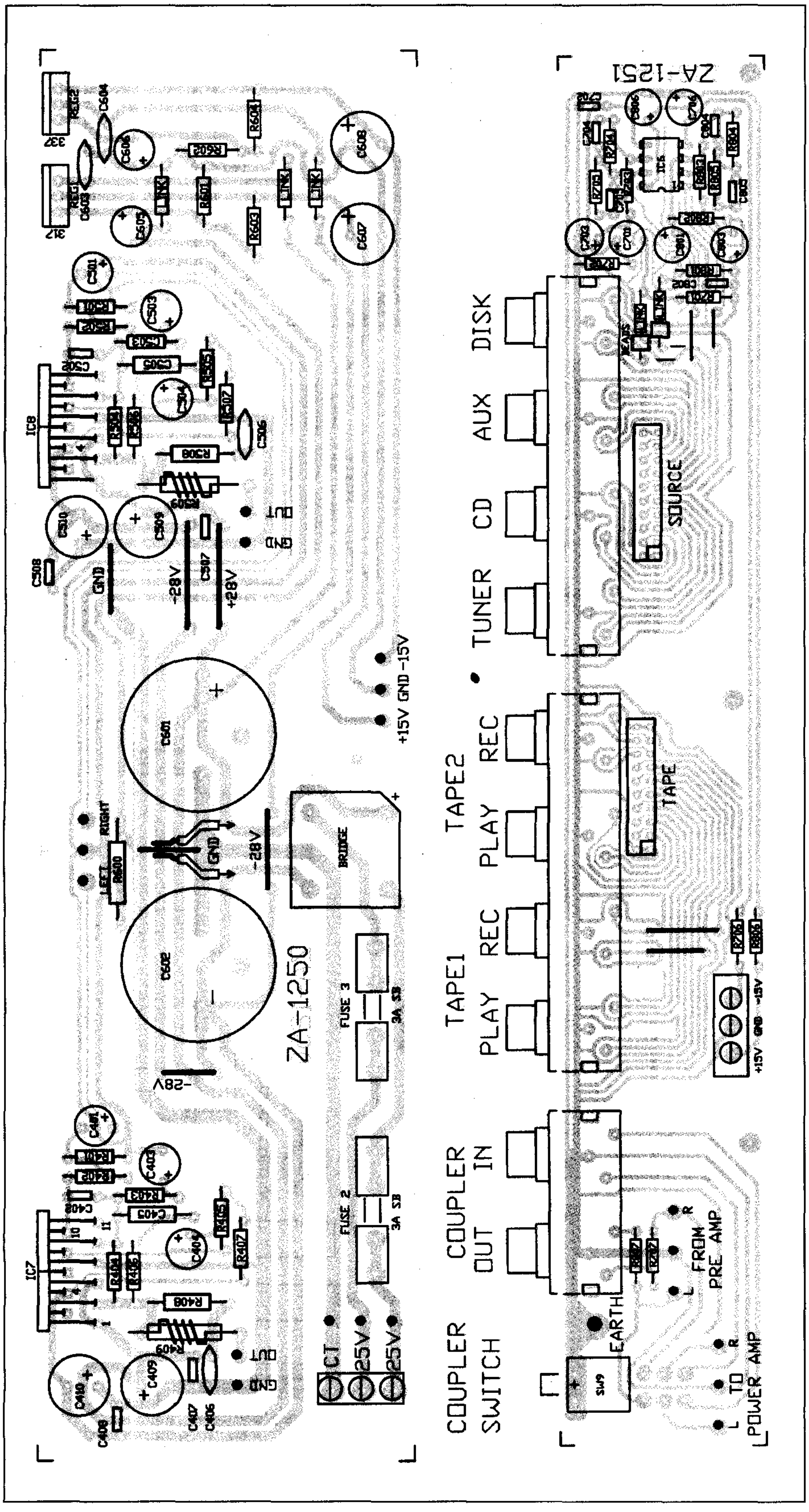
You will need to break the small alignment tags off each of the four pots. This is because the flat face of the pots, at the base of the thread, are to sit flat against the inside of the case front.

The PCB position for the Volume pot has some extra space around it. This is to accommodate an optional motor-driven pot, as a future upgrade. The motor-



Use this overall wiring diagram as a guide when you're making the interconnections between the PC boards. Note that it doesn't show the detailed connections for the mains wiring, which is shown separately. Similarly the component detail on each of the PCB modules is shown in separate overlay diagrams. The use of nylon cable ties is recommended in the positions shown, for neatness and reliable operation.

50W/Ch Stereo Amplifier — 2



Here are the overlay diagrams for the the power amp/power supply board (left) and the rear connector/phono preamp board (right). Use them as a guide when you're wiring up your own boards.

driven pot will replace the existing Volume pot, and be driven from an Infra Red control board to be mounted above it. The IR sensor will sit behind the red bezel in the front panel, and this will provide a remote IR volume control. This option is expected to be available in the near future.

Power amp board

Start assembly of this board by inserting the tinned copper wire links, as shown on the overlay diagram. There are six of them, made using the larger diameter tinned-copper wire.

Continue with the rest of the componentry, but leave the amp ICs and voltage regulators until last. Double check the polarity of each of the electrolytic capacitors as you fit them into the board. Use PCB pins for the speaker connections, the audio input, and the low voltage supply terminals. Use a three-pole screw terminal for the AC supply from the transformer secondary.

Resistors R409 and R509, at the speaker output of each channel, carry the output chokes. These chokes are formed by neatly winding 10 turns of 0.8mm enamelled copper wire over a 10Ω 1W resistor, and soldering the wire at each end to the resistor leads. The resulting composite resistor/choke is then soldered into place on the board using the resistor leads.

Once all the standard components have been fitted, fit the four ICs into place — the two LM3886 amplifiers and the two voltage regulators. Here it is a good idea to mount them loosely into the heatsink, to ensure that they are well aligned, and solder the leads while in this position. If they are soldered into place without the heatsink as a guide, there is a chance they may put uneven pressure on their leads, and even damage the PCB tracks when they are tightened against the heatsink.

Once the ICs are soldered, and the rest of the components are fitted, the board can be attached to the heatsink. Use a minimal amount of thermal grease and fit the mica insulating washers to the devices. Include the nylon insulating bushes, and bolt the devices to the heatsink using the M3 x 12mm screws, nuts and washers.

At this stage it is a good idea to check that the devices are all insulated from the heatsink. With a multimeter set to Rx1 or continuity-test, check each tag of the four devices to ensure that none is in electrical contact with the heatsink. If you find that *any* of the tags are in electrical contact with the heatsink, remove the bolt and check the mica insulating washer and the nylon bush. Somewhere there will be a short between either the IC tag, or the bolt, and the heatsink. There should be no direct continuity between any of the four IC tags and the heatsink.

Rear input board

Before you fit the components to this board, visually check the PCB tracks around the IDC headers, as some of these tracks are quite close together. If you notice a bridged track between two pads, first double check that it is not meant to be linked from the PCB pattern or schematic, and if not you will need to carefully cut this bridge with a scalpel or fine blade.

Ensure that all three RCA socket assemblies are at right angles to the PCB when they are soldered into place. Failing to do this may result in the PCB twisting and being stressed when the mounting screws are tightened.

When you mount the rear PCB in the case, include the supplied rubber grommet in the case hole for the coupler switch. This will act as a flush seal for the switch and prevent it from moving when it is operated.

The ground connection from the PCB to the case is made with a 100mm length of the thick blue cable. This cable is soldered into the PCB, and then soldered well to a solder-lug. The solder-lug will be fitted to the case ground bolt above the coupler switch, with a star washer. The PSU/AMP ground cable will also fit to this case ground bolt.

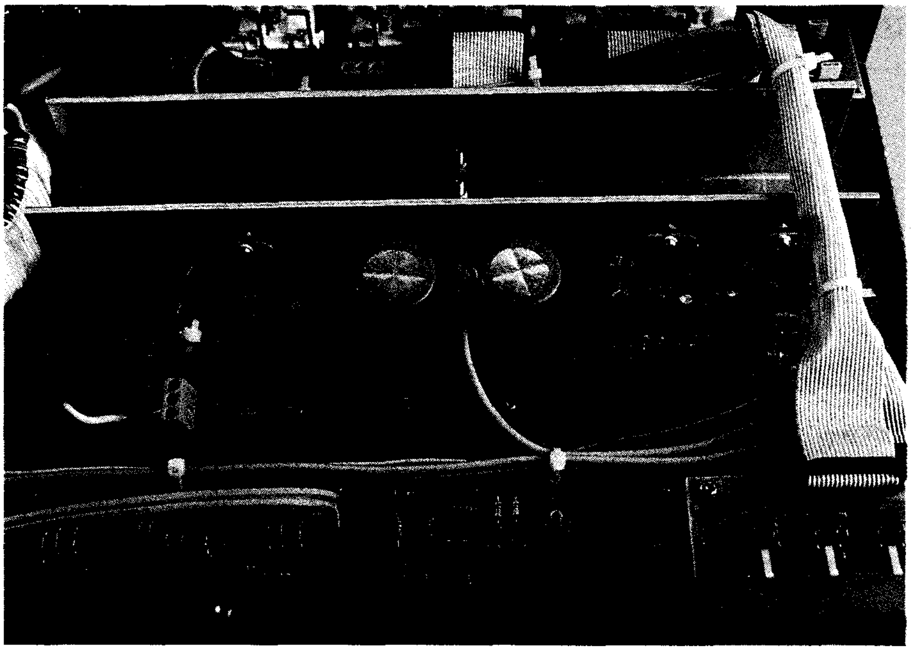
PCB pins are used for the power amp and preamp connections near the coupler switch. A three-way mains screw-terminal block is used for the power supply connection.Take care orientating the polarity of the electrolytic capacitors in the phono preamp.

Use the thinner tinned copper wire for the four links on this PCB. When the phono preamp is included, note that the two 0Ω resistor links at the input have a ferrite bead over each of their leads.

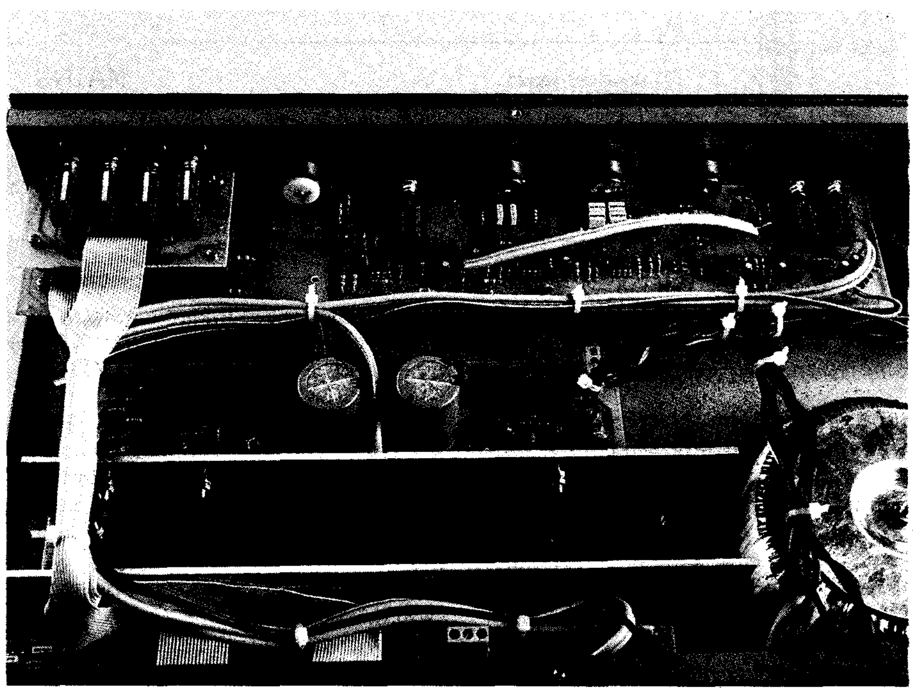
Assembling it all

When the three PCB modules are completed they can be fitted into the case, along with the toroidal transformer, and the internals can be wired up.

The rear socket/phono preamp assembly is mounted to the case with three M2.5 x 12mm screws and nuts, one in the centre of each RCA socket assembly, and should fit comfortably into the rear of the case. The ground wire from beside the coupler switch will be fixed by its solder tag to the bolt immediately above the coupler switch, with a star washer to ensure a good electrical ground.



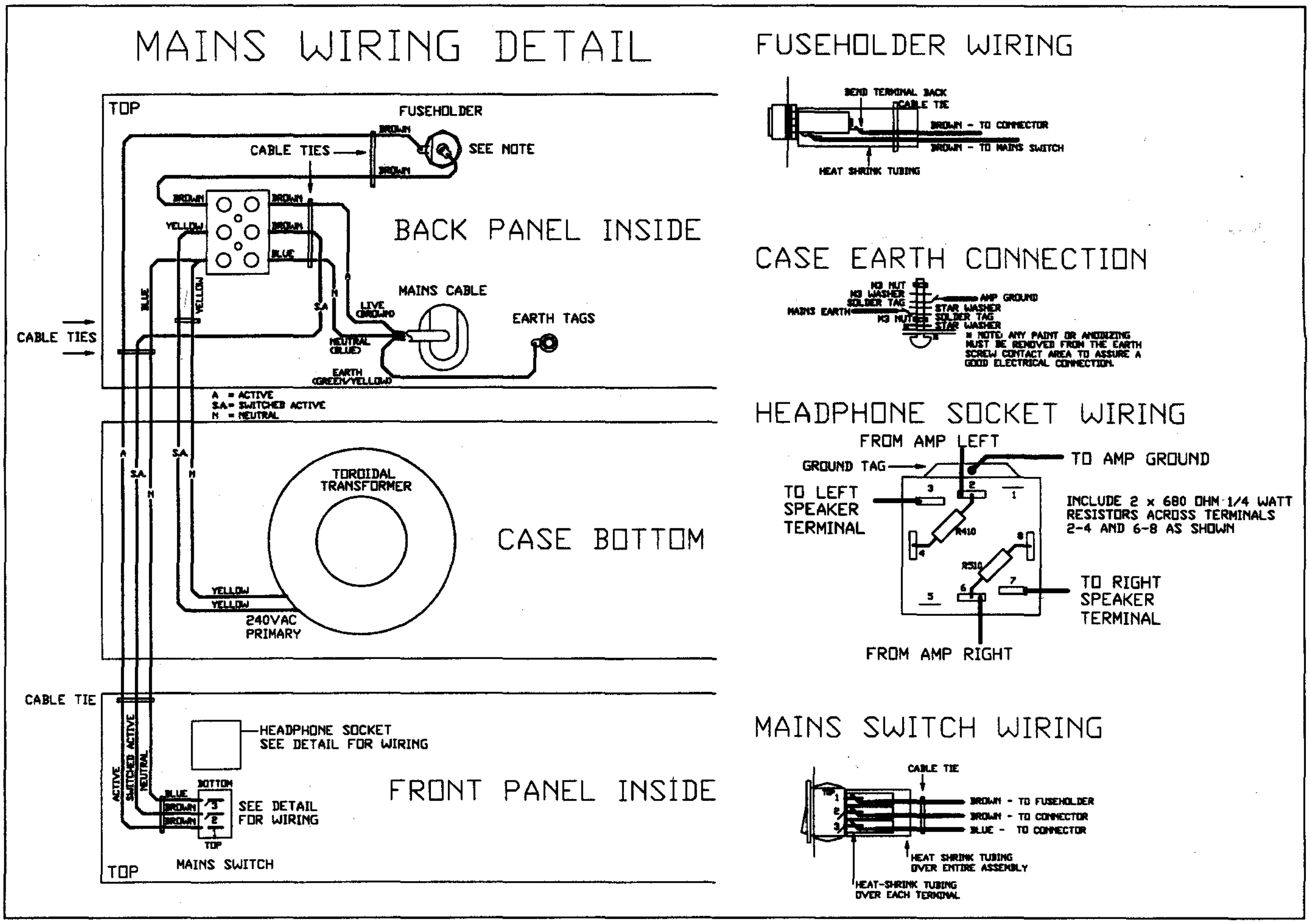
Visible in the centre of the closeup above is the power amp/supply board, with the two main ICs bolted to the heatsink. Below is a view from the rear, showing the preamp/control board and its piggyback board.



The PSU/AMP module is secured by three M3 x 12mm screws, nuts and washers, which pass through the case bottom and through the heatsink. The PCB of this module is supported by a single 10mm insulated spacer, positioned beside the bridge rectifier, between the PCB and case.

The preamp module is mounted directly onto the front panel, inside the case, and held in place by the pot nuts. Only tighten the pot nuts when you are happy the module is fitting well, and that the pushbutton switches are centralised in their holes and not scraping against the sides. The inside edge of the preamp PCB is supported by three insulated 25mm spacers to the bottom of the case.

Above the volume knob you will notice a round hole. This is to suit the single red bezel, which enables a future upgrade to an infra-red remote control. Fix the bezel in place by neatly trimming off the clips which pro-



Use these detail diagrams as guide when you're fitting the mains wiring, the case earth connection and the headphone socket wiring. Take special care with the mains wiring, especially that for the rocker switch and fuseholder. Don't be tempted to leave off the protective sleeving — your life could depend on it.

trude, fitting it into place and securing it there with two tiny drops of a suitable glue such as contact adhesive, applied from the inside of the case. Do NOT use Superglue unless you are *very* careful, as a spillage of this may mar the front panel.

The front of the bezel should be flush with the front panel.

Next, complete the mains wiring and carefully check this against the wiring diagrams.

If desired, the signal input wiring (ribbon cables) and the speaker output wiring (from power amplifier to speakers) can be left until last, and fitted after each module is given a preliminary check.

To do this, complete only the power supply wiring. This is the wiring from the transformer to the power supply, the earth and case ground cables, and the low voltage wiring from the power supply to the rear board and to the preamp board.

Take particular care with the mains wiring. You can check this with a multimeter before applying power, but following the wiring detail for the mains switch and mains connector block carefully.

Check that the terminals of the mains switch, and mains fuse are well insulated with heatshrink tubing.

Above all, before you switch on the mains, re-check your mains wiring. Check also that the low voltage supply (the +/-17V supply from the PSU/AMP board) is connected to the rear PCB and to the preamp PCB with the correct polarity.

Transformer secondary

There are four wires from the transformer secondary — one pair of wires for each of the two 25V AC secondary windings. To create a 25-0-25 volt centre-tapped secondary, join the black and grey wires together and connect these to the PSU/AMP connector marked 'CT' (for centre-tap). The remaining white and orange wires each go to the connections marked '25V', in either order.

The four wires of the transformer secondary should be loosely twisted together, as they run from the transformer to the AC input terminal of the PSU/AMP board.

Cable pairs which carry high currents should be kept as close to each other as possible, so as to minimise electromagnetic radiation from them. In particular, the speaker wires of each channel, which run from the PSU/AMP board to the headphone socket and then the speaker terminals, should be well twisted together from start to finish.

The three cable ties which will hold the wiring together in a loom, should be fitted last of all and after all the wiring of the modules is completed satisfactorily.

Route the cables as per the main wiring diagram, and use the cable ties to bind the wires into a loom. The twisted speaker wires can be bound quite tightly with the cable ties.

For the main inter-board wiring two ribbon cables are required, with IDC connectors on each end. To construct these you will need to measure out the lengths quite accurately for a neat fit, before cutting the ribbon cable into two and fitting the IDC connectors to each end.

When measuring the length of the ribbon cable, employ the technique of folding the cable loosely at right angles so as to get around corners, as this looks neat and causes no irregular contortion of the ribbon cable. Do not underestimate the length — you can always trim an amount off the end before you fix the final IDC connector, whereas you cannot 'uncut' the cable if it doesn't reach.

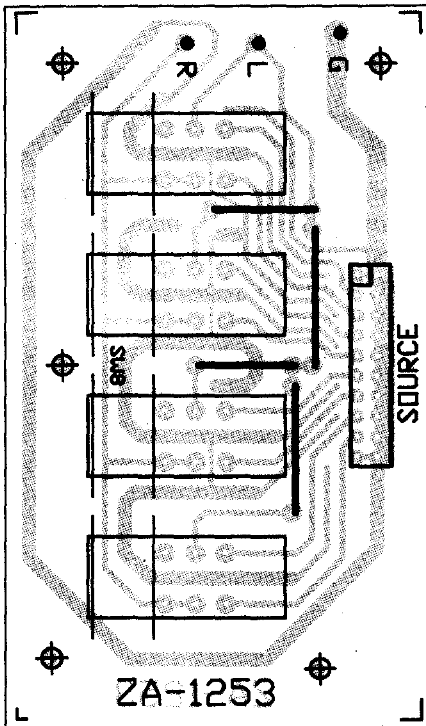
When fitting the IDC connectors, first ensure that the ends of the ribbon cable are neatly cut and that there are no strands of wire free that could come into contact with neighbouring conductors. The IDC connectors are polarised, so make sure you fit them the same way around on the cable; this can become confusing if the connector cable-strain-relief fitting is used before both ends are fitted, as this reverses the apparent exit direction of the cable from the connector. Fit a connector to one end first, then double check that the length is appropriate and fit the other one.

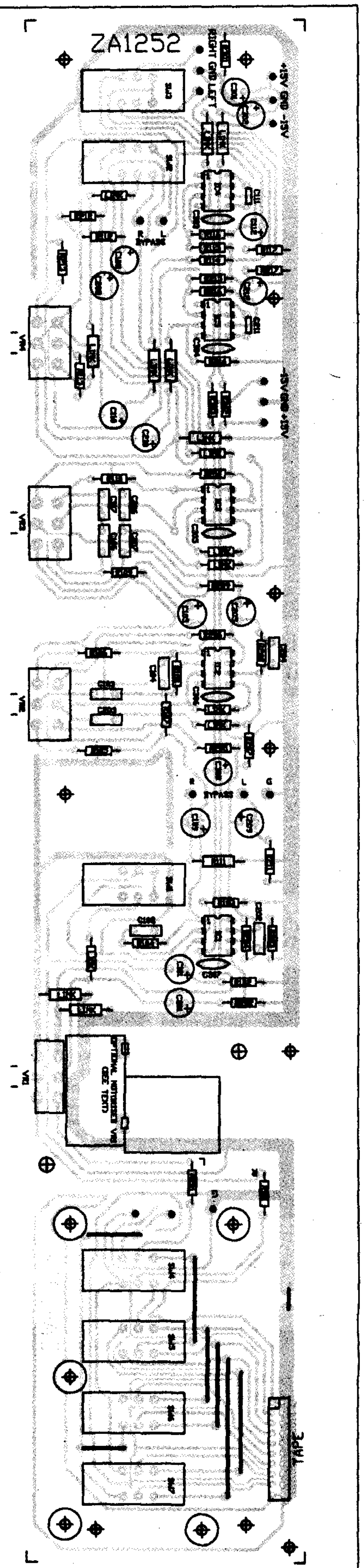
To fit the connectors to the cable, you can use a small vice. Carefully align the cable within the connector halves, place into the vice and slowly tighten it until the connector cable clamp clicks into its locked position. Do not overtighten, as this may damage the connector.

The cable ties for the group of wires which include the ribbon cables should not be over tightened and should not crush the ribbon cable.

Testing it

Once all the construction is completed, and the mains and transformer wiring has been double-checked, you can apply power to the unit. With no speakers or inputs connected, switch the POWER switch on and the lamp in the POWER switch should illuminate. If it doesn't, immediately unplug the unit from the mains and with a multimeter methodically check continuity from the mains plug, through the mains fuse, through the mains switch to the transformer primary, and from the other side of the transformer primary back to the mains plug.





Here are the two remaining overlay diagrams, for the source selector board (above) and the preamp/control board (right). Note that the diagrams are not to the same scale; the source board in fact fits over the lower end of the preamp board, in 'piggyback' fashion. Although a motorised volume control is shown on the preamp board overlay, this is not part of the basic kit from DSE.

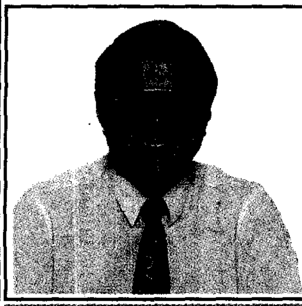
With the power on, use a multimeter to check the +35V and -35V rails. This can be done by placing one multimeter probe on one of the case ground points (such as the bolt above the coupler switch), and the other probe carefully on the links marked with the supply voltages on the PSU/AMP board. Both rails, +35V and -35V should be present, and they may measure up to 37 volts or so.

Now check the low-voltage output points, beside the bridge rectifier. These should read close to +17V and -17V.

Finally, check the DC voltage across the speaker terminals. This should be less than 0.01 volts. If there is any substantial DC voltage across either of the speaker terminals, then there is a fault condition and this should be traced back into the amplifier module. Should this occur, then check the other channel; if that is OK, then you can compare the two channels to assist in locating the fault condition. ◆

ALTRONICS COMPONENTS

Fax Order Line: (09) 328 3487



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Here's some excellent new kits to build and many bargain priced products and components. And remember - phone or fax your order today and we'll deliver within 48 hours* with our Jetservice Courier Delivery.

Regards, Jack O'Donnell, Managing Director

Jack O'Donnell

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Audio Frequency Analyser Kit

NEW

Turn your PC into an Audio Analyser! Test amplifiers, crossovers, speakers, etc. A professional research and development package for a fraction of the cost of a commercial unit!

$129

Stereo Simulator Kit

NEW

Upgrade Your Mono Video with Stereo Effects!

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Induction Loop Pickup Kit

(See EA Oct '95) Here is a novel way to listen to the television, CD etc with headphones but without long wires back to the set. Handy for listening to TV in bed, or for getting 'that little bit more volume' without irritating other members of your family. This works on the same principal of induction loops for hearing aids. Simply set up by laying cable around the ceiling or floor of the room. Full details supplied. Kit does not include earphones.

K 5200 **$24.95**

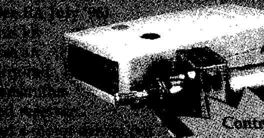
10A Automatic Battery Charger Kit

NEW

Charge your car or boat battery in a fraction of the time taken by a normal charger!

Remote Control Volume Kit

NEW



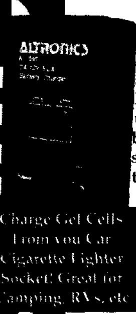
Control your stereo volume from the comfort of your armchair!

$45

2A SLA Battery Charger Kit

NEW

(See SC July '96) Powered from a 12V cigarette lighter socket, this sealed lead acid (SLA) battery charger provides up to 2 Amps charge current for 12V batteries of up to 6.5Ah capacity. It supplies an initial charging current of 2A to a discharged battery, and this current will gradually decrease as the cell reaches a fully charged state. This efficient step-up switch mode design includes reverse polarity and fuse protection and charges SLA cells to an end point voltage of 13.8V. Kit includes screened Jiffy box case and cigarette lighter plug. Ideal for camping, boats etc.



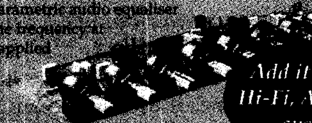
Charge Gel Cells from you Car Cigarette Lighter Socket! Great for Camping, RVs, etc

K 1690 **$39.95**

3-Band Parametric Equaliser Kit

NEW

(See SC July '96) A parametric audio equaliser allows you to select the frequency at which cut or boost is applied (the centre frequency), as well as the equalisation bandwidth around the selected frequency. Thus, you can apply cut over a small bandwidth in, say, the midrange region, to compensate for room resonances at a particular frequency. Or, you can apply boost to a large bandwidth in the same region if your loudspeakers have a midrange response deficiency. Traditional graphic equalisers have fixed centre frequencies and bandwidths, allowing for level adjustments only. With this 3-band parametric equaliser you can select a centre frequency in low, mid, and high regions, and apply cut or boost over a selectable bandwidth in each band. It gives you incredible flexibility to tailor the sound of your system exactly the way you like it! Requires ±15V DC supply (see our K 3215). Two modules are required for a stereo equaliser.

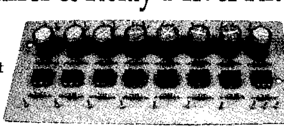


Add it to your Hi-Fi, A/V or PA system!

K 5530 **$45**

Input Buffer & Relay Driver Kit

(See EA Feb '89) This is a companion kit for our I/O Adaptor kit (K 2850). It has four relay outputs and eight opto-isolated inputs. This kit contains all parts necessary to construct both the input and output stages and even gives basic information on 240 volt triac controlling. As there is no professional software available for these items, a Qbasic program listing is supplied to help you complete your project.

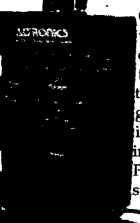


K 2852 **$34.95**

Combined, the K 2850 & the K 2852 Allow You to Turn Appliances On & Off with Your Computer!

Insulation Tester Kit

(See SC May '96) This high voltage tester can be used to test electrical mains wiring leakage and the breakdown of insulation in transformers, automotive generators, and alternators. Its an ideal piece of test gear for domestic, industrial or automotive electricians. Powered from a 9V battery (not supplied), and is enclosed in a Jiffy box with metal lid. It even includes the test probes!



Check insulation breakdown of transformers, motors, alternators, etc.

K 2557 **$79**

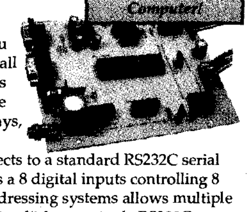
Mains Line Filter Kit

NEW

Protect your valuable computer or audio equipment from mains glitches and spikes!

PC I/O Adaptor Kit

(See EA July '91) Using this module you can computer control all kinds of things such as security systems, stage lighting, model railways, watering systems etc. The unit simply connects to a standard RS232C serial port on any PC. It has a 8 digital inputs controlling 8 outputs. A simple addressing systems allows multiple units to be "daisy chained" from a single RS232C port, expanding the number of inputs and outputs up to 64.



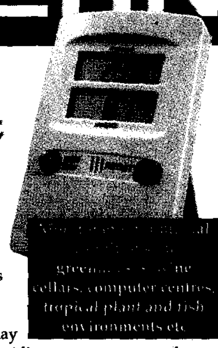
K 2850 **$59**

ALTRONICS

1-800 999 007 PERTH (09) 328 1599

OVERNIGHT DELIVERY

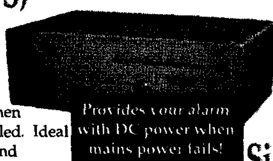
Dual Display Thermometer & Hygrometer



Of the many new items evaluated by our lab for the 1996 product range, none impressed us more than this fine German designed thermometer / hygrometer. Features simultaneous display of both temperature and humidity on an easy-to-read 12mm LCD digital readout. Enables storage and recall of maximum and minimum temperature and humidity readings reached, which are held in memory until reset. Temperature scale -15°C to +49.9°C. Humidity range 30% to 90% ±3% accuracy. Includes tilting bail for desk mounting, or can be wall mounted.
Excellent for monitoring air conditioning systems, wine cellars, hot houses, computer rooms and the weather.

A 0150 **$45**

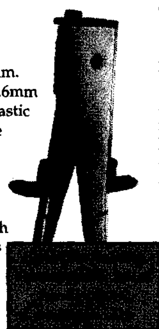
12V 1A Uninterruptible Power Supply (UPS)



This UPS will supply 12V at 1.2Amps via its internal sealed lead acid battery even when mains power has failed. Ideal for use with alarm and monitoring systems, warning panels etc. Includes an inbuilt battery charger circuit.
Requires 16V AC plugpack.

M 9090 Normally $99, This Month **$79**

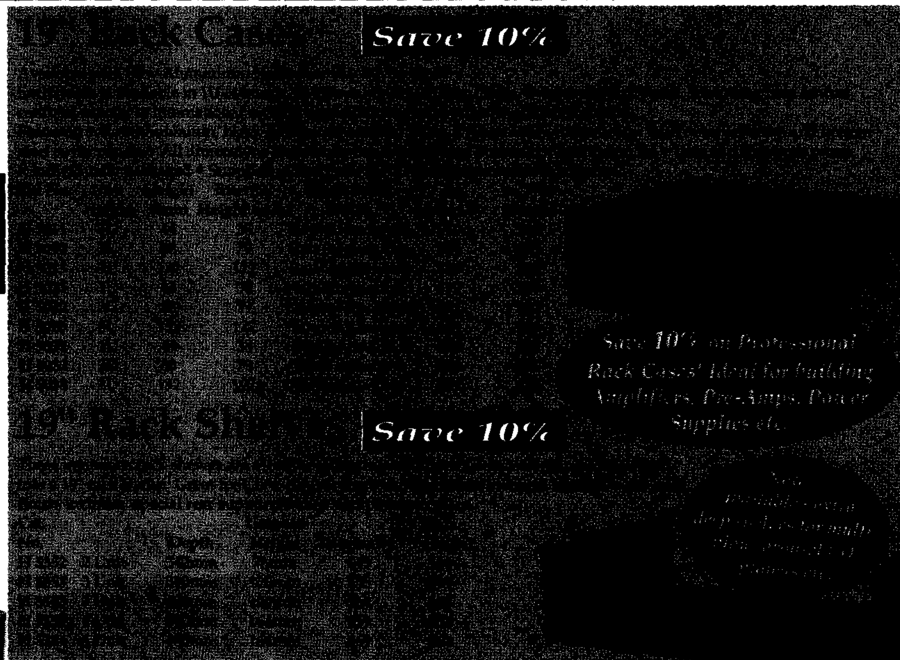
Nibbling Tool



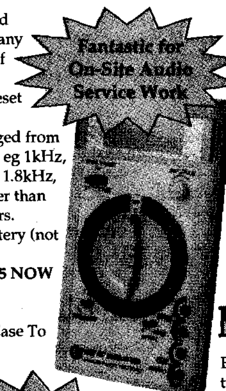
For steel, plastic and aluminium. Capacity 1mm for steel, and 1.6mm for aluminium. Will nibble plastic panels with ease. Ideal for the hobbyist and technician for nibbling holes in panels for LCDs, displays, switches, sockets etc. Give your project enclosures a professional finish and avoid any unsightly burrs or file marks!

T 2355 **$19.95**

19" Rack Cases — Save 10%



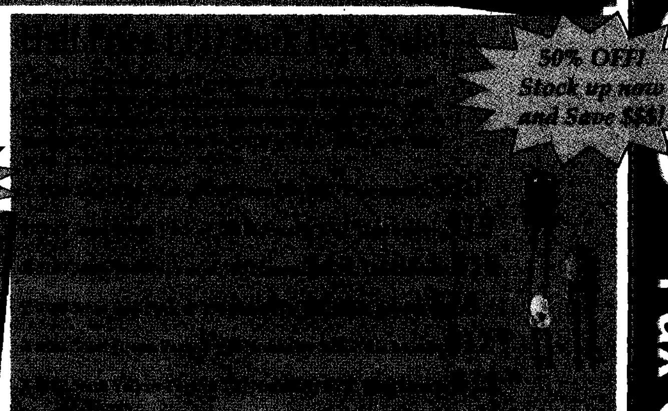
Pocket Sized Audio Signal Generator



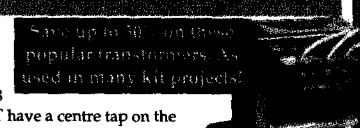
This pocket sized oscillator has many of the features of a large bench oscillator. 46 preset switched frequencies ranged from 20Hz to 150kHz eg 1kHz, 1.2kHz, 1.5kHz, 1.8kHz, 2kHz etc. Smaller than most multimeters. Requires 9V battery (not supplied).

Q 1542 Was $125 NOW **$99**

Q 1055 Carry Case To Suit $6.50

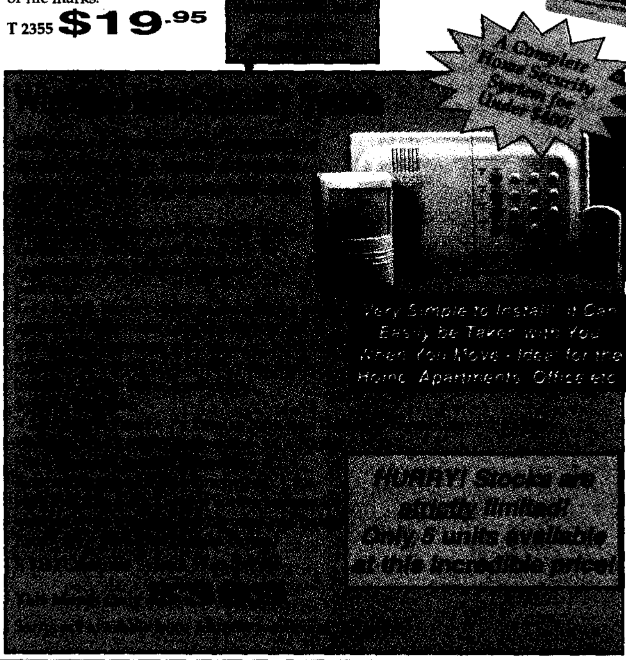


Mains Transformers



Energy Authority Approved mains transformers, manufactured to AS3108 standard. Transformers designated CT have a centre tap on the secondary winding. All have 240V AC primary.

	Normally ea	This Month ea	6 or More ea
M 2851 1.89VA 12.6V CT 150mA	$7.25	**$6.50**	**$5**
M 2852 3.78VA 12.6V CT 300mA	$8.35	**$7.50**	**$6**
M 2853 6.3VA 12.6V CT 500mA	$9.25	**$8.15**	**$7**
M 2854 3.6VA 24V CT 150mA	$8.35	**$7.50**	**$6**
M 2855 4.5VA 30V CT 150mA	$8.35	**$7.50**	**$6**
M 2155 15VA Multi-tap 1A 6.3, 7.5, 8.5, 9.5, 12.5, 15V	$11.75	**$10.55**	**$9**



Micron Series III Soldering Station

The *MICRON* Series 3 soldering station employs electronic switch mode circuitry in lieu of a mains transformer. Excellent for all general purpose and production soldering.
Features: • High insulation ceramic heating element • Rapid heat-up and instant recovery • Heater insulation of over 100MΩ • A zero voltage circuit ensures no high voltage spikes or magnetic field are present at the tip to damage sensitive components • Continuous temperature adjustable from 250° to 430°C (480° to 800°F) • Grounded power cord • Selecting the desired operating temperature is as simple as turning a knob.
Now Supplied with Long-Lasting Iron Clad Tip!
T 2443 Normally $129

This Month $99

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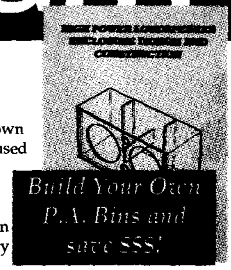
OVERNIGHT DELIVERY

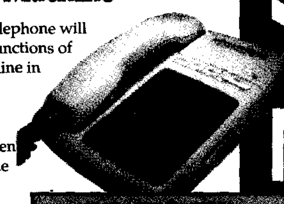
Loudspeaker Construction Book



Ever wanted to build your own speakers? This publication includes comprehensive plans and background info for you to construct your own PA bins for DJs, bands or REALLY big hi-fi systems! The designs are used worldwide in nightclubs, concert halls, and even stadiums.
"High Power Loudspeaker Enclosure Design and Construction" is a comprehensive reference and includes some extremely useful information on the different types of enclosures possible, how to obtain the optimum sound distribution in a PA setup, enclosure design theory and cabinet construction methods, plus detailed plans for 27 speaker designs from top-end horns to thunderous twin 15" W-bins! 166 pages.

B 2307 Normally $24^{.95}$, **This Month $19^{.95}$**

Telephone with Answering Machine



Audioline Model 909. This answering machine telephone will ensure you never miss a message. It has all the functions of a full featured telephone plus an answering machine in one compact package!

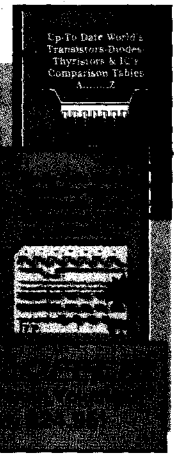
Features:
• Remote access with security code • Answers after two or four rings or announcement only • Ten memories • 200m range in ideal conditions • Tone or pulse dialling (switchable) • Message received counter/indicator • Memo recording facility • Variable length outgoing message • Last number redial • Adjustable ringer volume • Wall mountable • *Recall function for access to "Easycall"*

A 0507 Normally $159

This Month $109

[illegible]

Worlds Transistor, Diode, Thyristor & IC Comparison Tables



Volume 1 A - Z This comparative data book contains more than 28,000 different semiconductors all of which are listed alphanumerically from prefix A to Z with nearly 80,000 equivalents. Each page divided into 3 sections; description, data and equivalents. 1095 pages.

$19.95

Volume 2 [illegible]

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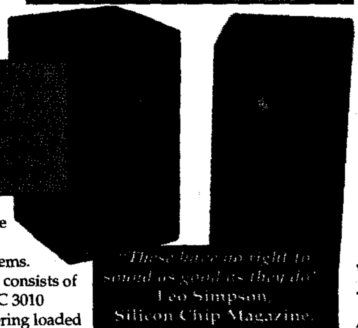
[illegible] Alarm

Exclusive to Altronics

For Less Than $100, This Alarm Acts Like a Silent Watchdog, Deterring Would-Be Thieves!

[illegible]

Stony Broke Speaker Kit



As featured in SC Magazine June '94. This speaker kit is a bit like the Volkswagon; not too pretty to look at but performs superbly. Frankly, the reproduction from these speakers must be heard to be believed. Ideal for bookshelf speakers, extension speakers or speakers for personal walkman type systems. Comes supplied in kit form. The kit for each speaker consists of two large jiffy boxes, one C 0629 30 Watt driver, one C 3010 tweeter, crossover, innerbond wadding, port tube, spring loaded terminals, 6 metres of cable, all fixing screws etc. In fact all you will need is a tube of silicon or similar to seal the 2 boxes together. The main speaker holes have been machined, all you will have to do is drill the mounting holes for the speakers. No special tools are required. Basically all you will need is a screwdriver, soldering iron, drill with 3mm drill bit, cutters etc. Even though these are a low cost kit, there has been a considerable amount of engineering to achieve the resultant sound! The main speaker driver complimented with the tuned enclosure exhibits quite amazing bottom end for a speaker this size.

C 3200 Only $99 per pair

Heavy Duty Speaker Stand

Adjustable height from 1 to 2 metres. Sturdy aluminium tube construction with steel anti-sway bars and heavy duty plastic fittings. Folds down for easy transportation and storage. Comes with tee piece for mounting to speaker boxes, or will fit a 'top-hat' adaptor. Ideal for raising speakers and lighting to audience level. Great for DJ's, bands, clubs etc.

30% Off! Only 50 units available at this incredible price!

C 0520 Was $140

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Mini construction project:

LINE FILTER & 'CONDITIONER'

Does your computer spontaneously reset whenever the people next door turn on their vacuum cleaner or lawn edger? Does your hifi system emit a loud 'click' whenever the fridge compressor turns on or off? Here's an updated design for a low cost, easy to build line filter and pulse clipper which can alleviate most of these problems.

by ANDREW PALMER

Back in July 1988, *EA* published a design of mine for a low cost, easy to build power line filter and 'conditioner'. Over the years since then it seems to have been fairly popular, and I gather that many hundreds of kits have been sold — and presumably found worthwhile. However I'm told that the metal box I used to house the filter has not only become rather expensive, but is no longer readily available.

In addition, some of the circuit values I used in the original design are really not recommended any more, because they result in an excessive leakage current to earth.

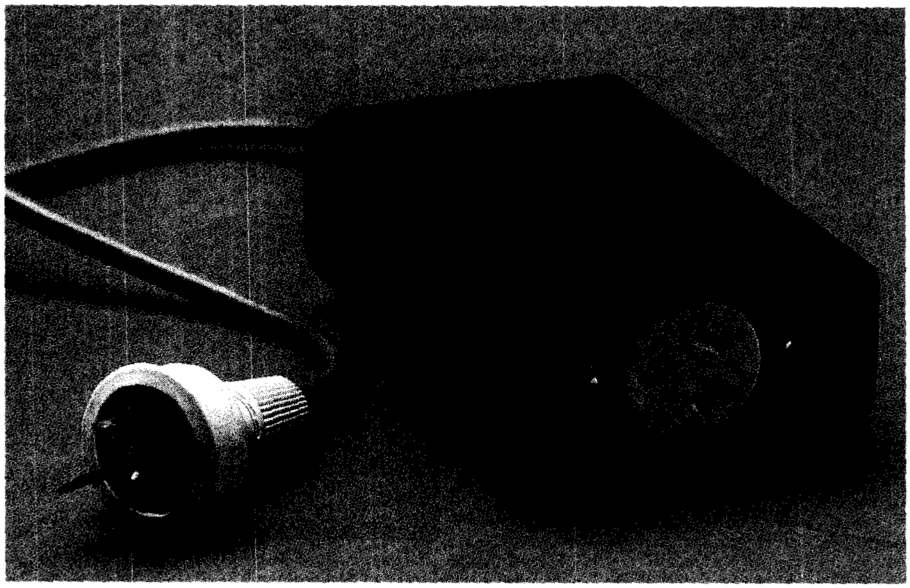
Because of these problems, it was suggested that the time was right to come up with an updated design — one that uses currently available parts, doesn't cause any earth current complications and is hopefully cheaper to build as well. It sounded a good idea, and I was happy to oblige...

Before we look at the new version in detail, though, a bit of background on why line filters are used, and what they do.

Whenever the current in an electrical circuit is turned on or off, noise pulses or 'spikes' tend to be produced due to energy storage in the circuit's inductance and capacitance. The higher the current and voltage being switched, the higher the energy in these spikes — and the more potential for them to cause trouble by finding their way into other, sensitive equipment.

Needless to say, a prime cause of this kind of trouble is equipment with electric motors, and operating from either 240V or 415V power. Even small electric motors can draw quite significant 'inrush' current when turned on, and with a fair amount of winding inductance they also produce a strong inductive 'kick' when turned off.

Although some modern electrical equipment is fitted with suppression circuitry to reduce the level of these spikes, there is still a lot of gear that generates them all too efficiently. This hasn't been helped much by the trend towards double-insulated tools and appliances, either, as double insulation tends to reduce the efficiency of most spike suppression techniques. Some of the worst offending appliances are thus electric drills and saws, food mixers, vacuum cleaners, lawn edgers and similar motorised appliances — with things like fridges and freezers often not far behind.

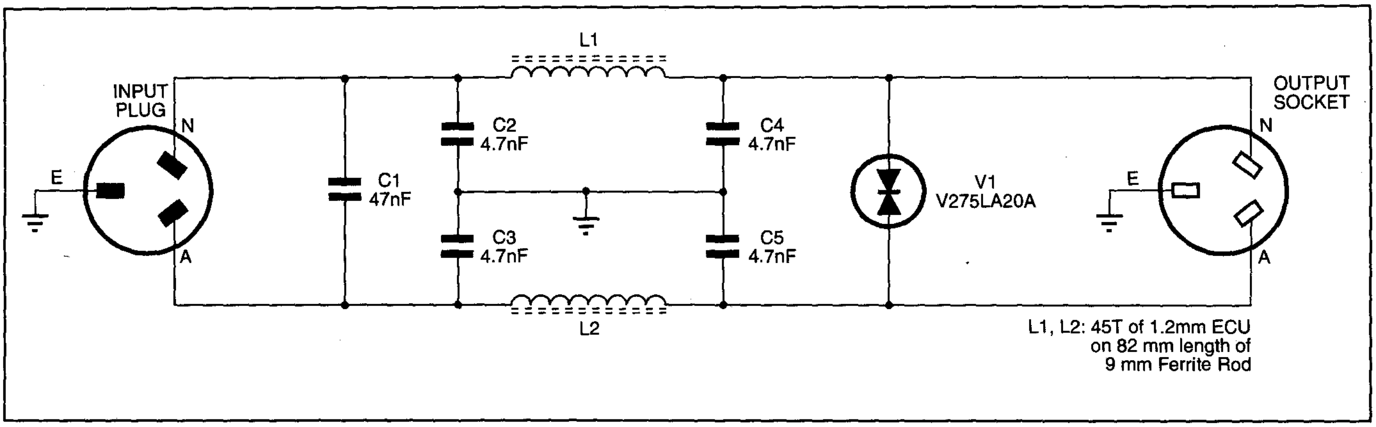


With so many pieces of equipment being turned on and off all the time in a typical city or suburban environment, there's a potential 'hailstorm' of noise or *electromagnetic interference* (EMI) being generated, almost continuously. Some of this is radiated directly into the air, to add to the overall level of atmospheric electrical noise, while the rest is propagated along the mains wiring.

Airborne EMI mainly affects radio and TV reception, causing static and bursts of 'snow' on your TV screen. But the EMI which travels along the mains wiring can find its way into all sorts of sensitive equipment like your hifi system, where it will cause those annoying 'clicks' or 'plops' or worse (like buzz-saw sounds) right in the middle of your favourite Beethoven piano sonata. Or it can get into your personal computer, and cause it to 'crash' or reset in the middle of a program or word-processing session — generally half an hour since you last remembered to save your file on disk!

Luckily most modern personal computers are provided with internal mains filtering circuitry, to make them less subject to this sort of problem. But there's still some that aren't, just as there are a lot of hifi systems that have no internal protection against mains interference.

A line filter and 'conditioner' can help in these situations. It provides a high degree of EMI filtering, together with the ability to 'clip' large spikes which



As you can see from the schematic, the filter uses only a small number of parts. Varistor V1 clips mains-borne 'spikes'.

force their way through the filtering and could otherwise still cause interference and/or damage.

And the good news is that you'll be able to build the unit described here for much less the current cost of comparable commercial mains filters and conditioners. So it's an ideal subject for a build-it-yourself project, especially as it's also very easy to build.

By the way, it won't necessarily be a complete solution to all of your EMI problems. It can't stop airborne interference, for which other techniques are needed. Nor is it capable of filtering out or clipping ALL mains-borne interference; no simple device can. But it *will* knock the spikes and noise down quite a long way, in most cases.

Of course the best place to tackle electrical noise is really at its source, rather than at the 'receiving end'. However you can't always do this, either because the offending appliance belongs to somebody else, or because fixing the problem would involve major 'surgery' inside the appliance. So a simple line filter at the receiving end may be the most practical answer, especially if it solves the problem.

Circuit details

As you can see, there isn't much in it. Basically the circuit consists of a pair of *pi-section* LC filter networks, using a series inductor and two shunt capacitors in each of the main power leads (active and neutral). The capacitors connect to mains earth, in each case.

Because the total shunt capacitance from either active or neutral to earth is nowadays limited to 10nF, to prevent earth leakage current problems, capacitors C2-C5 have accordingly been given a value of 4.7nF — somewhat smaller than in the original design. However as at least a proportion of mains-borne interference is carried differentially between active and neutral, rather than as 'common mode' signals between both and earth, capacitor C1 has been added to restore the overall filtering to much the same level as before. Inductors L1 and L2 are each wound on the centre 60mm of an 82mm length of 9mm-diameter ferrite rod. Each coil consists of about 45 turns of 1.2mm diameter enamelled copper wire, tightly wound.

Capacitors C2-C5 are all 275VAC rated MKT types, of the 'Class Y' type rated to operate continuously from active to earth. Similarly capacitor C1 is a 275VAC MKT type, of the 'Class X' type.

In addition to this basic EMI filtering, there's also a *varistor* device (V275LA20A or similar) connected across the filter output socket, directly between active and neutral.

The varistor is a non-linear resistor, which is virtually an open circuit for the normal 240V AC waveform. But if a high voltage 'spike' should blast its way through the filters, superimposed on the 240V wave, the varistor will suddenly conduct current. This allows it to absorb the energy in the spike, effectively clipping it to a voltage only a little above the normal 240V level. As a result, it is prevented from causing much trouble.

SAFETY WARNING

Please note that virtually all of the internal circuitry of this project is directly connected to the 240V power mains when it is operating. Great care should therefore be taken when the unit is being built, to ensure that there are no incorrect component connections or faulty solder joints, etc. Ensure in particular that all connections to the mains active, neutral and earth lines are made exactly as shown, with no accidental transpositions because these could cause heavy overload currents to flow and possibly start a fire.

Also to avoid the risk of serious or possibly even fatal shocks, the project should NOT be connected to the power mains unless the PCB is firmly fixed in the plastic case and the case itself is fully assembled, to prevent accidental contact.

Construction

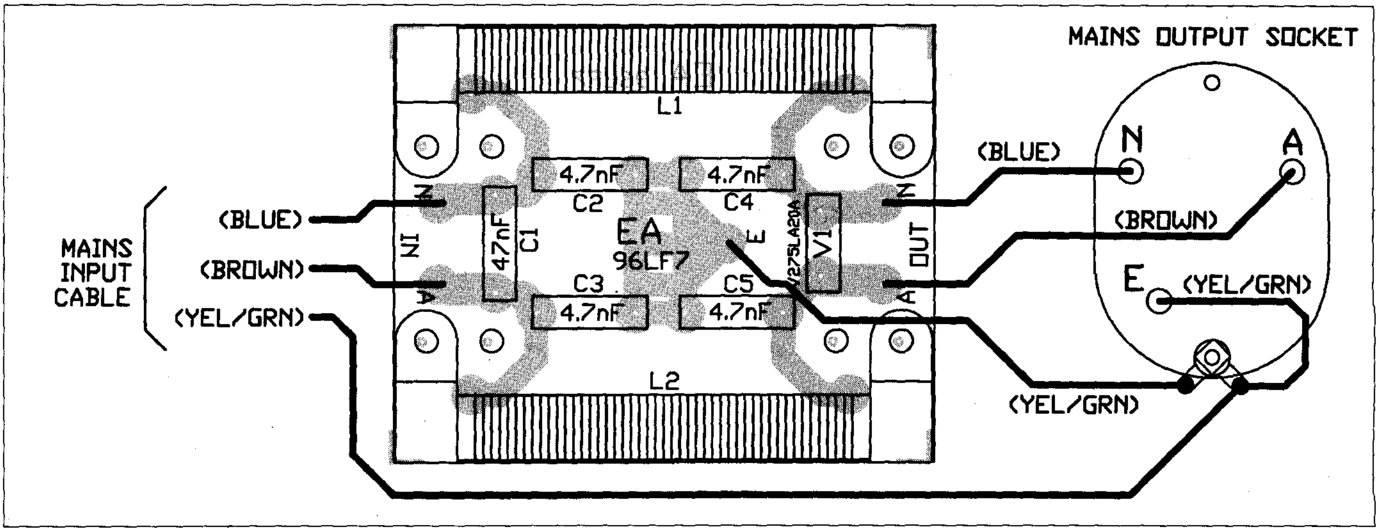
Although a line filter should ideally be housed in an earthed metal box, as used for the 1988 design — to ensure that the filter inductors don't radiate any of the interference they block — many current units are housed in a plastic case. So since the original metal case now seems to be unavailable, and the metal cases that *are* available are either too large or too expensive, I've elected to house the new version in a low cost plastic box as well.

The box I've chosen is a clip-together type measuring only 93 x 48 x 134mm, and readily available from Dick Smith Electronics outlets (Cat. No. H-2503) for only $13.95. A longer and slightly shorter screw-together box measuring 100 x 40 x 190mm is currently available from Jaycar (HB-6036) and Altronics (H 0220), for only $12.95, and would probably also be suitable.

With a bit of squeezing and redesign of the PC board, I've been able to get everything into this rather smaller box. The new PCB measures only 83 x 69mm, and is coded 96LF7. It's designed to be supported inside the box on four 15mm long insulated plastic spacers, of the type fitted with tapped brass inserts at each end. This allows the board to be firmly mounted while still providing effective 'double insulation' for the mains wiring and 'live' components.

The filter inductors are each fastened to the PCB using a pair of 9mm (3/8") nylon cable clamps, with one at each end of the ferrite rods. The space between the clamps is about 60mm, enough to comfortably fit a winding of about 45 turns in 1.2mm enamelled copper wire.

The high-voltage class 'X' and 'Y' MKT capacitors all seem to be standard nowadays in terms of overall size and 0.6" lead spacing, so the new PCB has been designed to suit this size. Similarly although there are a few different types of 275V varistor available, they all seem to be much the same size and with a



Use this combined PCB overlay and wiring diagram as a guide when you're building up the filter. Take great care when wiring it up, as most of the circuitry is live when operating.

nominal 0.5" lead spacing — so the new board should suit them all.

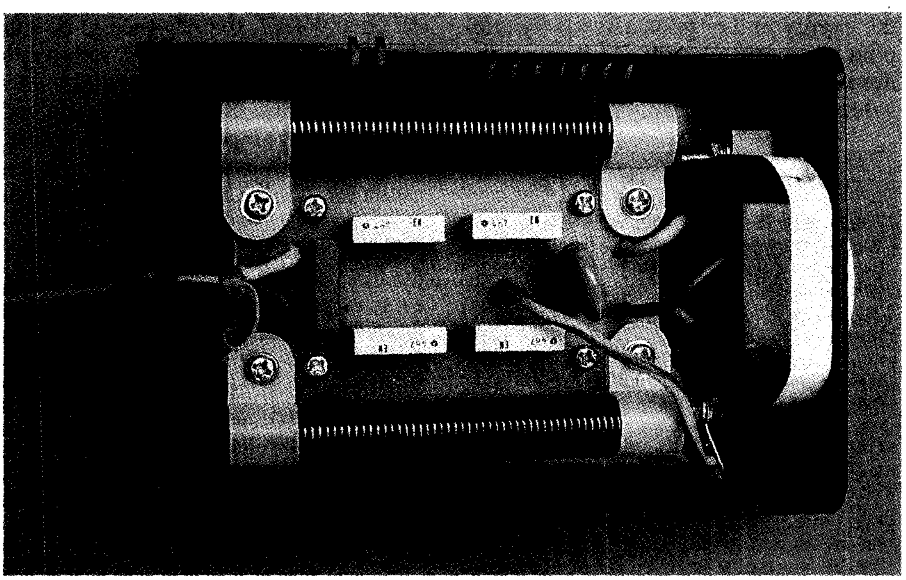
The construction of the filter should be fairly clear from the PCB overlay/wiring diagram and the internal photographs, I hope.

I suggest that you start by making the two inductors. The first step is to prepare the ferrite rod — this comes as a single length about 195mm long, from which you have to make two lengths 83mm long.

This is actually quite easy, as ferrite rod is very brittle and will snap like glass rod. All you have to do is make a small nick in the rod with a triangular file, at the correct length, and then grip it firmly in both hands with your thumbs facing each other on either side of the nick, but on the far side of the rod. Then apply gentle pressure, and the rod will snap cleanly at the nick. All you have to do then is smooth the broken ends with a file, so you won't cut yourself later...

The two inductor windings can be wound directly on the ferrite rods, or on a length of 9mm (3/8") scrap steel rod if you don't want to risk breaking the ferrite. You'll need about 1500mm of 1.2mm enamelled copper wire for each one.

I like to stretch the copper wire slightly first, before winding it. This straightens it out nicely, and gives a neater result. So to do this for this project I cut off about 1700mm, and clamped one end of it in the bench vyce. Then I gripped the other end with stout pliers, and carefully pulled it until the wire stretched slightly and became really straight. Then without letting it go, I took the rod and carefully wound the wire tightly on it, starting from the free end and gradually walking towards the vyce. Doing it this way only takes a few minutes, but gives a more professional looking coil.



This view inside the case also gives a good idea of where everything goes, as a guide to construction. The PCB is supported via insulated pillars.

After winding the coils, bend them carefully so the ends will go through the holes in the PCB. Then cut them so they will protrude about 4mm through the board, and carefully scrape off the insulating enamel so they'll solder properly. Then you can mount the two inductors to the PCB, using a nylon clamp at each end. Use a small flat washer underneath the head of the screw on the top, and a lockwasher under the nut underneath.

Finally you can solder the two ends of each coil to the PCB pattern, after carefully bending it over on the copper side to ensure a good joint.

The capacitors can now be fitted, making sure you put the 47nF unit in the C1 position and the four 4.7nF units in the remaining positions. None of the capacitors is polarised, so it doesn't matter which way round you fit them.

Finally you can fit the varistor, V1. This is again not polarised, so it too can go in either way.

When the PCB is assembled, I suggest that you cut about 90mm off the end of the mains cord, and remove the outer sleeve carefully to obtain the three short lengths of insulated mains wire. Then remove about 6mm of insulation from one end of the brown (active) and blue (neutral) wires, and solder these ends to their respective 'output' pads of the PCB. Their 'other ends' can be bared by about 10mm, and doubled over ready for fitting into the A and N receptacles on the rear of the output socket, shortly.

The third, green/yellow striped wire can also be bared by 6mm at one end, and this end soldered to the PCB's central pad between C4 and C5. The other end of this wire can also be bared by about 6mm, ready to solder to one of the earthing solder lugs.

Now I suggest that you prepare the rear of the case, by drilling the holes for the output socket. The main hole needs to be 36mm in diameter, with two 3mm holes for the mounting screws.

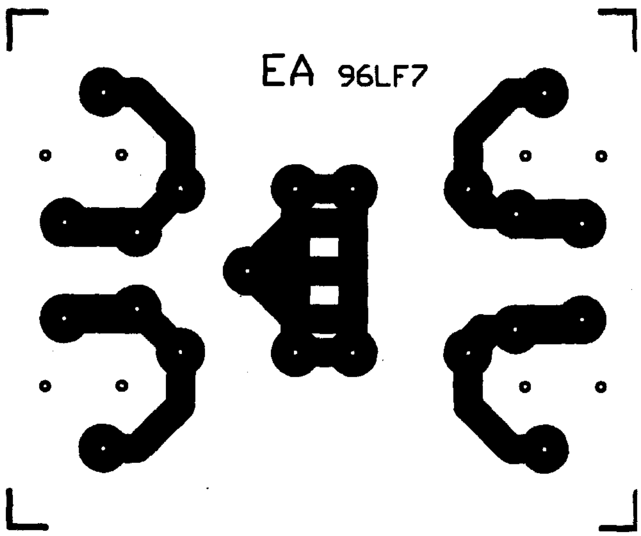
At this stage it's also a good idea to prepare the hole in the front of the case, for the self-locking grommet used for the input mains cable.

After cutting all of the holes, I fitted the locking grommet to the input cable about 135mm from the end, and then passed them through the front panel hole so that the grommet locks the cable in this position. Then I stripped back the outer sheath of the cable almost back to the grommet, cut the active and neutral wires about 25mm away from the grommet, and stripped about 6mm from the insulation of all three wires (the earth wire is left long). This allowed me to solder the active and neutral wires to the PCB, with the latter still outside the case. The longer earth wire was left at this stage.

The output socket was then firmly attached to the rear panel, using two 25mm long M3 machine screws with flat washers, lockwashers and nuts at the rear. Then two solder lugs were fitted to one of the screw ends, followed by another lockwasher and second nut — tightened firmly to make sure the two solder lugs were both secure and in good contact with each other.

The earth wire from the PCB was then soldered to one of the solder lugs, making sure that its wires all passed through the hole in the lug and were doubled around for mechanical strength, before soldering. Then the earth wire from the input cable was attached to the second lug in the same way, but together with one end of a further 60mm length of similar green/yellow wire, to make the connection to the earth wire receptable of the output socket.

After checking everything carefully, the final steps were to mount the PCB inside the lower half of the case, using four 15mm-long insulated spacers. Then the front and back panels were fitted into their locating slots, and the case cover fitted to complete the filter assembly.If you follow this procedure, you should find that it all goes together very easily. Your line filter and 'conditioner' should then be complete and ready for use. ❖



Here is the artwork for the filter's PCB, reproduced actual size for those who want to make their own boards. The tracks and pads are larger than usual to provide high current carrying capacity.

PARTS LIST

1	PC board, 83 x 69mm, code 96LF7
1	Plastic utility case, 93 x 48 x134mm
1	3-pin mains socket, flush mount
1	Ferrite rod, 9mm diameter by 170mm long
1	3.5m length of 1.2mm dia EC wire
4	Nylon P-clamp, 9mm
4	10mm x M3 machine screws with M3 nuts, flat washers lockwashers
1	47nF MKT capacitor, 275V class X
4	4.7nF MKT capacitor, 275V class Y
1	275V varistor, V275LA20A or similar
1	3m length three-core mains cable
1	Three-pin mains plug
4	Insulated tapped spacers, 15mm long
1	Self-locking mains cord grommet
2	25mm x M3 machine screws
3	M3 nuts, with 4 x lockwashers
2	Solder lugs
1	120mm length 4mm varnished cambric sleeving
4	Rubber feet, self-adhesive type

Fault diagnosis package for PC hardware:

PC-CHECK V2.53

Although not all that widely known in Australia as yet, PC diagnostic package Pc-Check comes from respected UK software firm Eurosoft and provides a worthwhile addition to the armory of tools now available to help service techs track down elusive hardware faults. Among the features it offers are its own operating system, for independence from DOS, a very thorough suite of memory testing routines and also the ability to generate a wide range of test patterns for video monitor setup.

by JIM ROWE

With traditional consumer electronic appliances becoming both more reliable and less capable of being repaired economically, many service technicians are looking towards personal computers as a potential source of income. However when they develop faults, PCs can present special problems for the service tech because of their symbiotic blend of hardware and software. What looks like a hardware fault at first sight can often turn out to be due to corrupted software, and vice versa — quite apart from the additional complications that can be caused by viruses and other deliberate nasties.

In this kind of situation, anyone trying to track down and solve functional problems needs all the help they can get, and quite a few firms have stepped in to provide suitable diagnostic software. Some of these packages are very helpful, too, although it's probably inevitable that each seems to have its own strengths and weaknesses.

As a result most people involved in PC servicing have found it necessary to collect a number of these packages — preferably with complementary features — and use them collectively as a suite, to help zero in on faults in an efficient manner. If one package tells you the fault lies in a memory chip or particular device controller, that's usually 'interesting' but not necessarily conclusive; but if a number of packages all seem to point in the same direction, it's generally more likely that the component concerned is indeed to blame. (Unless they're ALL being led astray by something else!)

One of the recent additions to the Australian PC service tech's armory of diagnostic tools is PC-Check, produced by British firm Eurosoft (UK) Ltd and distributed here by Tech Star International. Currently available as version 2.53, it is being promoted as 'the technicians' No.1 choice for reliably testing PC hardware' — and does indeed seem to have some noteworthy strengths in the area of testing memory and peripheral devices.

What you get

Pc-Check comes in a small clear plastic 'zip pouch', designed to slip into a service tech's toolbox or case. Inside the pouch there's the software itself on a 3.5" (720KB) distribution diskette, a user manual in convenient A5 format with metal comb binding (so it stays open voluntarily!), and three very handy 'loop-back' plugs I/O port testing: a DB-25 male plug for testing the printer port, and both DB-9 and DB-25 female plugs for comms ports.

Although nominally designed for troubleshooting in 'AT' and later model PCs, Pc-Check is also capable of carrying out most of the testing needed on earlier PC and XT models. However one of its features — the ability to 'self boot' from floppy disk using its own operating system — probably isn't going to be useable with either these or even earlier AT model machines, because the package comes only on a 3.5" disk and many of the earlier machines have only 5.25" drives of either double or high density.

I suspect that's not going to be a major problem, though, as most if not all of the program's other features seem to be available simply by copying all of the EXE and other non-hidden files on the distribution disk over to a DOS-formatted booting 5.25" DD or HD floppy, and then either running the program from that or using it to load them into the machine concerned.

Of course providing the machine you want to check has a 3.5" drive, there's no problem. You're not locked into using the distribution disk, either — DISKCOPY can be used to make a fully functioning 3.5" copy for day to day use, as the manual explains.

(In any case, booting up with Pc-Check's own operating system will of course only let you check the system's basic operation. Those aspects that are normally handled by device drivers, loaded in via CONFIG.SYS and AUTOEXEC.BAT won't be available — such as testing the mouse, CD-ROM drive, SCSI controller, some sound card functions, expanded memory and so on. On the other hand, unless you disable at least some of the drivers by booting up from at least a DOS floppy, you generally can't check *other* aspects, like cache RAM and some other memory tests. Life wasn't meant to be easy, as someone once remarked...)

Memory testing

One of the nice features of Pc-Check is its comprehensive and flexible suite of memory tests. You can perform tests on base memory (0 - 640KB), Extended memory (1 - 4095MB) or external cache RAM, and in the case of Base and Extended memory you have a choice of three testing levels: Quick, Normal and Advanced. The Quick level gives you fast testing of overall function using basic random pattern and parity tests, while the Normal level gives you a full run through up to 10 different tests: parity test, advanced address line test, pseudo-random test, walking bit left, inverted walking bit left, walking bit right, inverted walking bit right, checkerboard test, inverted checkerboard test and block move test. The Advanced level is essentially a 'Custom' option, allowing you to select any desired combination of the above 10 options.

The cache memory test uses random pattern testing and will test up to 2MB of external L2 cache RAM.

Another nice feature of Pc-Check is its ability to generate a video test pattern in a wide range of display modes, for setup and adjustment of video monitors. The pattern includes a central circle, a grid of vertical and horizontal lines, fine and coarse 'resolution bars' and a series of colour bars (according to the display mode in use). And you can generate it in many different CGA, VGA and S-VGA display modes — from mode 4 (320 x 200) up to mode 106 (800 x 600) in the 11 normal modes, and then from mode 100 (640 x 400) up to mode 106 (1280 x 1024) in the 16 additional VESA S-VGA modes. These patterns are quite separate from the colour bar and palette tests, which test display card and monitor functions in the various colour display modes.

Incidentally the program does warn that attempting to display a mode beyond the capabilities of the monitor can lead to monitor damage.

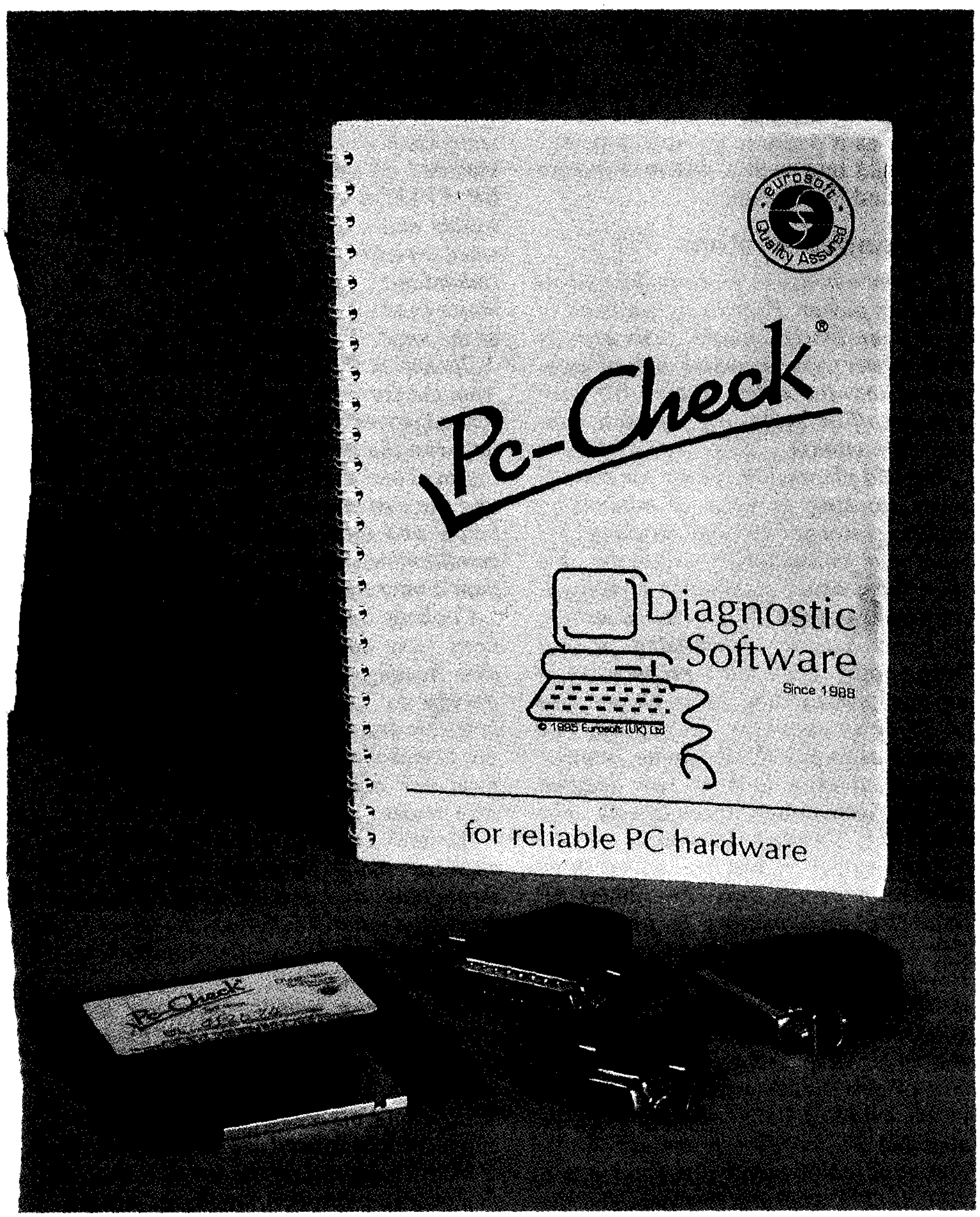
Still another nice feature of Pc-Check is found in the co-processor tests. Along with a series of four checks of the floating point processor's basic comparison and maths functions, there's also a fifth 'Pentium FDIV Problem' test check for the division bug present in 60MHz and early 90MHz Pentiums.

By the way, Pc-Check includes some utilities to check the functioning of a SCSI controller and its peripherals. The utilities require an installed ASPI compatible device driver, so they only work when the computer is booted up normally. However they let you check the basic controller operation, identify the presence of SCSI peripherals and allow these to be interrogated, and also allow low level formatting and testing of SCSI hard disk drives.

In addition to its testing of basic printer port functioning, Pc-Check also lets you send a test printout to either parallel or serial printers, to test them as well.

Similarly it provides a set of 'multimedia' tests, to test both the PC speaker and various aspects of the sound card if one is fitted (and its drivers are installed). You get a descending scale of notes to test an AdLib compatible FM synthesiser, and a short speech sample to test the PCM codec.

Associated with these tests are three which tests a CD-ROM drive, again if one is fitted and its drivers are installed. Here you can test the drive's sustained transfer rate, its random seek performance and its ability to play an audio CD. There's also a fourth test which checks block read accuracy over the full useable disk area, but this requires a special optional CD-ROM test disk from Eurosoft.



A further feature of Pc-Check is a provision for continuous 'burn-in' testing, either for acceptance testing or to ensure that a system is working reliably after repairs. Here you have the ability to nominate which of the normal range of tests is incorporated in the burn-in test cycle, and also to nominate either how many test cycles (1 - 9999) or the total testing time (00:01 to 99:59 hours) you want. A burn-in testing 'program' can also be saved on disk, for future re-use.

It's also possible to set up Pc-Check to produce 'beep' codes via the PC speaker when faults are encountered during basic system testing, especially during burn-in. This allows a tech to proceed with other tasks, while burn-in testing of a system is taking place. There are seven different beep codes, each indicating a fault in a particular system area. An optional 'status indicator box' with coloured LEDs can also be used to indicate system status when a computer is being tested without a video monitor.

Another 'extra' function available with Pc-Check is a low level formatting facility for most AT-type hard disk drives. It can be used to format both MFM and RLL type ST506 type drives, and also most IDE types. However it's not designed to tackle old XT type drives.

I should also note that PC-Check has the ability to either display a full test summary on the screen, after you've performed a set of tests, or to print them out as a 'Quality Assurance Report'. A nice feature, especially for the service tech who wants to show the customer what they've achieved. The printed report has a Machine Configuration section at the front, followed by the results achieved in the tests. You can direct it to show either all possible tests, or only

(Continued on page 94)

INFORMATION CENTRE

by PETER PHILLIPS

Free solar power — the practicalities

This month we look at alternative energy systems, the synchronous detector and how to wire the mains to an appliance. There's also a What?? question you'll want to show your friends when you see the answer, and letters about video protection and a simple way of testing a transformer.

Over the years we've had a lot of enquiries about alternative power systems. The most recent was presented in the April '96 issue, but being a specialised topic, I gave a sketchy outline of what's required, and asked readers to respond.

Before presenting the responses, let me make one point about an alternative power system: it tends to be expensive, especially if the system is to provide enough energy for an average house. Of course heaters and stoves can be powered by some type of fuel, but everything else needs electricity. And the system has to provide a level of comfort to warrant the expense and maintenance. An important aspect is the design of the house, which should incorporate as many energy saving features as possible, to reduce the cost of the system.

The minimum needs would typically be a system able to deliver 2kVA or so, to allow simultaneous operation of a microwave, toaster, lights, TV set and other appliances. That is, a current at the 240V side of 8 - 10 amps. For a 24V DC system, multiply this current by at least 10 (more to allow for losses), giving a maximum DC current of around 100A. As you'll read in the first letter, expect a cost of $30,000 or more.

I've often wondered why there is no real push towards the development of practical, low cost alternative power systems, not just for country folk, but for us all. If enough people installed a solar (or whatever) power system, the excess electricity from these systems could be sold to the local supply authority. This would not only make each system earn money for its owner, but reduce the use of our dwindling resources and the damage to the environment caused by power stations.

And surely sunny Australia, claimed as a leader in solar panel technology, is well placed to undertake such a project. The initiative can only come from government, in the form of grants and concessions. In the meantime we are locked into the present power station system, unless you live in an area where electricity is not available. Then it's up to you anyway!

So here's our first letter, from a reader who has recently installed a solar powered system. It's quite a long letter, which I've decided to include in its entirety as it's rare to get such a practical insight into such a system. I'm sure you'll find it interesting.

Alternative system

Our new house is entirely dependent on solar power. Previously we lived in a caravan for 18 months, also with its own power system, which is now integrated into the house system. We have a home office, and run a part time consulting business.

We had planned the house for several years, looking at ways of minimising power consumption and working out what our consumption would be. We then spent about six months investigating power options. This included writing to every supplier advertising in Soft Technology, a journal I recommend to anyone investigating solar power. Out of 30 or so suppliers, six replied, one wanted us to pay for the quote, another refused to even look at our detailed power consumption spreadsheets. The industry is obviously immature.

The caravan system comprised three 70W solar panels, two 12V 120AH BP Solarbloc accumulators in parallel, a BP charge controller and a 300VA Power Conversions sine wave inverter. I designed, assembled and installed this system myself, and later added a 60W wind generator (second hand). The total cost of this system was around $3000, which supplied power for lighting, fax machine, PC, cordless phone etc. A second hand 2kVA petrol generator and a 40A 12/24V charger provided backup and power for the photocopier, power tools and so on. Refrigeration and cooking were gas.

The main system in the house was supplied and installed by BP Solar, who were the only supplier prepared to make a firm quote. It was designed in consultation with me, to my specifications. The installation (in addition to the caravan system) consists of two identical systems, each with eight 75W solar panels mounted on a solar tracker, 12 779AH BP PVSTOR cells, a BP charge controller and a Selectronics 2000VA sine wave inverter. The dual system provides redundancy, with the refrigerator the major load on one system, and the freezer the major load on the other.

Backup is the charger and generator from the caravan system, wired through a changeover switch, although we have only run the generator once since moving in. Total cost was around $30,000, and the system provides for all normal house and office requirements (no air conditioning, heating or cooking, other than a microwave oven).

Cooking and heating are by wood-fired slow combustion stove, with in-slab heating. The quote from Western Energy to install grid power to our property was $30,900 plus clearing. We are 6km from the nearest road, and 4km from our nearest neighbour, who has grid power.

We took steps to reduce power use such as using compact fluorescents throughout, and designing the house to give good natural lighting. The house is also designed so an air conditioning system is not needed.

There are a number of issues that need to be considered by anyone installing such a system. All 240V wiring must be installed by a licensed electrician, otherwise your insurance might be jeopardised. Battery warranty is likely to depend on the use of a specified charge controller. Intelligent charg-

ers give a longer battery life.

Other than the above, you could design and install the low voltage system yourself, although you need to consider safety. The system stores a lot of energy, which could be disastrous in the event of a short circuit. There is also the danger of hydrogen from charging batteries, and the danger from battery acid. A code of practice is now coming into use.

Equipment can be expensive, for example a 250A fuse costs more than $400. To avoid wasting money you must design the system starting from planned power usage. There are two key factors: peak power consumption, which dictates the inverter size (and to some extent the battery capacity), and the average daily use in watthours, which dictates the solar panel and the battery capacity.

Normal practice is to design for five days of no sun, and no more than 50% of rated battery capacity. All calculations must include equipment efficiency, mainly the charge/discharge cycle and the inverter efficiency at a typical load. These figures will dictate the battery voltage. Connecting batteries in parallel is not recommended, even though we did it on our caravan system.

A further consideration is wiring size, as the higher the current the greater the expense. Systems are usually designed for a maximum current of about 100A. Inverters (12V) with a capacity greater than 1500VA are rare, and 24V inverters are usually limited to 2500VA. Domestic systems are rarely over 48V.

Solar power was cheaper in our case compared to wind, but this would depend on location. Solar is more flexible, as more panels (maximum size 75W) can be added to increase the output. Wind generators are available in sizes large enough for any installation, with the cost per watt decreasing as the size increases.

If available, hydro power is probably the cheapest of all. For the lowest initial cost, you can't go past a petrol generator, followed by a diesel generator. However these are noisy, expensive to run and troublesome (especially petrol generators).

We decided to pay the extra for sine wave inverters, as the proportion of the total cost is small, and some equipment (like our fax) is not covered by warranty if used on a square wave inverter. As well, a sine wave inverter produces less RFI and interference (with audio equipment).

Note that inverters are rated in VA, not watts, so power factor is critical. Some inverters have significant restrictions on power factor. Inverters are not totally reliable. Our 300VA inverter was replaced under warranty, and one of the 2kVA inverters failed for no apparent reason.

Other costs to consider are a shed and slab for the system, trenching for underground cables, foundations for the trackers, shelving etc. We would be happy to show our system to anyone who is interested. (John Denham, Elong Elong, NSW)

Thank you for this interesting summary of your system, John. By the way, Elong Elong is about 60km NE of Dubbo, a district not short of sun. As you can see, John has really researched the field, and although the initial cost of his system is high, he now has free electrical energy forever, apart from maintenance costs.

To finalise the topic, here's another very short letter from a reader who works in the field.

Energy consultant

I am a consultant on renewable energy, and I specialise on remote area power systems. I have written to Charles Collins offering advice to his enquiry regarding alternative power in EA April 1996, If any of your readers have queries about alternative power, please feel free to contact me. A business size stamped addressed envelope would be appreciated. (Gordon Wilson, 74 Skene St, Dunkeld 3294)

We don't normally include letters from suppliers in the column (otherwise we'd have very few advertisers), but I've made an exception here given the specialised nature of the topic.

Appliance wiring

The next letter broaches a topic we've not discussed before: how best to connect the mains fuse and switch in an electrical appliance.

I service and repair electronic and mechanical weighing systems used in laboratories. Over the last 10 years I have done a couple of in-house training courses in the European factory that makes the equipment, and I run my own business quite successfully here in Western Australia.

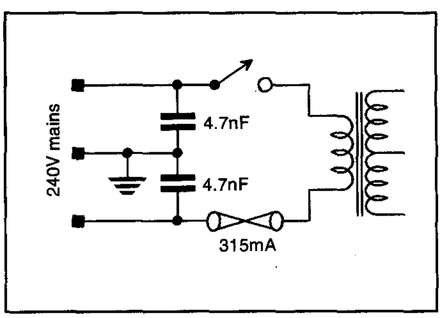


Fig.1: Taken from the circuit diagram, this is how the instrument manufacturer wires the mains supply.

During the 80s, this manufacturer introduced a new series of microprocessor controlled electronic balances. The mains power transformer and associated supply are inside the housing, connecting to the mains via a standard IEC socket. However, the active and neutral in the moulded mains lead were reversed in the supplied IEC lead. The IEC socket also had its active and neutral reversed.

This meant that the active conductor connects to the thread side of a standard 20mm fuse holder, with the other side of the fuseholder going to the primary of the mains transformer. The mains switch is in the neutral lead. While dubious to begin with, the situation is made more dangerous if a standard IEC lead is substituted for the supplied lead. Then the fuse is on the neutral side, and the switch on the active side. Therefore the active is still connected to the transformer (if the switch is on) when the fuse blows.

To correct this, I replace the mains lead and change the connections so both the fuse and switch are in the active line. I have enclosed a copy of the circuit, which as you can see doesn't label the active and neutral connections on the IEC socket. Later models don't use a mains switch, but have a standby switch in the secondary winding of the transformer which supplies the display.

To me, the circuit design could be dangerous, as a blown fuse doesn't cut the active conductor before it reaches the transformer. Perhaps you or your readers can make some comments about the safest way of wiring mains transformers. (Peter Van der Wedden, Bull Creek, WA)

I've reproduced the relevant part of the circuit diagram Peter sent with his letter, shown in Fig.1. I agree with you Peter, this circuit could present a danger. For instance, if the transformer develops an earth fault sufficient to blow the fuse and thereby cut the neutral conductor, the active is still present, and current can flow through the earth conductor. Given there's now a fault condition, this current could be high enough to cause a fire, but not high enough to blow the fuse in the switchboard.

Unfortunately, although it's accepted practice to connect the active to the left hand socket (from the front) of a power outlet, as far as I know, this is not a legal requirement. And even if it is, there's still a possibility of the neutral and active conductors being reversed, through incorrect wiring of the outlet, or from an extension lead being used with the unit.

Perhaps the only way to be sure is to fit fuses in both the active and neutral conductors, and to fit a double pole on-off switch so both conductors are switched. However your method is probably the most practical, and is what I would do.

I connect the active conductor directly to the fuse, at the tip end, not the thread end of the fuse holder as there's usually less exposed metal at the tip. As well, when the fuse blows there's a reduced likelihood of getting a shock while it's being replaced. The other side of the fuse goes the mains switch.

Some might argue this means the fuse can't be isolated by the switch, but I argue that the fuse is now protecting against the possibility of the switch developing an earth fault. As well, I connect the fuse so it also protects the suppression capacitors, unlike Fig.1 where these capacitors have no protection. Perhaps readers might like to comment.

Video copy protection

Here's a letter that gives brief details about the copy protection system used on some rental videos. It also gives references for further information.

In response to a letter in the April '96 issue, the copy protection in rental videos was created by Macrovision and relies on presenting false synchronisation signals of various levels in the first 18 or so lines. While this upsets AGC circuits, most TV sets (but not all) aren't affected.

But VCRs also have an AGC circuit. Here the false signals make the AGC circuit respond as though the picture brightness is too high, causing it to reduce the gain a little, giving a dark picture. In the absence of the false signals, the AGC brings the picture back to normal levels. This is an ongoing cycle, hence the bright-dark oscillations.

The history and theory of Macrovision protection is publicly available. Suggested references are "Video Demystified" available at DSE, and an Internet web document at http://www.paranoia.com/~filipg/F_Macrovision.Html.

Not all tapes are protected, but as far as I've seen, all Disney and CIC videos are. As for a means of defeating the protection, it can only be done by clamping the false sync signals to black level (essentially 0V DC). I won't go into how this is done, although I have successfully built such a circuit. Unfortunately this was fairly costly, due to the price of components and PCB manufacture.

Perhaps you can advise me on the cheapest place to get PCBs made, and also where to buy cheaper components. My circuit uses two Analog Devices 50MHz bandwidth opamps, one single and the other dual. The cost of those two ICs was around $55 from Farnell Electronic Components. Cheaper sources would help me make this circuit more feasible to potential buyers. (Tony Antoniou, Enfield, NSW)

Thanks for this information Tony, and for telling us where to look for more. I'll leave it to readers to judge the ethics of building (and selling) a system that gets around this scheme, but as I see it, it's fair game to build (and sell) something that prevents reduced picture quality caused by the protection.

And given that software producers have realised the futility of copy protection schemes, it's likely customer complaints will eventually see copy protection removed from videos.

Regarding PCB manufacture, you'll find most suppliers charge a lot for a prototype, but considerably less for a production run. A number of PCB makers advertise in *EA*, so I suggest you contact them for a quote. See the list of advertisers, usually on the second last page of the magazine. The same applies for suppliers of ICs. One that comes to mind is Geoff Wood Electronics — phone (02) 428 4111.

Surround sound

This next letter asks about our May '95 Economy Surround Sound Decoder, and how to use it with a TV set that has a 'stereo wide' function.

I recently bought a Sony TV (KV-F29SZ2) that includes a subwoofer (with independent volume control) and a Stereo Wide function. I would like to get some sort of surround sound to go with the set, and I thought of your May '95 surround sound project.

I won't need the subwoofer, centre or the left and right outputs, but I would like instead two L-R surround outputs for speakers behind either end of my lounge chair, perhaps with the addition of a 20ms delay unit. Would this work? Will I get a feeling of surround sound? (G. Johnson, Potts Point, NSW)

Mr Johnson also sent proposed modifications to the circuit to achieve the two L-R outputs he wants. I've not reproduced it here, as there's no need to modify the circuit.

The simple decoder of May 95 produces a third (surround or ambient) channel by subtracting the right (R) audio signal from the left (L) signal, giving a signal called L-R. As well, it produces a centre channel by summing the two main signals (L+R). As the article points out, adding a delay to the L-R signal will increase the surround effect.

You don't need to duplicate the existing circuitry to get two L-R signals, Mr Johnson. Instead just connect the existing L-R output to both inputs of a stereo amplifier, which then drives two speakers. You could experiment by connecting a delay unit between the L-R output and one of the inputs to the amplifier, with the other L-R signal connected directly to the amplifier. Alternatively, delay them both.

But will it work, considering there's also a stereo wide function? I suggest you consider using the L+R output as well, to get a centre channel, as the effect of both a surround and stereo wide function could give an interesting but wildly unfocused sound. In fact, I think you might find the stereo wide function disconcerting, with the additional surround speakers. Place the centre speaker as close as possible to the TV set.

So yes, you should get the effect of surround sound, although don't expect movie theatre accuracy. For that you need to spend bigger bucks, on a Dolby Pro Logic unit. I also recommend you place the surround speakers as far as possible behind your listening position.

Identifying windings

In April I described a simple way of identifying transformer windings. Here's another, even easier technique:

Your trick of connecting a lamp in series with a transformer and the mains while you're identifying its windings is a good one. I've always avoided connecting 240V to unknown transformers by using a trick of my own.

I connect 6V AC to the low voltage secondary winding (very easy to identify). Then measure the voltage on any other windings. The primary is often multi-tapped for 220/230/240 ... and this method makes it easy to identify them. Thanks for an interesting column. (John

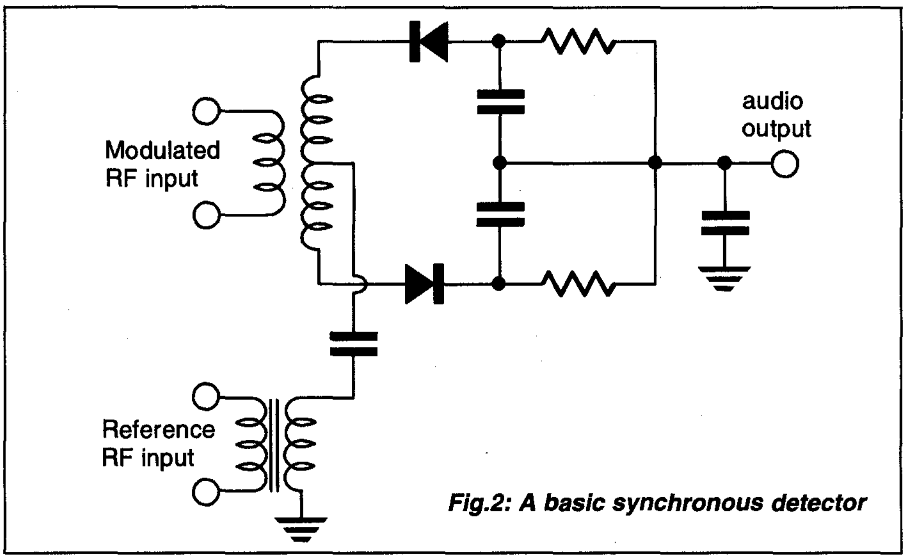


Fig.2: A basic synchronous detector

Freeman, Little River, Vic)

And thank you, John, for this easy way of checking out a transformer. However it's important to remember that the current taken from the 6V AC source could be very high if the transformer being tested is faulty. I suggest connecting a 1A fuse between the source and the transformer, just in case.

Synchronous detector

These days the synchronous detector is best known for its use in colour TV sets. But this is not its only use, as our next letter explains.

I would like to know if EA has published any constructional articles for a synchronous detector (side band selectable) which could be fitted to a communications type receiver. This type of detector formed the basis of a broadcast band receiver (synchrodyne) described in June 1975, but this is the only reference I can find.

Do you know of any Australian company that could supply such a detector? Sherwood Engineering of Denver, Colorado USA makes one as an accessory (model SE3 MkIII) which by all accounts gives excellent results. However it will cost around $1000 by the time it's delivered to Australia; sort of defeats the purpose of upgrading an old receiver. (Peter Cilento, Toowoomba, Qld)

Sorry Peter, we haven't developed such a project. However your letter spurred me into some research, as I was not aware this type of detector had an application in radio. It seems it's also used in double sideband suppressed carrier (DSSC) receivers.

The basic circuit of a synchronous detector is shown in Fig.2. It's simplicity makes you wonder why it would cost $1000! According to my sources, this detector is used in a DSSC receiver as the envelope of a DSSC amplitude modulated signal doesn't duplicate the modulating frequency. Because of the absence of the carrier, the two sidebands combine and the envelope has a frequency twice that of the modulating frequency. This means a conventional detector can't be used.

The Reference RF input to the circuit is the regenerated carrier, from elsewhere in the receiver. This signal must be exactly in phase with the original suppressed carrier, and have exactly the same frequency.

Note that a single sideband (SSB) receiver uses a different type of detector, usually a product detector, which operates on a different principle to the synchronous detector, despite having two inputs and one (audio) output.

What??

If I could give a prize for a What!! question, this one would be a strong contender. It comes from Mr P. Steel, who asks:

What is the length of line AB in Fig.3?

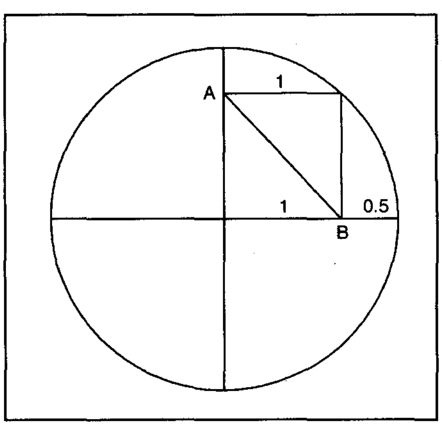


Fig.3: Find the length of line A-B.

Answer to June's What?

This problem is best handled by converting all time intervals to seconds, commencing at four seconds before 9.00am. Therefore, timer A sounds at zero seconds and timer B at four seconds. As well, one of the timers sounds at 3608 seconds and the other at 3612 seconds. This gives two possibilities for the duration between the neighbour's observations: 3608 seconds for timer A and timer B, or 3612 seconds for timer A and 3604 seconds for timer B. In both cases we need to find the factors of the time durations, with one of the factors (the timer interval) lying between 60 and 90. The calculations are further reduced by knowing that the factors of 3608 must also end in a 1, 2, 4 or 8; the factors of 3612 must end in a 1, 2, 3, 4 or 6; and the factors of 3604 must end in a 1, 2, 4 or 8.

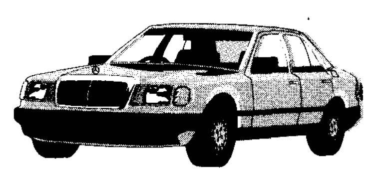
Possible factors of 3608 are therefore 82 or 88; for 3612 possible factors are 84 or 86; and for 3604, 68 is the only possible factor.

Next look for coincidence of the two timers between 10.10am and 10.20am, that is between 4204 and 4804 seconds. If we assume timer A is set for a time interval of 82 seconds, and we divide this into 4204, take the next highest integer and multiply it by 82, we find the instant when timer A went off (4264 seconds).

Successively adding 82 to this value until 4804 is passed gives the times when timer A sounded between 10:10am and 10:20am. Doing the same calculations for timer B (set to 88 seconds), but remembering to subtract four seconds from 4204 (timer B started four seconds after timer A), gives a similar list of times.

Coincidence of the timers is therefore at 4756 seconds, or 10.19.12am. So, timer A was set to 82 seconds and timer B to 88 seconds. This is the only setting based on the other possible factors that gives coincidence between 10:10 and 10:20 am. ❖

AUTOMOTIVE ELECTRONICS



with JON LOUGHRON Assoc. Dip.Electronics

Ford's EA/EB Central Control Unit

As a change from engine control units, ignition and transmission control, we're looking this month at the so-called Central Controller fitted to EA and EB Fords. This is 'yet another' onboard microcontroller, used to look after such things as the windscreen wipers, motorised radio aerial, rear window demister and interior lights.

Over the previous months I have covered the engine management, fuel injection and electronic ignition systems found on the VL and VK Commodores and the XF Falcon. From the previous articles presented it can be seen that the development of engine management systems was essentially a combination of the EFI and EST systems. There are of course other functions, such as idle and emission control, and it was the fact that the EFI and EST controllers needed similar input information that made combining the units to make an engine management system such a natural progression.

Another device the main ECM now controls on late model vehicles, like the EF Falcon and VS Commodore, is the automatic transmission. These vehicles now have no external controller for the transmission. So now the main controller gets more information of the overall engine/transmission system, can provide more fault codes, has more external connections and a new name: the Powertrain Control Module (PCM).

Previously vehicle builders have been distributing the relays, timing devices and controllers all around the vehicle, but now they have combined a lot of devices into a single controller.

As mentioned above, the PCM controls related engine and transmission functions and considering that the above functions are closely related, it is probably a very good idea. But personally I would not like to see many *more* functions incorporated into one main controller. From what I read I have no need to worry, because 'distributed intelligence' may be applied in the near future with the implementation of a automotive on-board local area network system called CAN. (Warm up those protocol analysers...)

The main idea behind all this technology is to provide better emission control, driveability, safety and creature comforts — and also to reduce the amount of wiring in the vehicle and therefore reduce installation time and production costs.

But enough of the future. Back here in the nineties we have enough technology to keep us busy and this brings me to the topic this month.

Modern vehicles have a number of controllers apart from the engine management unit, and on late model Fords (EA onwards) the vehicle may be populated with some or all of the following electronic devices, depending upon the year, type and model (i.e., Falcon, Fairmont, Ute etc.). For example it may may have a Central Controller, Cruise control, Climate control, Transmission controller, Suspension ride height controller, Airbag controller, ABS unit and Smartlock unit — and most of these devices contain some sort of microprocessor!

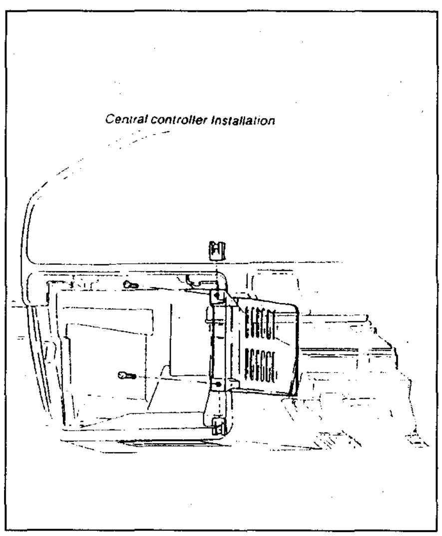
The Central Controller

The control unit of interest *this* month is the central controller in the high series vehicles. That is, the Fairmont Ghia, Fairlane and LTD. This unit is responsible for controlling the intermittent windscreen wipers, radio aerial height, rear demister and interior lights (fade and on/off).

The CC unit has a grey case and interfaces to the vehicle by two plugs. The 24-pin plug connects the lower current devices such as the interior lights and input switches, while the 6-pin plug connects to plus +12 volts, earth, the aerial drive unit and wiper motors. The connections and basic descriptions are given in the table of Fig.1.

Inside the controller there a is a microcontroller, interface circuitry and relays. The three relays control the wipers and aerial (up and down).

When the radio power switch is



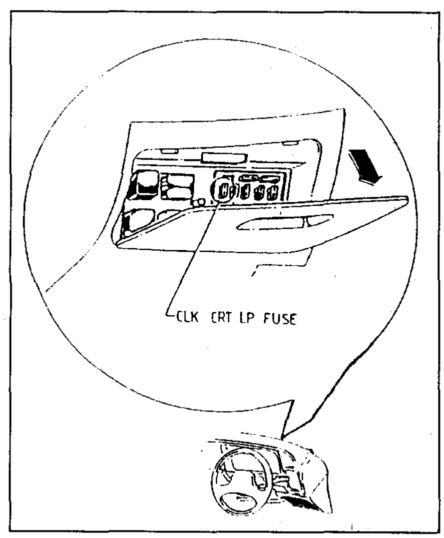
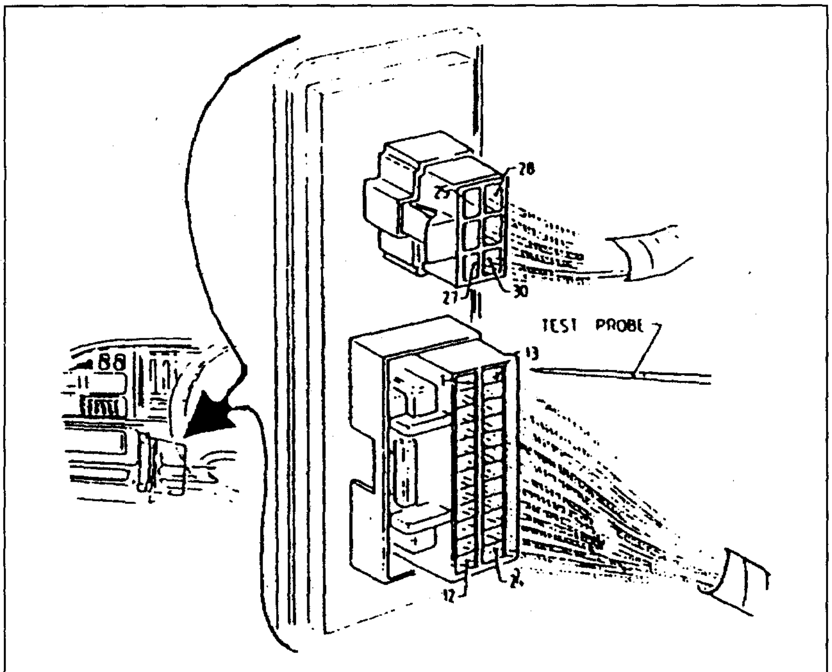


Fig.2: The diagram at left shows where the CCU mounts, behind the dash facia. That at right shows where the CLK CRT LP fuse is located. (Courtesy VACC)



Connector Terminal Identification

Pin No.	In/Output	Description
1	Input	Accessories Switch
2	Output	Graphics Illumination (Dash)
3	Output	Courtesy Lamps
4	Output	LCD Backlighting (Dash)
5	Input	Park Lamp Switch
6	Output	Rear Demister (Relay)
7	Input	Graphics Illumination (Dim)
8	Input	Rear Demister Switch
9	Input	Radio Switch
12	Input	Front Wash Switch
18	Input	Ignition Switch +12 volts
19	Input	Graphic Illumination (Bright)
21	Input	Door Handle Switch
23	Input	Aerial Height Select
24	Input	Front Wiper Int. Switch
25	Output	Aerial Up/Down
26	Supply	Main Earth
27	Output	Wiper Motor
28	Supply	Main Power +12 volts
29	Output	Aerial Up/Down
30	Input	Wiper Arm Park Switch

Fig.3 (above) : The unit may have to be repositioned so that access can be gained to the rear of the connector, for testing. (Courtesy VACC)

Fig.1 (right) : A table of the system connections. Note that not all of the connector pins are used.

engaged (ignition on) and depending upon position of the aerial height switch on the dash, +12 volts will appear at pin 29 (0 volts at pin 25) and the aerial will extend. When the radio or the ignition key is switched off, the voltages will reverse on pins 29 and 25 and the aerial will retract.

The unit samples the status of the ignition key on pin number 18 and main power is always connected to pin number 28, so even when the ignition key is off the controller is still active. Also the ignition switch accessory position is connected to pin 1.

The intermittent wiper timing is a function also controlled by this unit (via an internal relay), when the intermittent mode is selected (pin 24, +12V). Pin 27 supplies power to the wiper motor and as the arms sweep, the wiper park switch indicates on pin 30 the home position.

One problem associated with a faulty or 'irrational' controller is that the windscreen wipers will not park. Such a unit may have to be reset, and to acheive this, power must be interrupted on pin 28. This can be done by removing the positive battery terminal, unplugging the unit (not at all easy! see Fig.2 for its location) or — probably the easiest — removing the CLK CRT LP fuse momentarily.

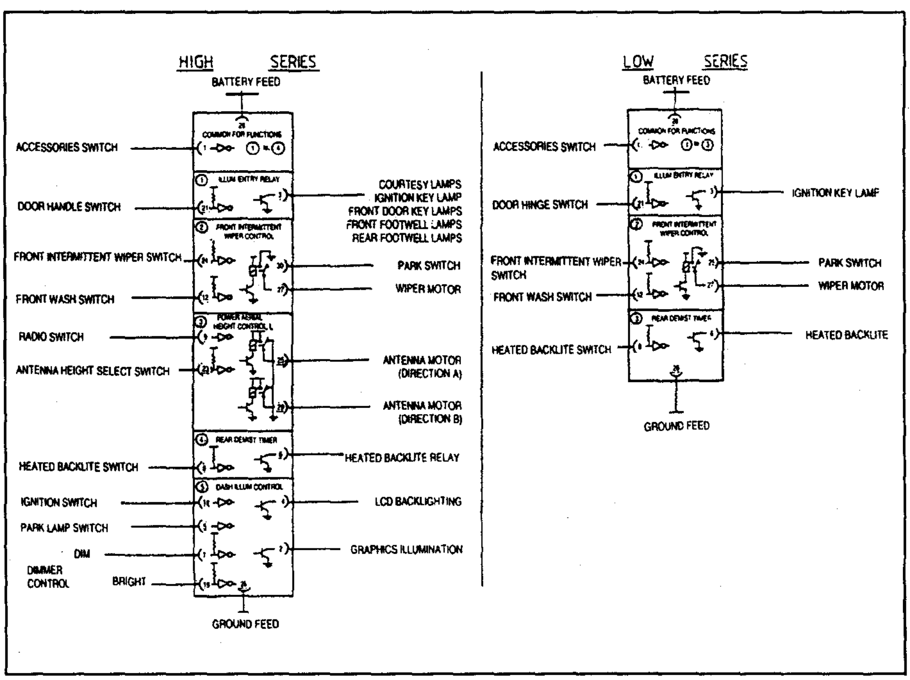


Fig.4: Diagrams identifying the connector pin functions, for both the 'low series' and 'high series' control units.

Radio reset risk

When removing the fuse or disconnecting the battery, ensure that you have the radio security code handy because if the power is disconnected too long, the radio may also reset. If this happens the radio will request the security code when turned on again; without the code, you'll find yourself enjoying many happy hours of quiet driving...The owners manual has the relevant procedure to enable correct radio operation.

If the central controller still misbehaves and the peripheral devices test

THE SERVICEMAN

(Continued from page 49)

fed into the touch knob so negating the drop of amplitude that was supposed to occur when the knob was touched.

He said that they had had some problems in the past with machines of this configuration used in close proximity to radio transmitters. It seemed that peaks of amplitude modulation RF during voice transmission had caused a few numbers to be cycled through for just one touch of the knob. Maybe you or some reader has come across a similar situation to our problem.

Well Colin, I can quite imagine your puzzlement at that turn of events. It would be quite an effort to explain the fault unless you were fully acquainted with the circuitry involved. You were obviously grasping at straws, yet you were able to get things going without really knowing what you were looking for.

My only encounter with bingo machines was reported in these pages back in May 90 (page 60) and on that occasion I was looking for a faulty transistor — easy to diagnose, but most difficult to locate. I don't know how I would have managed a fault like the one you faced. Still, now that the trouble has been revealed, we'll all be better able to face it, if we ever come across that problem.

Thanks, Colin. And please send us your full name so that we can put it on the cheque we'll give you for this story.

Well, that's the end of our first ever scanned-in Serviceman. In fact, there have been more problems than I anticipated. I have had to check the spelling far more carefully than ever before, and not even my spelling checker has been immune to some of the odd errors that have cropped up.

Some are easy to find, like 'mistake' read in as 'mistal<c' (k's and e's seem to confuse the programme out of its tiny mind). Far more difficult to find are ones where 0 (zero) is copied as O (Capital O). And as far as the OCR programme is concerned, 'l', '1' and 'I' seem to be interchangeable!

So technology *does* get the bulk of the work done quickly; but if you find some weird spelling mistakes in this column, just blame it on the OCR. As for me, I'll try harder next time.

(Continued on page 103)

AUTO ELECTRONICS

OK, then the unit may need replacing.

Testing the circuits with a multimeter is relatively easy. The rear demister is controlled by an external relay that is enabled by pin number 6. When a request is made (i.e., when the backlight switch on the dash is depressed) pin number 8 receives 0 volts and the demister is operated for approximately 12 minutes. Re-pressing the switch instigates another 12-minute cycle.

All of the other circuits are associated with the lighting control — that is the interior lights, dash lights, LCD brightness and door key courtesy lamps. The dash backlight level is controlled by switching the interior light switch up and down (pin 7 at 0V = dim and pin 19 at 0V = bright). Pin 2 outputs an analog voltage to increase and decrease intensity.

If either of the front door handles are lifted or the remote locking device is used the key courtesy and interior lamps will illuminate. Pin 21 is normally high and is switched to earth when the door handle is used, while pin 3 provides an analog output to activate on/off and fade control.

Access, removal

Testing or replacing the CC unit is quite time consuming, because the dash facia and radio surround must be removed. But if problems exist, these tasks cannot be avoided. Once access is gained the unit may have to be disconnected, turned around and reconnected so that the plug can be back-probed.

Operate the switches and ensure the corresponding inputs and outputs change. The connections can be seen in Fig.3.

When you have finished testing the unit, restore it to its original position. Then test all of the functions and if all seems well, then finally refit the dash components.

Well, that's it for another issue. Hopefully you're not likely to encounter too many problems with the EA central controller, because it is obvious that the controller is not as complex as some engine management computers. On the other hand, getting access for testing is *more* of a problem — so it's just as well that it doesn't give much trouble!

Until next time, 'bye. ❖

PC-CHECK V.2.53

(Continued from page 87)

those you actually had it perform.

What we found

Distributor Tech Star International sent us a sample Beta release version of Pc-Check 2.53, for us to try out. It came with a warning, though, that as a Beta version it could have some bugs — which wouldn't be in the version available to users. In fact they advised that there *was* one known bug, wherein it would 'hang' after performing the keyboard test during continuous burn-in. So we had fair warning...

As it happens, we were able to try it out on a number of machines, including a somewhat tired AT clone, an even more elderly XT, a reasonably up to date 486 and a 90MHz Pentium with a full array of 'bells and whistles'. And overall, we found it not only easy to use but also quite reliable and unambiguous in its presentation of test results.

The only evidence we could find of a bug, other than one we were warned about, was that it would consistently crash when we tried to test the *second* IDE hard disk drive fitted to the Pentium machine. During the 'Analyse HD drive' step, it would drop back to DOS with a 'Run time error R6003 - integer divide by 0' message.

Otherwise, we were very impressed with Pc-Check. It seems a very practical and 'friendly' hardware testing package, and one that should be of considerable value to anyone testing PCs. We especially liked the memory testing options, the CD-ROM drive tests, the SCSI utilities, thorough hard disk drive tests and the ability to generate the monitor test pattern in so many different video display modes — including the VESA S-VGA modes.

Mind you, like just about all such packages it does seem to have a few 'blind spots'. For example there don't seem to be any tests for PCI bus functions or cards — surprising in view of the extended video display mode tests, and the SCSI and CD-ROM tests. But I guess all this means is that you're still likely to need some other diagnostic packages, to round out your testing armory.

The quoted RRP for Pc-Check is $395.00, by the way. Further information is available from Tech Star International at PO Box 259, Paddington Qld 4064; phone (07) 3367 1444 or fax (07) 3367 1331. You can also contact them by email at **Techstar.group@Mailbox.uq.oz.au.** ❖

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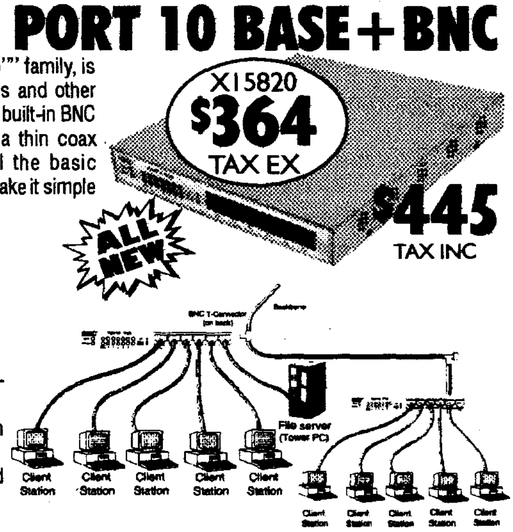

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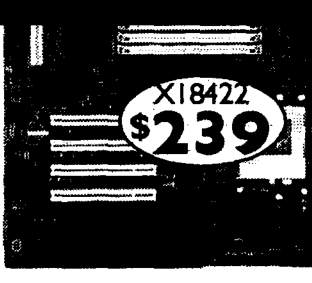

X18422 **$239**

Key Features: CPU Supports Intel Pentium 75, 90,100,120,133,150, 166 MHz CPUs • Supports P55C and P54CTB in specification • Supports Cyrix 6x86 100, 120 MHz CPU • 2.5V circuit on board, ready for future P55C support **Chipset** Intel's Triton/82430 FX chipset **Main Memory** Supports 4x72pins SIMMs module • 64-bit data path for flexible memory size expanded from 8MB up to 128M DRAMs on board • Supports EDO and Hyper Page mode DRAM (High speed) and also supports Standard Page mode DRAM **Cache Memory** Supports Write-Back Cache policy for 256KB L2 Pipelined Burst Cache **On-board IDE** Supports PIO and Bus Master IDE • Supports up to Mode 4 Timings • Supports transfer rates up to 22 MBytes/s • Supports 2 Fast IDE interfaces for up to 4 IDE devices including IDE hard disks and CD ROMs **Green Functions** Supports 2 Green modes: Standby and Suspend **On-board I/O** 3 x ISA Slots and 4 x PCI Slots • Use NS Plug & Play IC) chip PC87306 • Supports up to two 3.5" or 5.25" floppy drives • 360K/720K/12M/1.44M/2.88M format • All IO ports can be enabled or disabled • Two high speed 16550 compatible UARTs (COM1/COM2/COM3/COM4 selectable) with 16-byte send/receive FIFOs and support MIDI mode • One parallel port at I/O address 378H/278H/3BCH with additional bi-direction I/O capability and multi-mode selection (SPP/EPP/ECP) (IEEE1284 compliant) • Provides protection circuit to prevent damage to the parallel port when a connected printer is powered up or operated at a higher voltage • Real-time clock and keyboard controller built-in I/O Chip • Supports PS/2 mouse • Supports IrDA Infrared **BIOS** Licensed advanced AWARD BIOS. Supports Flash ROM BIOS, Plug and Play ready. Built-in NCR810 and Adaptec 7850 SCSI drivers **Board Size** 220mm x 250mm

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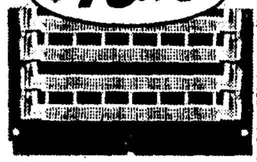

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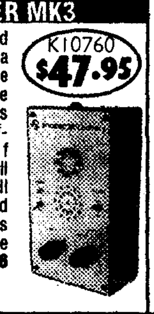

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Vintage Radio

by PETER LANKSHEAR

Valve filament/heater voltages

Have you ever wondered, when searching for a replacement valve for an old treasure, why there were so many different filament voltages, and how they came to be selected in the first instance? And did you know that at one time 'air batteries' were used for filament heating?

The very first purpose built radio valves were some diodes made by lamp manufacturers Edison & Swan in 1904 to the order of Professor J.A. Fleming, the Marconi Company's technical adviser, and his order specified four volt carbon filaments. Just why he chose 4V is not known for sure, but from catalogues of the period, it is apparent that this was a popular voltage for low wattage lighting and bicycle lamps. By a coincidence it was eventually to become a major standard for valves.

The first triode valve in quantity production, the Western Electric 101A, was not intended for radio applications but was used early in 1915 for repeater service on the original transcontinental telephone line, connecting New York with San Francisco. Again, the filament was rated at 4 volts.

Incidently, the 101 series, which went through at least 10 developments was in production until 1985, 70 years later! Obviously, suitability for the job and proven performance rather than fashion, governed W.E. valve selection!

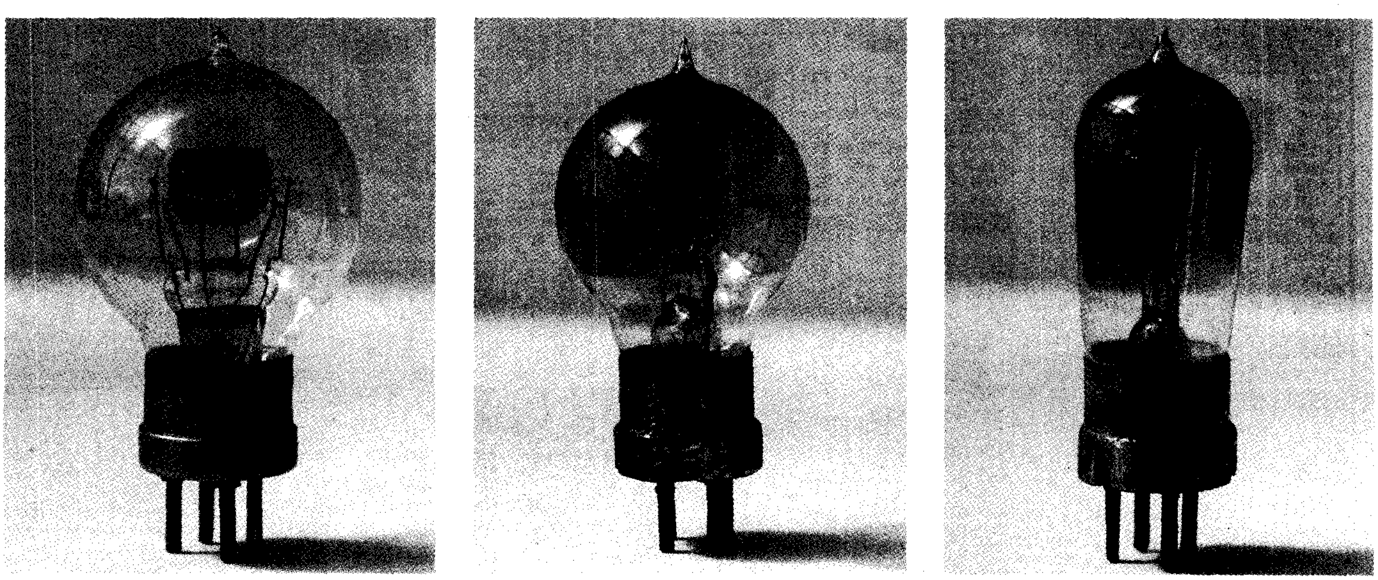
Probably the earliest standardised radio receiving triode made in any quantity was the famous type R, adapted from a World War I French design. Not only was the R valve made in large quantities by several manufacturers, but from it further types were developed to become the first generation of valves used in domestic receivers.

The pure tungsten filament of the R valve was a relatively inefficient emitter of electrons, requiring about three watts of heating. This is far too much for dry cells, especially with multi valved receivers. Some primary cells such as the bichromate type might have might have been adequate for lighting one or two valves, but the lead/acid accumulator was by far the most satisfactory source of filament power. A two-cell 4.0 volt battery was a convenient and available size and at this voltage, the current for drawn by one R valve filament was about 0.75 amperes.

Landmark valve

A landmark in American valve development came in late 1920, with the production by General Electric (for the newly formed RCA) of the UV201 and its companion gaseous detector, the UV200. A fuller account of this valve, and its successor the UV201A, which held a preeminent position for most of the 1920s, was given in this column away back in April 1991. Like the R valve, the UV201 had a pure tungsten filament, and, with performance a *major* consideration, this was given a generous rating of no less than five watts! There was no possibility of these valves being lit from dry cells.

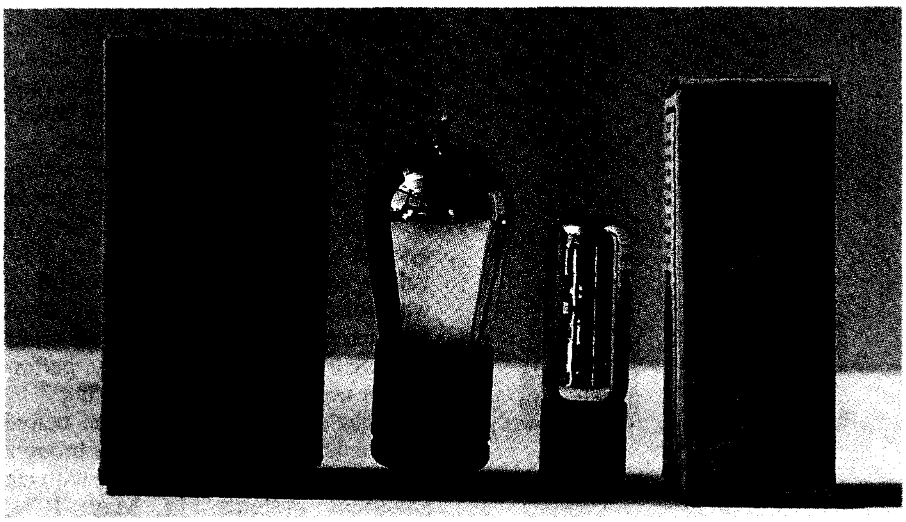
In America, with its healthy economy and the activities of manufacturers like Henry Ford, the motor car indus-



These first three photos are of direct developments from the French R valve. At left is a Philips ZI, practically identical in appearance to the R, but with a higher anode voltage rating. Centre is the Mullard type K, with the electrode assembly vertically mounted, while at right is the Mullard ORA (Oscilates, Rectifies, Amplifies) — a small bulb version of the K, also dating from 1920. Note the absence of silver gettering in the R type valves, which had pure tungsten filaments operating at about four volts.

try, with an electrical system standard of six volts, was thriving. Automotive secondary batteries were therefore readily available and convenient for lighting the new radio valves. As each valve would need a current of the order of 1A, an allowance was made for a significant voltage drop in connecting leads, receiver wiring and for reduced voltage when the battery was nearing the fully discharged condition. Accordingly the filament rating of the UV201 was set at 5V at 1A.

It was usual then to have individual filament control series rheostats for adjustment, and to judge actual operating voltage, little windows were commonly provided in receiver front panels. The idea was to compare filament colour with that of a standard incandescent lamp, as a guide to correct operation!



During the early and mid 1920's, the American scene was dominated by the '01A and '99. In contrast with the pure tungsten filament valves, these thoriated tungsten types needed heavy gettering.

Within a short time of its introduction, the UV201 was superseded by the UV201A which had a considerably more efficient thoriated tungsten filament. Although the current was dramatically reduced to 250mA, the voltage remained unchanged at 5.0V. The number of '01A valves made worldwide is reckoned by some authorities to be the largest of any valve type — ever. Inevitably then, 5.0V became the standard voltage for storage battery triodes introduced during the 1920s. Quite incidentally it was later to become perpetuated in a quite different series of valves.

Low consumption valves suitable for dry battery operation were developed during the 1920s. Most popular in America was the little '99, with a 3.0V, and later, a 3.3V 60mA filament intended for operation from three series connected dry cells with an end voltage of 1.0V for each cell. Very similar valves to the '99, but not so widely used, were the '11 and '12, which had 1.1V/250mA filaments. None of these voltages was used for valves developed after 1927.

A companion to the original '200 and '201 valves was the '202, a small transmitting triode. This had a 7.5V filament, a voltage that shortly later was used for the '210 triode, the '216(A) and '216(B) and '281 rectifiers, and then the massive '250, the first of the big output triodes that are still popular with dedicated high quality sound enthusiasts. The 7.5V filament was not used further, although it survived with small transmitting valves.

Rectifier standard

Early on in the history of broadcast receivers, mains power supplies were used to eliminate anode supply or 'B' batteries. Although electrolytic and copper oxide rectifiers had some success in these supplies, the future clearly lay with valve rectifiers, and in 1925, General Electric developed a small double rectifier, the UX213.

This was a similar sized valve to the '01A, and similarly was given a 5V filament. However, at this time, developments in radio were rapid and within a short time, an uprated replacement superseded the '213, and retained the same filament rating. This was the well known type '80 — which especially as the octal 5Y3 version, was to continue to be available for as long as valves remained in production. The 5V filament was to be used as a standard for a wide range of American rectifiers.

There remained one more major voltage standard to appear in America before 1930. As we related in this column for last November, the process of evolution of the mains powered valve initially created some odd filament voltages, but with the wide acceptance of the new type '27 triode, 2.5V was adopted as the filament supply standard for mains powered radios. It is likely that 2.5V was selected as it was considered desirable in the interests of hum reduction to keep voltages as low as possible, and halving the previous standard of 5V seemed as good a figure as any.

To summarise the American valve situation in 1929, there were the recently introduced AC valves were rated at 2.5V which were a considerable improvement over the existing obsolete battery valve range. This consisted of three or four triodes with 5V/250mA filaments and for dry cell operation, there were, with 3.3V filaments, two triodes and the pioneer screen grid type '222. It was clearly time to produce some modern battery valves.

Meanwhile though, we will return to Britain, where car ownership was much less common than in America. Here small accumulators were specifically made for radio and usually could be readily charged. In contrast with the American scene where the domination by RCA meant that there were relatively few valve types, there were in the early 1920s many British valve manufacturers making a wide range of valves with little standardisation, and filament ratings varied from 1 - 6V.

From around 1925, however, with the general adoption of oxide coated filaments to replace thoriated tungsten, there was a rationalised production. Unified families of valves were produced in 2V, 4V and 6V filament ranges and in making a 2V range, they were ahead of the Americans. Very popular in Australia and New Zealand was the Philips 'Point One' series. The name referred to their filament current, and these valves could be used as economical substitutes for the high current American 5V valves.

Battery eliminators were also popular in Britain, and from 1927 a range of rectifiers became available. Whereas at this stage the Americans concentrated on the '80, English manufacturers had by 1930 produced at least 20 different rectifier types, varying in filament voltage from 4 - 7.5V.

By 1929, the British were concentrating on 2V filaments for battery powered valves. Furthermore, they were not far behind America in producing indirectly heated AC heated cathodes. And whereas previously English filament voltages had been a bit chaotic, apart from a couple of experimental Osram triodes all makers standardised on 4V heaters and AC filaments.

Many receiver manufacturers used 4V valves right up until WWII, and it was only after the fanfare accompanying the American octal valves in 1935, that there was a British and Continental move to what eventually became the international standard of 6.3V.

New valves, battery

By 1930, the American battery valve series was, as we have previously noted, thoroughly out of date. In that June RCA announced a new series of economic valve. These were the 230 general purpose triode, the 231 low-mu output triode and the 232 screen grid tetrode.

America thus now had 2V battery valves, and with a 120mA filament, the '31 required only 270mW compared with the 1.25W of the '71A it replaced. This was a dramatic reduction in filament consumption, and the improvement with the other two valves was even more impressive. They had 60mA filaments, consuming only one eighth of a watt.

The 2V valves did not, in some instances, work out quite as well in America (or in Australia and New Zealand for that matter) as they had in England, as for many US radio users there was a significantly different situation. Many could not use lead-acid batteries, because living remotely from any large town, they were not able to trot off with a filament battery to a handy radio shop or garage for recharging.

One rough and ready solution was to use a car battery, one cell at a time; but this still needed charging, and the idle sections could deteriorate between charges.

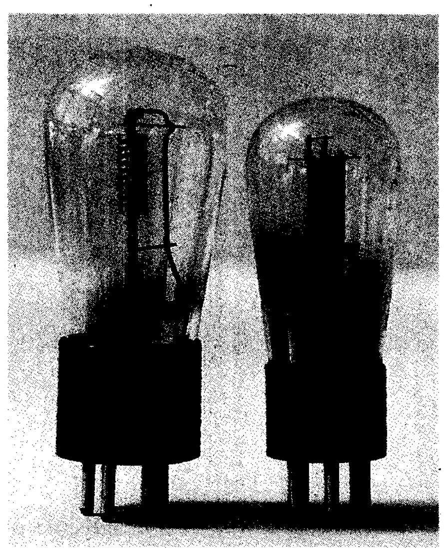
Unfortunately there is no combination of dry batteries that can provide 2V, and anyway these have a poorer voltage constancy than lead-acid batteries. To operate safely from a two-cell dry battery, which steadily drops in voltage throughout its life, a receiver needed an adjustable series resistor in the filament line, and ideally a voltmeter as well.

The air cell battery

Shortly after their introduction, the National Carbon Company announced the unlikely sounding Eveready 'Air Cell Battery' for the new valves. About the size and shape of a car battery, the air battery, like modern alkaline batteries, provided a much more constant voltage than the dry cell.

A useful feature for remote localities was that it was inert until its two 1.25V cells were activated by the addition of about 3.5 litres of water to dissolve the appropriate amount of sodium hydroxide (caustic soda) electrolyte. The negative electrodes of each cell were a pair of heavy zinc plates with a positive electrode made of porous carbon, with its upper end in contact with the air — which provided oxygen as a free depolariser.

When current was drawn from the battery, the zinc electrodes reacted with the electrolyte to form sodium zincate and hydrogen. The hydrogen migrated to the carbon electrode, where it combined with oxygen from the air to form water. Provided that evaporated water was replenished, and the battery was run within its ratings, its capacity was an impressive 600 ampere-hours. According to Eveready, this was equivalent performance to that from three dozen No.6 cells.



Two historically significant indirectly heated triodes were, at the left, the 2.5 volt 227 and with very similar characteristics, the 6.3 volt 237.

The New Zealand price in 1939 for an air battery was 55 shillings ($5.50), while 36 No.6 cells would have cost 90 shillings ($9.00). Melbourne's Vealls Radio and Electrical Catalogue for 1935 lists a range of 'AD' (air depolarised) batteries ranging from 60 to 500 ampere-hour capacities, plus a full set of separate components for rebuilding batteries. These seem to have been an 'in house' type using sal ammoniac (ammonium chloride) rather than caustic soda for the electrolyte.

Australian specials

Regardless of any difficulties in lighting the filaments, the 2V filament range of valves expanded in both Britain and America during the 1930s, and in Australia the Amalgamated Wireless Valve Company developed a series of 2V valves suited to local conditions. These required twice the filament current of the standard series, but had performances approaching that of indirectly heated cathode valves.

From the earliest days of broadcasting, enthusiasts had combined the hobbies of radio and motoring, and some very haywire and impractical lashups resulted. However, in the late 1920s, serious efforts were made to produce practical car radios, and naturally the car's battery was used for lighting the filaments.

Directly heated valves were microphonic and subject to electrical system noise, especially for the RF and detector operation, but the indirectly heated 2.5V valves were much more successful. It was found that although three valves with series connected heaters were under run when lit from a car battery, performance was nevertheless promising.

It was only a matter of time before some enterprising manufacturer brought out valves which could be used with car electrical systems. In May 1931, National Union won the race with a series of valves with 6.3V/400mA heaters. These were the NY64, NY65, NY67 and NY68. The first two corresponded to the standard '24A and '35 screen grid tetrodes, the NY67 was equivalent to the '27 triode, and the NY68 was a new development — an indirectly heated output pentode.

A couple of months later RCA brought out a landmark series of equivalent valves, but with important differences. The 236 was the sharp cutoff tetrode, the 237 the triode, and the 238 was, like the NY68, an output pentode. Completely new was the innovative 239, the first variable-mu RF pentode. The whole series had the new space saving small S12 bulb, but of greatest significance was their 6.3V/300mA heater rating.

A lead-acid battery's voltage varies considerably, depending on its condition, degree of charge and charging rate, but as a compromise, 6.3V was set as the design centre voltage for use with automotive batteries. The pre-war American car electrical system can therefore be said to have been responsible for what eventually became the international standard heater voltage for valves, and accounts for the apparently odd value of 6.3V.

Direct mains operation

With the 300mA rating and indirect heating of the new valves, another type of receiver became a practical proposition. Direct current mains were common worldwide, and although they could be used for HT supplies, heating of existing valves provided considerable difficulties. Filamentary valves introduced too much noise from mains born interference, and the 1.75A required by a string of 2.5V valves was very inefficient, as even with 110V mains, dropping resistors needed to dissipate around 175 watts.

The new 300mA automotive valves reduced this to about 25W, a much more practical value, and these transformerless receivers made mains operation possible in DC mains areas. Fitted with rectifiers, these radios became especially popular in 110V AC as well as DC areas as budget priced sets. Although for higher voltage mains, more heat had to be dissipated, the transformerless receiver nevertheless filled a need.

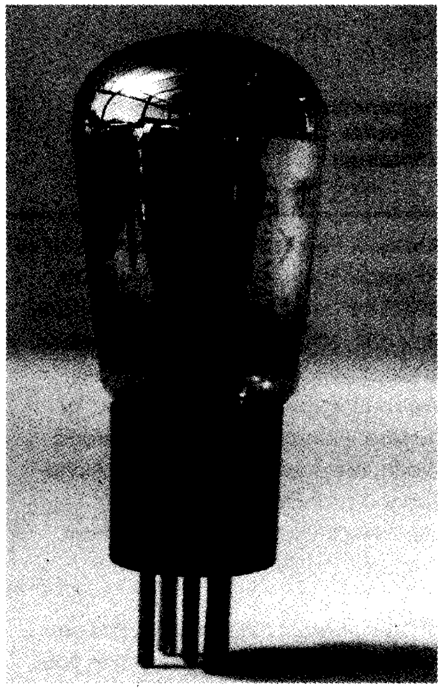
For rectifier and output valves, the approximately 2W of heating provided by the 300mA heater was insufficient for larger output valves and rectifiers. For 6.3V operation the current rating of these valves was increased, but for series-connected filaments, 25V 300mA heaters were developed. Eventually, quite a range of voltages, even up to 117V could be found for output valve and rectifier heaters. After all, the excess heat might just as well be dissipated in a valve as in a resistor.

A further development was to reduce the current to 150mA and double the basic voltage to 12.6V. Eventually, with the advent of television, series operation of heaters became very common.

During the 1930s the British standard voltage for transformer equipped receivers remained at 4V for all types of valves, but series-connected valves intended for transformerless sets were also developed. Typical was the Philips C series of 200mA heaters, popular in Australia.

Following the initial success of the 6.3V valves, the range was soon extended to include valves such as the 78 RF pentode and the 42 output pentode that were to become established favourites.

In fact, for a while, the 2.5V valves, which were the still the standard AC mains series, were left behind, but this situation was soon redressed and equivalents were produced in both series, and many were identical apart from the heater voltage. Thus the 6.3V type 42 had a 2.5V counterpart in the 2A5, and the 75 diode high-mu triode the 2A6. Some later pairs, including the 2B7/6B7 and the 2A7/6A7 were introduced simultaneously.



Germany's Telefunken were making indirectly heated valves very soon after America, but with 4V heaters. This REN1004 dates from 1928.

Duplications

Although the 2.5V series was established as the AC mains standard, there was a minor problem, especially with the earlier 1.75A types. Heater current for a large receiver could be in the region of 10A. Not only did this require extra heavy heater wiring, but suitable transformer windings used large wire gauges which can be difficult to handle in winding.

Nevertheless, until the mid-1930s most manufacturers, here as well as in America, used the 2.5V series for AC mains transformer equipped receivers. A few however, notably among them Philco, as soon as the 6.3V series became available, successfully switched to them for all mains and car receivers. With the performance of 6.3V valves proven, there was little point in duplication, and the last new 2.5V designs appeared in 1933.

The advent of the octal valves in 1935 finally provided a universal standard, and by the outbreak of World War II in 1939, the 6.3V heater was firmly established world wide, and remained thereafter as the international standard voltage.

And finally...

There remained one more voltage to become a standard. Although 'non spillable' accumulators did receive some acceptance, liquid filled lead acid and air batteries were not very practical for portable receivers, and during the late 1930s it was increasingly apparent that there was a considerable need for filaments that could operate from a single dry cell. This was not easy as the voltage of a dry cell varies during its working life from more than 1.5V to about 1.0V.

The problems were solved with improved filaments designed for a median of 1.4V. At first, the new valves had octal bases and then in 1940, RCA released the revolutionary new seve-pin button based series of miniature 1.4V valves. These were used in great numbers until they were eventually supplanted by semiconductors.

This has been a very brief outline of a significant aspect of valve history. It has only dealt with the major developments, and there were many other voltages and might-have-beens. For readers interested in the subject in greater depth, the following books are reference standards and are all good reading:

70 Years of Radio Tubes and Valves, by John W. Stokes.

History of the British Radio Valve to 1940, by Keith R. Thrower.

Saga of the Vacuum Tube, by Gerald F.J. Tyne. ◆

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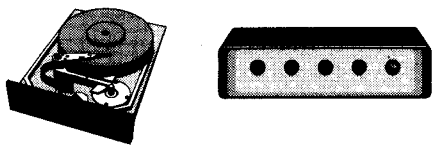


THE SERVICEMAN

(Continued from page 94)

Last month I mentioned that I was working on an Index of all Servicemen stories from August 87 to March this year. The work is now finished and will be presented in place of our usual stories next month. There'll be pages and pages of useful references, so watch out for it.

Footnote:

In Colin Leonelli's story about the AWA 'ML' chassis, he refers to R557 as 12 megohms on his circuit diagram and 12 ohms in the chassis. I couldn't find the exact diagram, but the closest version in my files (see diagram) shows the resistor as a '12K'. The sheet carrying the diagram also has an extensive array of other information, including IC and transistor pinouts, tables of critical voltages — and interestingly, a table giving resistor and capacitor types, values and tolerances. And it's this last item that both creates and explains the confusion.Resistor tolerances are given as 'no mark = 5%, K = 10% and M = 20%'. So, as far as the ML chassis circuit diagram is concerned, 12K is not the same as 12k. 12K is a 12 ohm 10% resistor and 12M is a 12 ohm 20% resistor! No wonder Mr Leonelli was confused.

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. Here we feature some items from past issues.

July 1946

Outback Radio-Phones: Radio telephone services may soon be established in outback parts of Australia, where the cost of erecting ordinary telephone lines would be prohibitive. The Postmaster-General (Senator Cameron) said it was proposed to establish the first country radio-telephone service at Broken Hill as soon as possible, to link up remote areas.

"The aim of the department is to provide the people living in sparsely populated areas of Australia with telephone facilities", Senator Cameron said.

Television Again: Recent press announcements tell of the re-opening of the BBC Television Service, which was used for the first time since the war on Victory Day. Results were apparently up to expectations, and readers who have equipment to cover the band may hear some unaccountable signals. The range of the stations concerned is supposed to be limited to 40 miles, but GSK has frequently been heard here. The frequencies in use are GSQ 25,750kc, GSK 26,100kc, GSR 26,400kc and GSS 26,550kc. Reports on any of these stations will be appreciated by us, and no doubt the BBC will be interested also.

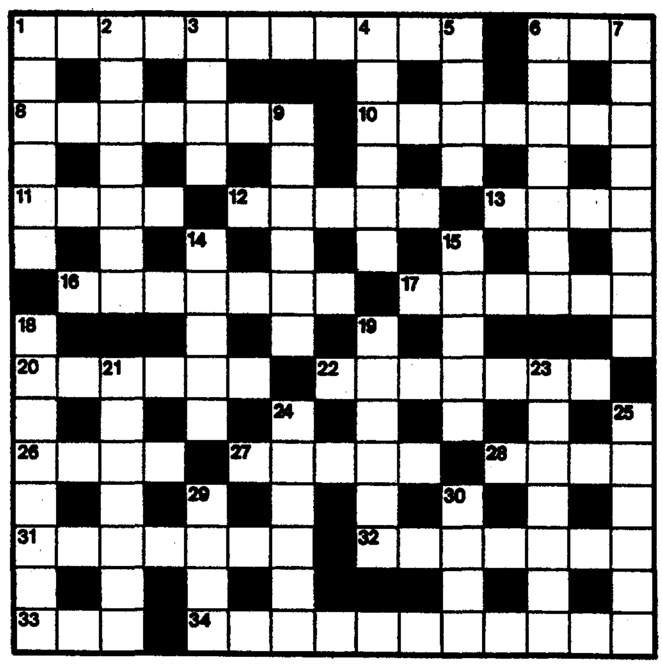
July 1971

Computers in Solar Study: The CSIRO Division of Radiophysics has installed two computers, supplied by Digital Equipment Australia, at Culgoora and Epping. The computer at Culgoora is a PDP-15/10 assigned to collecting data from a heliograph. This consists of 96 steerable aerials, each 13m in diameter, arranged in a 3km circle. Two observations of the sun are made every second during the five hours each day when pictures can be received. The computer compresses the information, retaining only vital data. The information, stored on magnetic tape, is transported to Epping, where further processing is performed on a larger PDP-15/20.

Antarctic Observatory: An unmanned geophysical observatory being assembled near Casey station in the Antarctic will automatically record geophysical data, taking 40 measurements per hour. Instruments will also record geomagnetic variations caused by buffeting of the Earth's magnetosphere by solar particles, and a 16mm camera will photograph auroral displays at five minute intervals. The observatory is housed in a shelter below the snow's surface, leaving only the sensors and structures needed for data collection above the surface.

Details of the unmanned observatory were given to delegates *at the recent* 13th National Radio and Electronics Engineering Convention by two engineers from the Antarctic division of the Department of Supply, Messrs I.G. Bird and A.E. Humphreys. The convention was held at Melbourne University. ◆

EA CROSSWORD



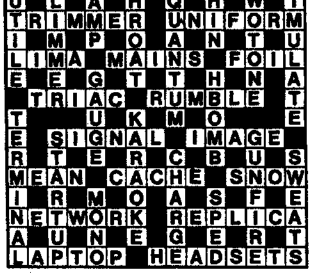
ACROSS

1 No pretensions, or grounding instructions? (4-2-5)
6 Base for mouse. (3)
8 Ten to ninth power. (7)
10 Basic rule of current. (4,3)
11 Respected authority. (4)
12 It could be self-tapping.(5)
13 Name of effect associated with Suhl effect. (4)
16 Sent forth. (7)
17 State of matter. (6)
20 University city in UK. (6)
22 Not active. (7)
26 Average. (4)
27 Region of influence. (5)
28 Rate of flow. (4)
31 Plural of index. (7)
32 An accumulator is a .... battery. (7)
33 Entry control. (3)
34 Deposit. (4,7)

DOWN

1 Eliminates circuit problems. (6)
2 Tungsten. (7)
3 Activate a switch. (4)
4 Again give access. (2-4)
5 Amateur enthusiasts. (4)
6 Astronomical radio sources. (7)
7 Obtain information with computer. (8)
9 Metal used in batteries.(6)
14 Reference points for navigation. (5)
15 Medium for signal transmission. (5)
18 Data pathway from satellite. (8)
19 Groups of conductors. (6)
21 Unit of electricity. (7)
23 Physical quantity named after Italian physicist (1745-1827). (7)
24 Cutting tool. (6)
25 Describes 11 across. (6)
29 Missile used in Gulf War. (4)
30 Major brand in electronics industry. (4)

SOLUTION TO JUNE 1996:



Electronics Australia's

Professional Electronics

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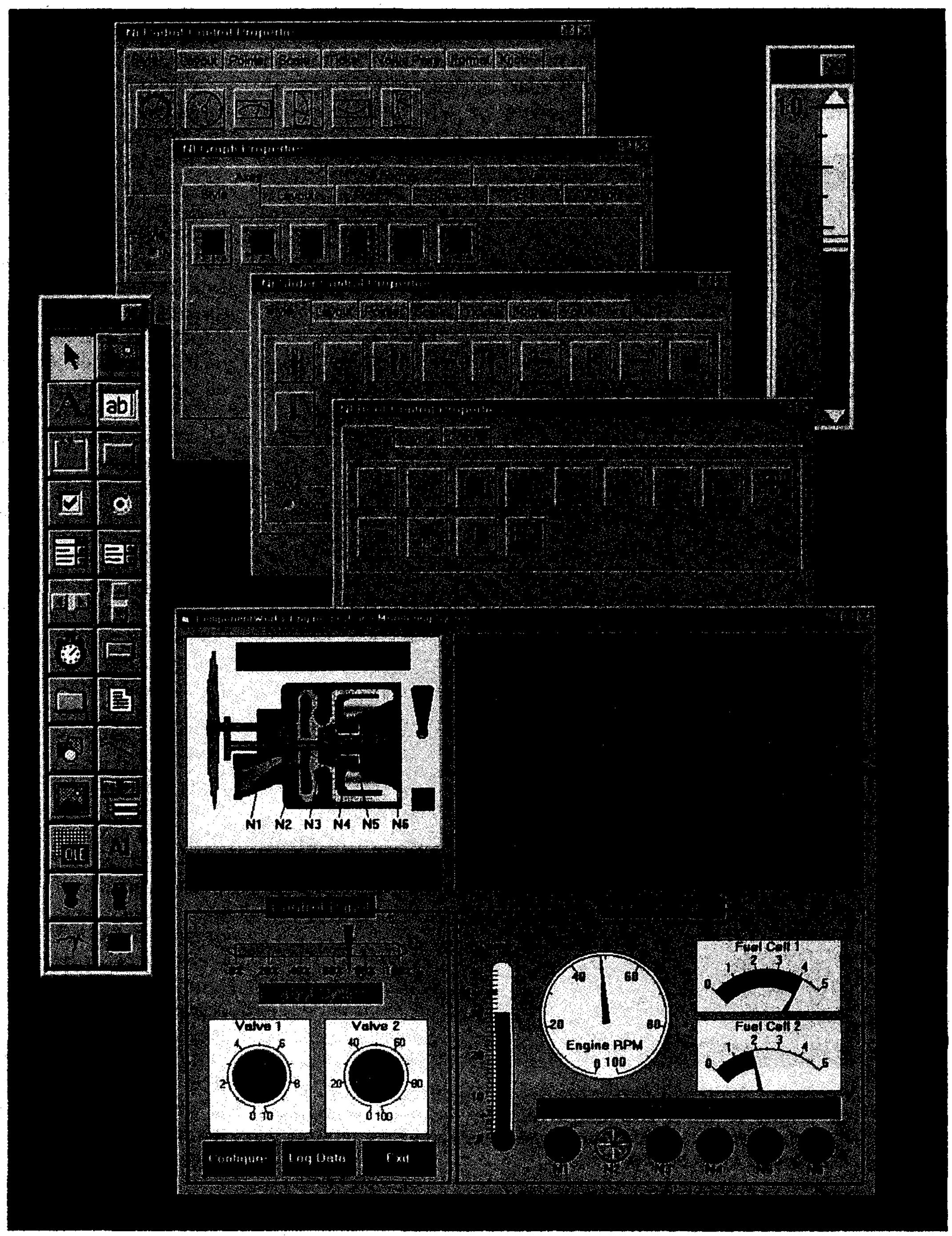
UNSW PHYSICIST PIONEERS IN IMPORTANT NEW TECHNOLOGY: COMBINING 'NO FATIGUE' FERROELECTRIC CAPACITORS & SUPERCONDUCTING SUBSTRATE

REVIEW OF NEW VERSION OF ELECTRONICS WORKBENCH: EASY TO USE DIGITAL/ANALOG CIRCUIT SIMULATOR

A LOOK AT THE LATEST DATA ACQUISITION PRODUCTS

COMPONENTWORKS FROM NATIONAL INSTRUMENTS: ADD-ON CONTROLS & LIBRARIES TO MAKE VISUAL BASIC AN EASY TO USE ENVIRONMENT FOR DEVELOPING VIRTUAL TEST INSTRUMENTS & DAQ SYSTEMS...

(See page 120)

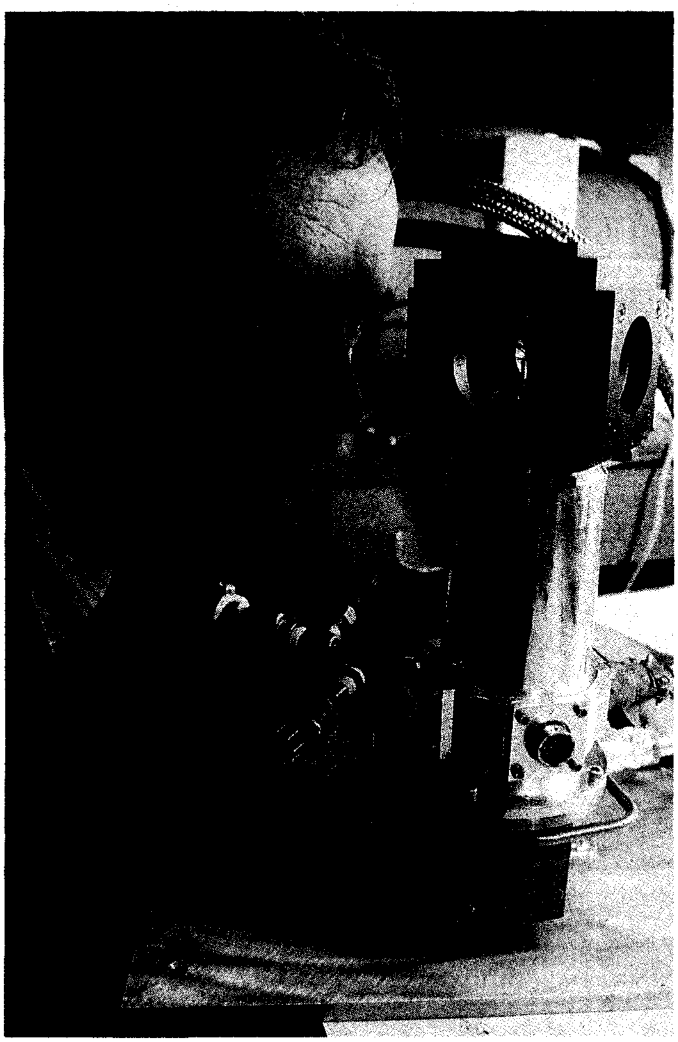


NEWS HIGHLIGHTS

UNSW PHYSICIST PIONEERS IN FERROELECTRIC DEVICES

A remarkably broad world-wide patent has been issued to a team of scientists including University of NSW physicist Professor James F. Scott, for a family of devices combining ferroelectric and superconducting materials. Some of the devices covered by the patent are already being manufactured in Japan, and are expected to have uses in a wide range of new applications in telecommunications.

Professor Scott, who has been Dean of UNSW's Faculty of Science since June 1995, was formerly Dean of Applied Science at the Royal Melbourne Institute of Technology and before that worked for 10 years at Colorado University. He is also one of the founders of US firm Symetrix Corporation, a leading player in the development of ferroelectric device technology. He is currently setting up his own research facility in the School of Physics, in conjunction with co-researchers Dr Kazi Resa and research student Jason Chaffey.



Professor Scott pictured in his new research laboratory at the University of NSW. The patent recently awarded to his team for ferroelectric devices on superconducting substrates is very broad in its scope.

A combination of $250,000 worth of equipment, which has been brought to UNSW from RMIT, along with a $150,000 Australian Research Council grant, will help establish UNSW at the forefront of world research into ferroelectric devices.

"It is important to have world class research to gain and maintain respect at a university's Faculty of Science", Professor Scott said.

A key concept embodied in the patent awarded to the Symetrix team, of which Professor Scott is a member, is for the fabrication of devices combining ferroelectric thin films on a superconducting substrate. The team has pioneered in the use of on-chip ferroelectric capacitors using thin-film dielectric materials, and has achieved very impressive results. Their capacitors show no significant 'fatigue' after 1012 switching cycles, good retention characteristics and low leakage. (Fatigue has been one of the crucial problems associated with ferroelectric devices, and describes a tendency for the amount of charge switched each time to decrease, when the dielectric is subjected to repetitive charging/discharging or charge reversal.)

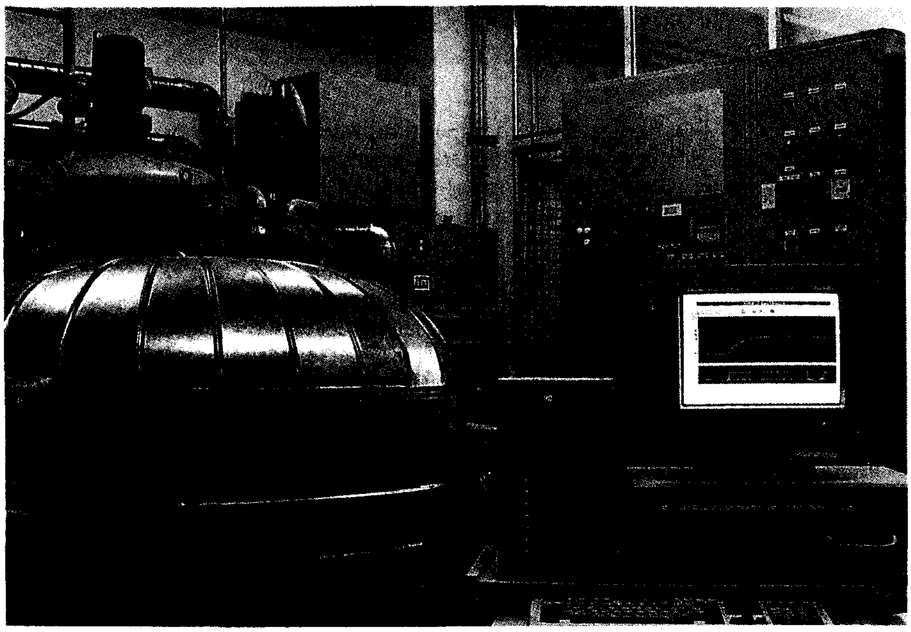
There is enormous interest world wide in the use of ferroelectric technology, which has many potential applications of great importance. One area is non-volatile memory devices, where the ability of a ferroelectric dielectric to retain a charge when the charging source is removed is one of the most practical ways to achieve memory devices which don't lose their stored information when powered down.

Another area is DRAM memories, where the very high dielectric constant of the materials allows a dramatic reduction in the chip area needed for the storage capacitor in each cell, and also a significant reduction in the number of chip processing steps. Hence it is expected to provide the key to future generations of very high capacity DRAM — e.g., 256 megabits and beyond.

The third area is in microwave devices, including phased-array antennas for millimetre-wave radar. Here ferroelectric films on superconducting substrates can be used to make very small but also highly effective bypass and tuning capacitors, with Q values as high as 1000 at frequencies up to 15GHz.

Professor Scott was invited to Tokyo in May, to present the plenary lecture at an 'Urgent International Forum' organised by MITI, the Japanese government body which coordinates research and development activities for the micro-electronics industry. The Forum was attended by 500 representatives from leading electronics manufacturers including NEC, Toshiba, Hitachi and others.

It is expected that by 2001, virtually all DRAM chips are likely to use ferroelectric capacitors using the technology developed by Professor Scott and his collaborators. By then the market for devices using ferroelectric capacitors is likely to amount to $10 billion annually.



Australian firm ISOVOLTA has recently released its new ISOCAP automated system, designed to measure and display the insulation status of wound coils for transformers, inductors, motors and other power machines — during impregnation.

FORUM TO PROMOTE TINY MEMORY CARDS

Fuji Photo Film, Sega Enterprises, Olympus Optical, Tokyo Electron and Toshiba Corporation have established the Solid State Floppy-Disk Cards (SSFDC) Forum to promote SSFDC as an industry standard for a super-small data storage medium. The Forum will provide manufacturers with opportunities for exchanging technical information required to develop SSFDC applications. In addition to the Forum's founders, it received the support of 32 additional companies.

SSFDC is a new kind of memory card that combines simple structure with small size. A card consists of a NAND flash memory chip embedded in a thin card, only one third the size of a standard credit card. This simple design offers the most cost-efficient memory card available.

Small size, light weight, large memory capacity and low cost all contribute to positioning SSFDC memory cards as a key storage device for mobile multimedia products. SSFDC is expected to become the storage medium of choice for portable information terminals, digital still cameras, voice recorders, personal digital assistants (PDA) and games machines.

37 companies have already announced their membership of the SSFDC Forum, among them Alps Electric, AMP (Japan), Cirrus Logic, DDK, Eastman Kodak Asia-Pacific, FDK Corporation, Kyocera Elco, Matsushita Electric Industrial, Minolta, Murata, National Semiconductor Japan, Nikon, Ricoh, Samsung Electronics Japan, Sanyo Electric, Sony, TDK and Yamaichi Electronics.

Features of SSFDC include a very simple structure with a high speed NAND flash memory chip on a plastic base, to realise a cost lower than any other memory cards. This makes SSFDC suitable for use in private digital data libraries storing image, audio and data recorded on digital equipment, including digital still cameras, voice recorders and PDA.

The SSFDC card is only 0.76mm thick and measures 45 x 37mm, with a weight of 1.8 grams This allows it to be slipped into a wallet, pocket or bag.

SSFDCs of 2MB capacity are ready for mass-production. As larger capacity memory chips become available, the capacity of SSFDC will be expanded to 4MB and then 8MB, while retaining the same pin count.

1996 ATERB SCHOLARSHIPS

The Australian Telecommunications and Electronics Research Board (ATERB) has announced the recipients of the eight scholarships which it has awarded this year. Each is worth $11,000 per year, and may be extended to three years.

The 1996 ATERB Postgraduate Scholarships in Telecommunications were awarded to:

C C Patrick Chan (University of Melbourne): Access Control for Wideband Mobile Communications.

Ms Linda Davis (University of Melbourne): Hidden Markov Model Technique for Communications Systems and Signal Processing.

Paul W. Davis (University of Queensland): Low Profile Antennas for the Reception of Direct Broadcasting Satellite Transmissions.

Andrew Logothetis (University of Melbourne): Adaptive Nonlinear Filters for Narrowband Interference Suppression in Spread Spectrum CDMA.

Jonathan H. Manton (University of Melbourne): Blind Equalisation and Frequency Tracking of Time-Varying Markov Modulated Channels.

Malcolm D. Macnaughtan (University of Technology, Sydney): Location of GSM Mobile Telephones.

Emma T.H. Pearce (University of Adelaide): Quasi-Stationarity in M/G/1- and G/M/1-Type Block-Matrix Processes.

Peter J. Wiskich (University of Adelaide): Modelling ATM Traffic in Networks.

ATERB was established in 1927 as the Radio Research Board, and has a long history of support of research and training. It is currently sponsored by Telstra, CSIRO and DSTO; academic representatives are co-opted onto its management committee.

ATERB believes it is critically important for Australia to increase the number of professionals, researchers and future academics in the area of telecommunications to meet the projected demand. A total of 99 postgraduate scholarships has been awarded since this program began in 1982.

FORUM LOOKS AT CLEARING 1.9GHZ BAND

The Wireless Technology Forum is preparing options to provide to the Government on approaches to clearing the CTS band for new Personal Communications Services (PCS). The second meeting of the Forum was held in Melbourne on 29 April and included representatives of vendors, carriers and engineering consultants.

A working group of the Forum reported on possible options for clearing fixed links from the 1880-1900MHz band. Members of the Forum are unanimous that fixed links have to be cleared from the band for the growth of the PCS industry.

Options examined included an SMA mandated clearance; clearance by industry either via unsystematic partial clearance (funded by an ad-hoc group); or a systematic style clearance by industry.

Under the latter options members discussed the US experience and the establishment of an industry body, UTAM, to act as the frequency coordinator for PCS systems and devices.

The Wireless Technology Forum is a joint activity of the Australian Mobile Telecommunications Association and ATIA, and provides a focus for the wireless industry on spectrum and technical matters.

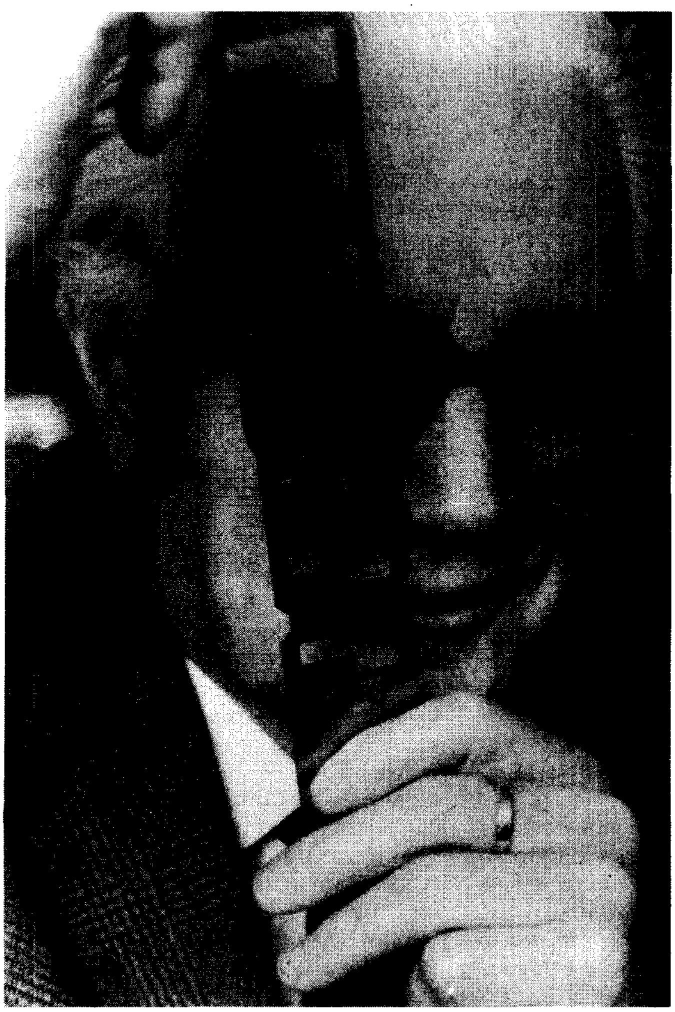
HEARING IMPAIRED NEED VOLUNTEERS

SHHH Australia Inc is a Sydney-based volunteer organisation dedicated to assisting adult hearing impaired people and increasing public awareness about the frustrations of hearing loss. One of its main activities is the hiring out of audio loops on a temporary basis, to make meetings more accessible for hearing impaired people wearing hearing aids or using assistive listening devices equipped with a T switch or telecoil.

The organisation undertakes these temporary installations when most commercial suppliers of loops will not, and charges very competitive rates as a service to hearing impaired people. Orders are processed by volunteers and then installed and dismantled by other volunteers with an interest in electronics. Training and instruction can be provided as required. All volunteer loop installers are paid travelling and parking expenses. They are not required to stay at the meetings, but often wish to do so.

Currently the organisation desperately needs more volunteers to help with this aspect, especially as the Disability Discrimination Act is starting to make itself felt and require all meetings to cater for every type of disability.

Sydney readers interested in assisting are asked to contact SHHH Australia at 1334 Pacific Highway, Turramurra 2074; phone (02) 44 7586 or fax (02) 449 2381 (marked attn. SHHH).



Germany's Konrad Zuse, often credited as the 'father of modern computing', who passed away late last year at the age of 85. His third machine 'Z3', completed in 1941, had program control and was capable of both multiplication and division — three years before Howard Aiken's 'Mark 1' machine.

3000KM TEST FOR SOLAR CYCLES

The Adelaide World Solar Cycle Challenge will commence in Darwin on Sunday 27 October. As a trial World Solar Cycle Challenge, it will be held in conjunction with the 1996 World Solar Vehicle Challenge. Sponsored by the Australian Major Events Department of the South Australian Government, this stage race will be for solar assisted, human powered vehicles. If successful, the World Solar Cycle Challenge will become a separate event to the World Solar Challenge and be held annually.

The tri-ennial World Solar Challenge for solar powered vehicles will again cross Australia from Darwin to Adelaide. Honda won the last 3000km race in 1993, achieving an average speed of 84.9km/h. The solar vehicles in this event race from 0800 until 1700. At the end of the days racing teams camp where they finish, often hundreds of kilometres from the nearest town.

Since competitors in the World Solar Cycle Challenge will need a good wash and quality food at the conclusion of each day's racing, this event will run as a stage race with eight fixed stops between Darwin and Adelaide.

Solar Cycling started at Ogata Mura in Japan. The Japanese event is a 100km track race staged every year at Akita. It has grown dramatically, with the third event being held the weekend of July 20-21 1996 attracting many international entries. The Australian event will be the first open road race for solar cycles.

The main difference from the World Solar Vehicle Challenge is cost to participants. The cost of running a Solar Car can amount to $50,000 for a local team, and can exceed $75,000 for an overseas team. The cost of running a Solar Cycle can be from as little as $5000.

PIRELLI PHOTONIC AMPS FOR CABLE TV

Pirelli Cables Australia's photonic amplifier technology will be deployed in a pilot installation by Telstra in its cable TV network, to boost television transmission over long distances.

This is the first trial of optical amplifiers in the cable TV network, and is expected to at least double the transmission distance of the broadcast signal. Pirelli's photonics transmitters, line amplifiers and fibre-optic cable are the key components of its pay TV system, developed by its specialised Photonics Business Centre for users such as Telstra and Philips.

By replacing traditional electrical-to-optical repeater equipment with Pirelli's optical amplifiers, longer links can be achieved without the need for intermediate amplification. The amplifiers will be supplied to Telstra via Philips Electronics, the prime vendor and systems integrator for Telstra's broadband cable network.

According to Pirelli's managing director, Mr Colin Bale, the deal represents an important step in the repositioning of the company from cable manufacturers to high technology telecommunications network system providers. Mr Bale said Pirelli had established a Photonics business in Australia in 1995, specifically in order to design and support the new optical communication systems for local customers.

HALT TARIFF PHASEDOWN, SAYS AEEMA

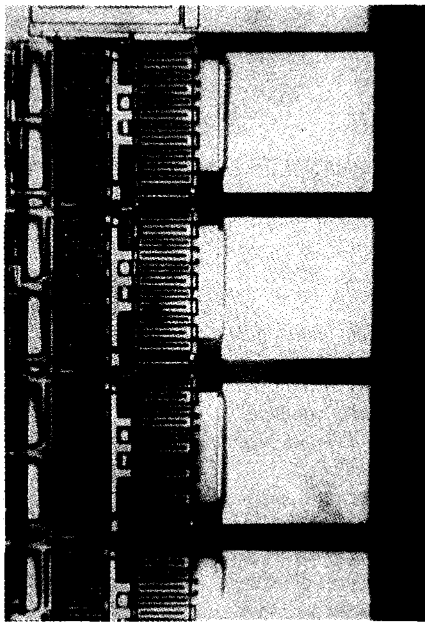
"Changes to the tariff concession scheme (TCS) must have a neutral effect on Australian industry competitiveness", commented Alex Gosman, Executive Director of the AEEMA, following the Association's submission to the Government review of the decision to abolish the TCS for business inputs.

"AEEMA recognises the urgent requirement for the Government to balance the budget, however abolishing the TCS will have an extremely adverse effect on the Australian electrical and electronic industries."

"The electrical and electronic industries would be the hardest hit sector of manufacturing industry, given its reliance on key imported components which are not manufactured in Australia. A survey of membership indicated that the proposal would lead to a fall in investment, exports, R&D and output."

"Such inputs include connectors, capacitors, chemicals, laminates, speciality steel, etc. Estimates of the additional cost impact upon individual member companies vary from $150,000 up to $4 million — overall average costs increases of 2 - 3% will occur", said Mr Gosman.

"If this decision isn't changed then from 1 July many parts of industry will be placed overnight at a cost disability of 8% arising from the increased costs flowing from the TCS removal and the 3% reduction in tariffs."



A microphoto of an IC chip — taken from below. Hypervision's new BEAMS system allows the chip to be thinned and polished to within 50 μm of the circuit layer, for fault analysis. (See article last month.)

X-RAY SCOPE SEES FASTEST STELLAR VIBRATIONS

Astronomers working with NASA's Rossi X-Ray Timing Explorer (XTE) spacecraft have discovered rapid fluctuations in the intensity of X-ray emissions from three unusual binary star systems. The fluctuations seem to be the signatures of the fastest vibrations ever detected in celestial objects.

The observations provide a new window on the strange physical conditions that scientists envision on neutron stars, which are believed to form when massive stars reach the ends of their lives and then explode as supernovas. The outer layers of a supernova are expelled into space, while its inner core remains and becomes a neutron star. Unlike normal stars, which are balls of hot gas, neutron stars are believed to possess solid crusts.

The first detection of the remarkable fluctuations by Rossi XTE was made in February 1996. Astronomers led by Dr Tod Strohmayer of the Universities Space Research Association (USRA) were observing the binary star 4U 1728-34, located in the general direction of the centre of the Milky Way galaxy, in the constellation Sagittarius.

This star pair was already well known to astronomers as a frequent source of powerful bursts of X-rays, which are thought to originate in hot gas that has streamed downward onto a neutron star from a companion star. As the gas accumulates on the neutron star, it turns into a natural nuclear bomb, burning with a thermonuclear flash that produces a burst of X-rays lasting about 10 seconds.

Fortunately, 4U 1728-34 was in a bursting state when the Rossi XTE observations commenced. The astronomers were able to detect both the powerful bursts and the weaker 'persistent' X-ray emission that is always emanating from the binary star.

"We were very excited to catch several X-ray bursts in our first pointing at the object. We were even more excited when a quick look at the persistent X-ray data revealed very high frequency, nearly periodic oscillations which no one had ever seen before", said Strohmayer, who is stationed at NASA's Goddard Space Flight Center, Greenbelt, MD. "The observations seem to confirm long-standing theoretical ideas suggesting that physical conditions on a neutron star can change in less than one millisecond."

The oscillations detected in 4U 1728-34 occurred at varying rates, reaching as high as 1100 times per second. In subsequent Rossi XTE observations, investigators led by Michiel van der Klis of the University of Amsterdam, The Netherlands, have detected even faster oscillations in X-rays emitted by another binary star system, Scorpius X-1, which is named for the constellation in which it is located.

"It's possible that the oscillating X-ray emissions come from gas orbiting very close to the neutron star," according to Strohmayer. For example, material orbiting at 10 miles above a neutron star would circle it about 700 times per second.

"We have also measured a very periodic oscillation of 363 times per second during the bursts from 4U 1728-34. This may be the period at which the neutron star is spinning", he added. ◆

NEWS BRIEFS

- ***SMPTE '97*** is being held at the Darling Harbour Convention and Exhibition Centre, July 1-4.
- The International Computer Expo for China ***Computer China '96*** will be staged at the China Foreign Trade Centre, Guangzhou, September 17-20, 1996.
- Dr Walter Green, an R&D specialist in the telecommunications and computer industries has joined the Perth office of ***Consultel***, the national telecommunications consultancy.
- A one day seminar on ***The Internet***, organised by Fred Pryor Seminars will be held in various parts of Australia during July and August. Cost is around $150. Enquiries on 1800 125 385.
- ***Intelligent Systems*** has announced its new World Wide Web site at http://www.intelsys.com.au.
- Philips has appointed ***Amtex Electronics*** as sole distributor for its range of FPD active matrix LCD displays.
- The International Ideas and Inventions Expo, ***Inventex*** will be held in Hall 3, Sydney Showground, August 22-25, 1996. For details phone (02) 810 6645. ◆

Solid State Update

KEEPING YOU INFORMED ON THE LATEST DEVELOPMENTS IN SEMICONDUCTOR TECHNOLOGY

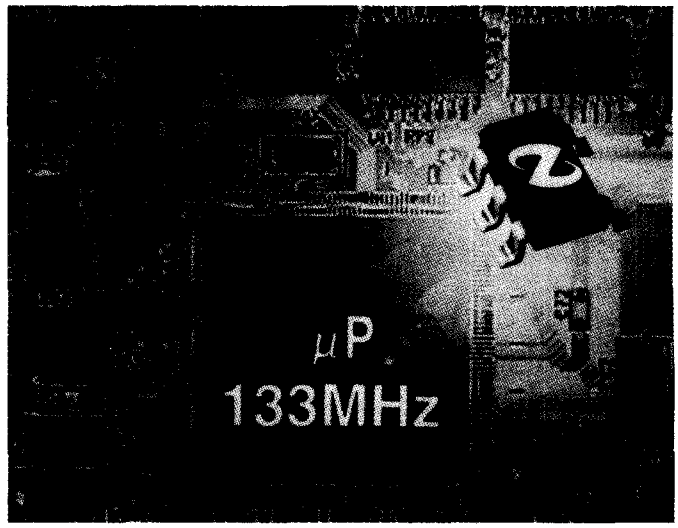
Precision voltage control

A new precision controller with the voltage output accuracy needed for high-current bus termination has been released by National Semiconductor. The IC, type LM3460 is optimised for the precise operating conditions of high-speed microprocessor and communications systems that use Gunning Transceiver Logic (GTL) and Gunning Transceiver Logic plus (GTLp).

Part of a complete GTL linear voltage regulation circuit available from National, the device offers an output current of up to 7A at an output voltage of 1.2V for GTL, or 1.5V for GTLp technology designed specifically for Intel's new Pentium Pro processor.

To support the voltage and current level requirements of GTL and GTLp technology, the output of the LM3460 has an accuracy of 1%. As well, it is available in National's TinyPak SOT23 5-pin package, which is one third the size of an SO-8 package.

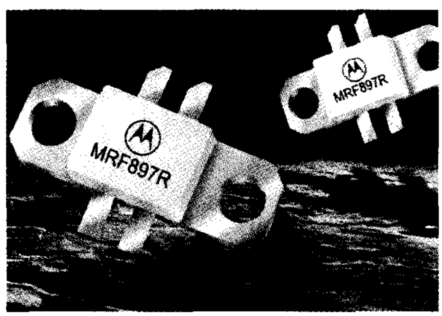
For further information circle 271 on the reader service coupon or contact National Semiconductor (Aust), Business Park Drive, Monash Business Park, Notting Hill, 3168; phone (03) 558 9999.



UHF transistor delivers 30W

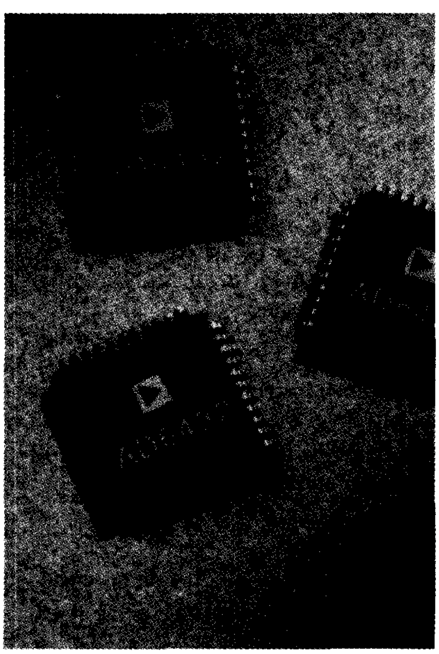
Motorola has announced the MRF897R RF power transistor. The device operates in the 800 to 970MHz range with an output power of 30W, and is designed for use in large-signal common emitter, class AB linear amplifier applications in industrial and commercial AM/FM equipment.

Other specifications include a minimum power gain of 10.5dB, a maximum intermodulation distortion of -30dBc at 30W and a minimum efficiency of 30% at 900MHz and 30W (PEP).



The transistor design features nitride passivation, gold metallisation and emitter ballasting for long life and resistance to metal migration.

For further information circle 274 on the reader service coupon or contact Motorola Australia, 673 Boronia Road, Wantirna 3152; phone (03) 9887 0711.



Transceiver IC for digital systems

Analog Devices has released its newest RF/IF product, the AD6432 3V transceiver. This monolithic device includes all the building blocks needed for modulation and demodulation of signals for digital wireless systems, and replaces a dozen or more discrete components. It can be used by itself for low-power systems up to 300MHz (RF carrier frequency) or with an RF down-converter for higher frequencies.

The I/Q modulation and demodulation method allows the chip to work with the most commonly used digital wireless modulation formats including GMSK, QPSK, DQPSK and spread-spectrum systems.

The receive section accepts input signals up to 300MHz, down-converts to a user-selected IF (intermediate frequency) between 10 and 30MHz, provides gain from -20 to +60dB, and provides baseband I and Q (in-phase and quadrature) output signals with up to 8MHz bandwidth. The gain is controlled by an analog control voltage.

The transmit section includes I/Q modulators and summing amplifier, and accepts modulation bandwidths up to 1MHz for a carrier frequency up to 300MHz. The output level is nominally -15dBm and can drive an up-converter.

The device is claimed to be the first to operate on a single power supply voltage of 2.7 to 5.5V. It includes provision for independent 'sleep' modes for the transmit and receive sections. The receive and transmit sections each take 8mA (active) and around 100uA in sleep mode.

For further information circle 272 on the reader service coupon or contact Analog Devices, PO Box 98, West Rosebud 3940; phone (059) 86 7755.

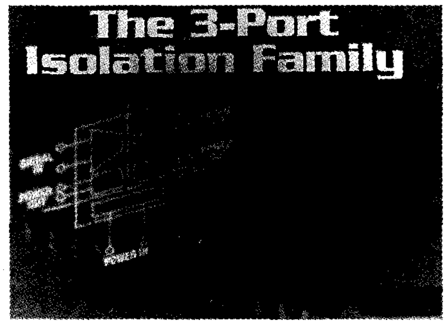
Precision amps with 1500V isolation

Burr-Brown's new ISO25X family of precision three-port isolated amplifiers comprise a buffer (ISO253), programmable gain (ISO254), instrumentation (ISO255) and operational (ISO256) amplifiers, aimed at the industrial process control market. Each amplifier is claimed to incorporate a novel modulation/demodulation duty cycle technique which provides excellent accuracy.

The amplifiers have a continuous isolation of 1500V RMS and are for applications such as thermocouple, RTD and pressure bridge isolators, medical instrumentation, power monitoring, analytical and biomedical measurements, and test equipment.

The amplifiers transmit signals digitally across a 2pF differential capacitive barrier. Digital modulation is claimed to preserve signal integrity across the barrier and gives excellent reliability and good high frequency transient immunity.

The buffer amplifier has +/-0.01% nonlinearity and inputs protected to +/-100V. The programmable gain amplifier specs include programmable gains of 1, 10, 100 and 1000; 5nA input bias current and 625uV input offset voltage. The instrumentation amplifier has a gain of 1 to 10,000, 10nA input bias current and 125uV input offset voltage. The opamp specs include +/-0.01% nonlinearity and



input bias current of 3nA. Supply voltage for the family is 11 to 18V.

For further information circle 277 on the reader service coupon or contact Kenelec, 2 Apollo Court, Blackburn 3130; phone (03) 9878 2700.

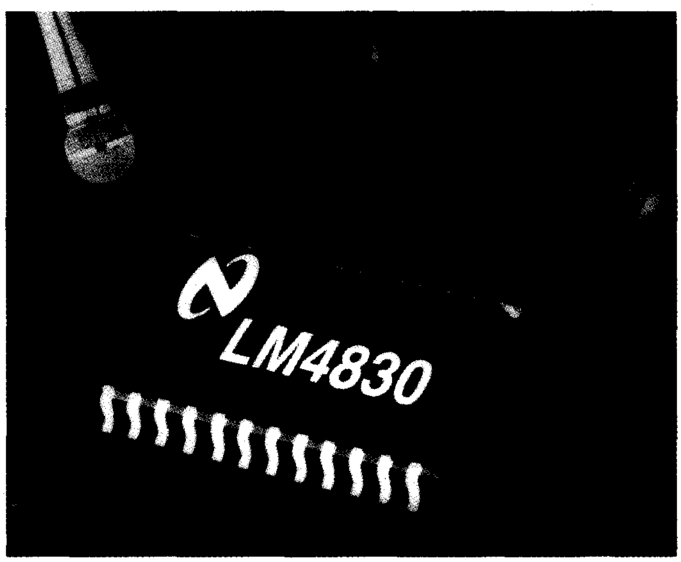
Audio IC for hands-free phones

National Semiconductor has announced a new product in its Boomer audio amplifier range. The new IC, type LM4830, is a highly integrated stereo audio amplifier system designed for hands-free two way audio communication.

The new system includes a power amplifier, headset driver, 4-bit volume control, a microphone preamplifier with two switchable inputs and a separate line buffer for general purpose use. The output power is up to 2W from a 5V supply with a 4Ω load. Total harmonic distortion is specified as less than 0.1% at an output of 1W.

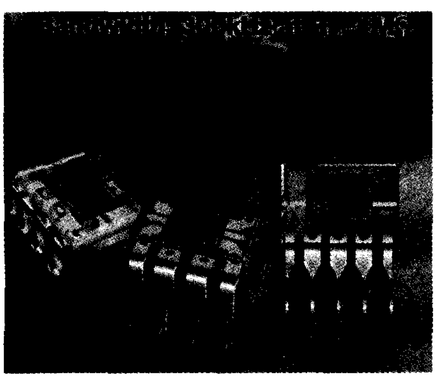
During normal operation, the device takes around 11mA, dropping to 0.5uA (typical) in shutdown/mute mode. It doesn't need an external bootstrap capacitor or snubber network, giving a simplified design with few external components. Applications include a driver for speaker phones, car mobile phones, mobile two way radios, personal communicators and portable tape recorders.

For further information circle 275 on the reader service coupon or contact National Semiconductor (Aust), Business



Park Drive, Monash Business Park, Notting Hill, 3168; phone (03) 558 9999.

Photodiode amp IC has 300kHz BW



The OPT210 from Burr-Brown is a photodetector containing a high performance silicon photodiode and precision FET input transimpedance amplifier, integrated on a single monolithic chip.

The device features a photodiode anode bootstrap circuit to reduce the effect of photodiode capacitance, extending bandwidth and reducing noise.

Output is an analog voltage proportional to light intensity. Applications include barcode scanners, medical and laboratory instrumentation, position and proximity sensors.

The key specifications of the device include a +/-2.25 to +/-18V supply voltage, 650nm sensitivity, a bandwidth of 300kHz and a quiescent current of 2mA.

The device is specified for operation over the temperature range of 0°C to +70°C and is available in transparent 8-pin DIP, 8-lead surface mount, and 5-pin SIP packages.

For further information circle 273 on the reader service coupon or contact Kenelec, 2 Apollo Court, Blackburn 3130; phone (03) 9878 2700. ◆

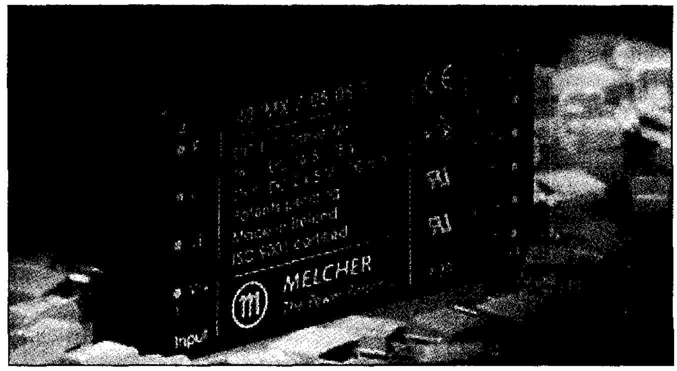
NEW PRODUCTS

Converters have planar transformer

Melcher's new family of 7W DC-DC converters are claimed to be unique in their use of multi-layer PCBs to form a planar transformer onto which all SMD components are mounted. According to the manufacturer, this construction provides high repeatability in manufacture, improved magnetic coupling for low loss, high input-output isolation (up to 1500V RMS), and relatively low cost compared with conventional wound transformers. Heavy input and output filtering ensure that conducted emissions are within the limits of EN 55022 level B, making the IMX7 family one of the quietest on the market.

The units feature broad input voltage ranges of 8.4 to 36V DC, 16.8 to 75V DC and 40 to 121V DC which, together with an internal transient suppressor, enables them to be used in applications with variable source voltages and where transients and surges at the input are significant.

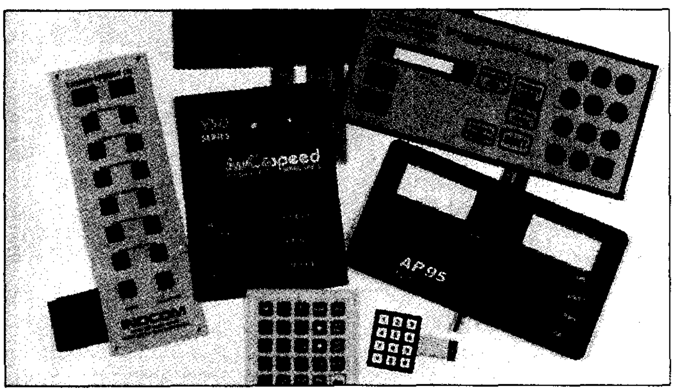
The output voltage can be user set over the range 75 to 105% of the nominal output, while maintaining a conversion efficiency of typically 84%. The efficiency also remains virtually



constant over the entire operating input range.The products measure 50 x 25mm with a 10.5mm profile, and are available in both conventional leaded format or SMD.

For further information circle 248 on the reader service coupon or contact Scientific Devices Australia, PO Box 163 Oakleigh MDC 3166; phone (03) 9579 3622.

Membrane switch

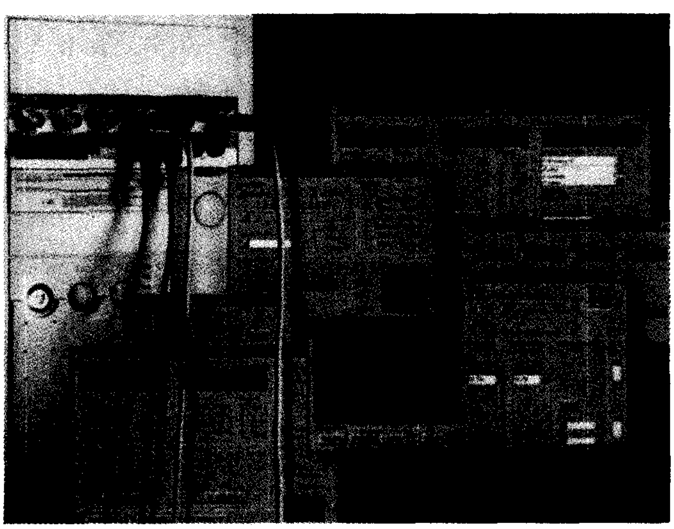


Permark Industries has released a new style of membrane switch. This device is a circuit screen printed onto layers of polyester film with conducting inks. The layers are separated by a spacer and laminated together with high performance film adhesive. When the top of the membrane is compressed the layers make contact and complete a circuit, thus giving a switching action.

The membrane switch can be used as a substitute for an existing fitting or it can be designed to suit an application. A membrane switch is deemed non-mechanical, therefore its life expectancy is far greater than conventional switches. Because these switches are sealed they will operate in harsh conditions where a mechanical switch may fail.

For further information circle 247 on the reader service coupon or contact Ross Read on (03) 9866 1153 or Amrat Parbhu on (02) 9911 6656.

PCB test and measurement system



British firm ABI Electronics has developed a six test instrument combination, which is contained in a single unit which slots into the drive bay of a standard PC and outputs on industry-standard sockets at the front of the computer. Australian distributors are being sought for this new product.

The multiple instrument station (MIS) system is the latest addition to the company's System 8 range of PCB modular test and measurement tools. Only one expansion slot is required for MIS, which incorporates frequency counters, a digital storage oscilloscope, direct-voltage probes, function generators, programmable analog outputs and a power supply. It works in a Windows environment, and comes with the necessary software, plus free lifetime updates.Tests include VI tracing for analog devices and functional testing for digital devices, which allows the system to locate virtually all types of faults that occur on PCBs. It can identify unknown or unmarked ICs, and a software package is also available to allow custom devices such as PALs and ASICs to be added to the library.

For further information contact Steve Ahern or Susan Redden, British Consulate-General, Sydney; phone (02) 247 7521.

12 channel GPS receiver/chartplotter

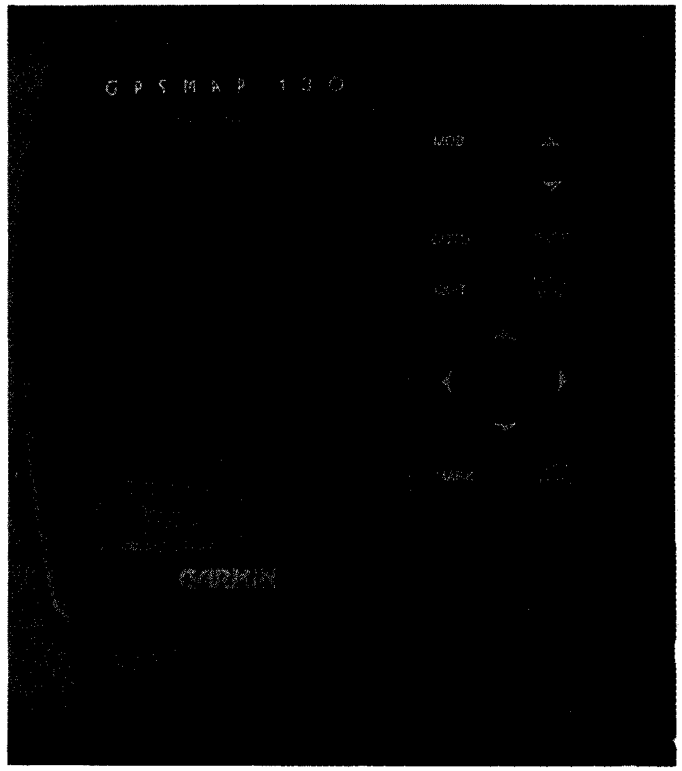
The GPSMAP 130 is a combination GPS receiver and chartplotter from Garmin. It's the company's first commercial product to be released with the super small PhaseTrac12 parallel channel receiver, claimed to give fast, accurate position fixes and superior tracking ability.

The unit is a compact, fixed-mounted receiver with a large, high resolution (26,400 pixels) FTN LCD display and an inbuilt full-featured chartplotter. It measures 125 x 185 x 61mm. The electroluminescent, backlit display measures 10.4cm (diagonally). The GPSMAP 130 is both waterproof and DGPS ready.

The device introduces a new software design which, among other features, allows boaters instant, one-touch access from any screen to all available options via a dedicated Option Menu key. Additionally, the TracBack feature lets mariners navigate their track log back to port without manually establishing waypoints along the way. Also, a new 3-D 'virtual highway' display graphically presents a mariner's route to a selected, active waypoint.

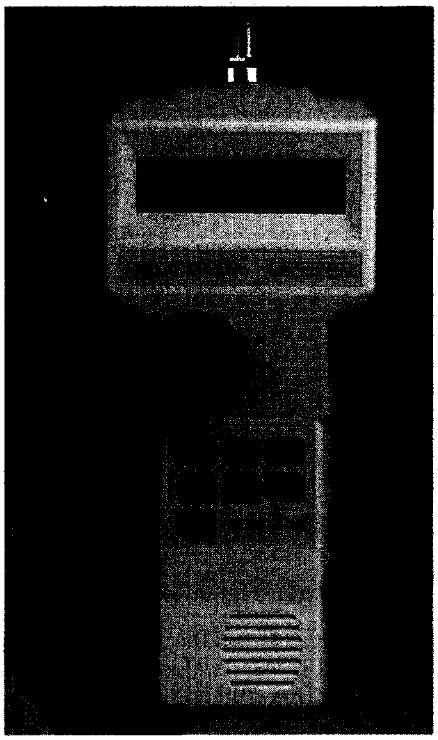
Other features include 250 alphanumeric waypoints with user-selectable icons and on-screen point-to-point distance and bearing calculations; 20 reversible routes with up to 30 waypoints each, including one-touch MOB mode; differential accuracy of five to 15 metres when used with the optional Garmin GBR21 differential beacon receiver.

At first-time initialisation, the user selects the country, state or region for a fast, first position fix. The unit comes with a remote antenna and nine metre cable, a universal mount bracket and power/data cable.



For further information circle 241 on the reader service coupon, contact your nearest GME dealer; or write to Standard Communications, PO Box 296, Gladesville 2111; phone (02) 844 6666.

Cable TV analyser



The Promax-4 from Promax is a handheld cable TV analyser that includes video and audio level measurement, carrier to noise and video to audio ratios, sound demodulation and programmability.

Measurements are taken by tuning the channel through its rotary selector and reading the result on the backlit display.

The unit is supplied in a sturdy carrying case which houses the main unit and all accessories. An optional shock protector to protect against accidental drops is available.

Specific channel plans, different measuring units and other additional information can be preprogrammed from a computer.

With the help of the RM-004 Windows based software package, it's possible to program the unit for measuring specific channels only, i.e., those corresponding to the cable network under test.

For further information circle 245 on the reader service coupon or contact Sam Technology Communications,36 Binney Road, Maryong 2148; phone (02) 671 5588.

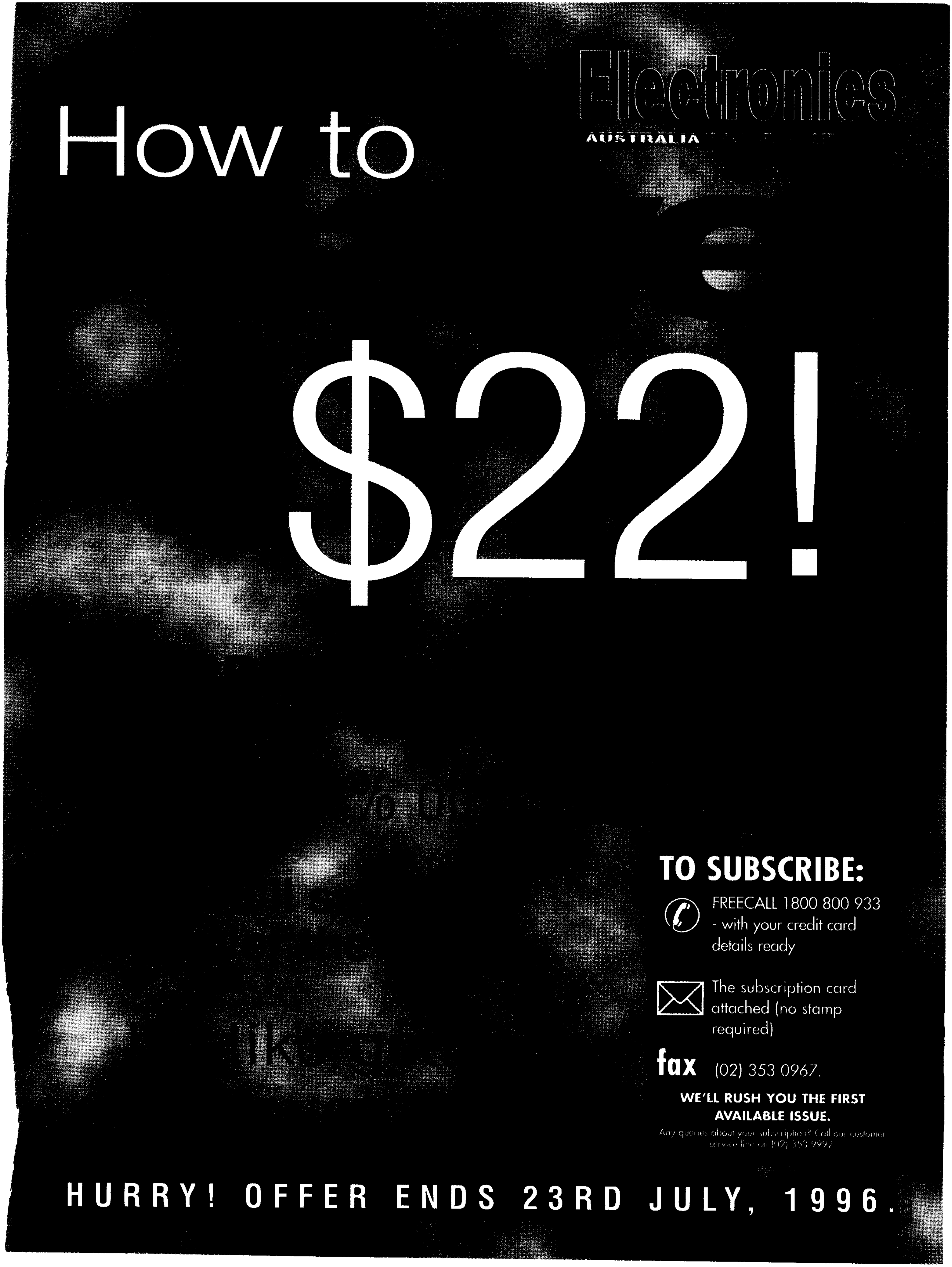
0805 SMT fuse

AVX has released an 0805 size version of its Accu-Guard SMT fuse series, believed by the company to be the industry's smallest SMT fuse — measuring 2.0 x 1.22mm. It is available in current ratings from 0.5A to 2A.

Using the same thin-film technology as the Accu-Guard 1206 fuse, the 0805 device also offers, according to AVX, extremely accurate and consistent fusing characteristics which are vital when providing one-on-one protection for microprocessors, ASICs, etc.

The fast fusing action of its thin film structure also helps limit the destructive short circuit current flowing into a fault condition.

For further information circle 242 on the reader service coupon or contact Veltek Australia, 9 Bastow Place, Mulgrave 3170; phone (03) 9574 0300. ❖



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SPOTLIGHT ON

SOFTWARE

Electronics Workbench 4.1

It's been a while since we last looked at circuit simulation packages, so when Emona Instruments showed us the latest offering from Interactive Software, *Electronics Workbench 4.1*, we gladly took the opportunity of reviewing it for our readers. It offers many features over previous versions, not the least being the ability able to simulate circuits containing both analog and digital components.

by GRAHAM CATTLEY

If you look back through the history of circuit simulators, you will see that they have come a long way from the early and almost impenetrable text-file based SPICE systems.

These days, users expect more humane treatment from their software, and various companies have come to the fore with GUI-based systems, allowing users to concentrate more on their designs rather than wrestling with recalcitrant software.

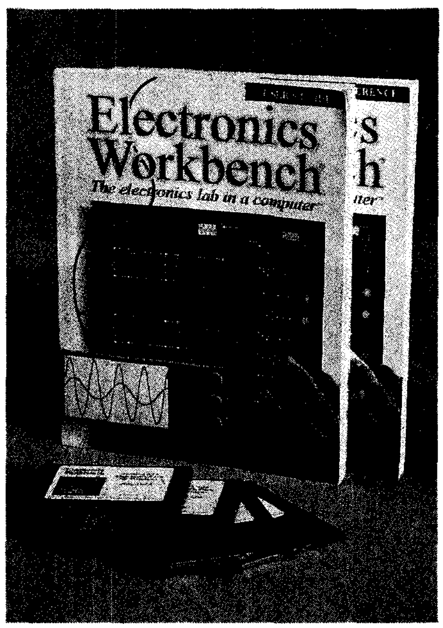
One package that has been well received in this area is *Electronics Workbench.* Originally aimed at the educational market, EWB has evolved into a powerful circuit simulation package which can be configured to suit almost anyone from first year students through to professional electronics engineers.

By installing various add-on additional libraries containing thousands of components, educational examples and ideas, as well as teaching notes and even faulty components (for teaching repair and troubleshooting techniques), EWB can be tailored to almost any application.

Latest version

For the purpose of this review, we decided to look at the Engineers Pack, which incorporates the Professional version of EWB, as well as over 2000 component models, SPICE import/export and PCB netlist output facilities. A large collection of ready built circuits is also included.

The software is supplied on four 3.5" HD floppy disks, and comes complete with professionally bound Users Guide and Technical Reference manuals. A couple of other booklets cover PCB and SPICE export formats, as well as a few release notes that didn't make it into the



users guide. Also supplied is a handy crib sheet detailing all the keyboard shortcuts and component information.

Electronics Workbench 4.1 offers several advantages over previous versions, if not over other analysis packages, in that the user can mix analog and digital components in the one circuit. This change is due to the way in which EWB models digital components — by treating each digital component as having analog inputs and outputs, each interfaced to a digital logic core. Realistic emulation of digital devices is therefore possible, allowing such factors as propagation delay and input threshold voltages to be incorporated into the simulation. This means that there is no restriction on the type of parts that can be used in a circuit, and that analysis results will be true to life.

For a given circuit, EWB can perform three major analyses: DC Analysis, sometimes referred to as Steady State Analysis, which determines the DC operating point of a circuit; AC Analysis, including AC Frequency-Response Analysis and AC Time response analysis, where the circuit is analysed as a function of frequency; and Transient Time-Domain Analysis, where EWB calculates the circuit's response as a function of time.

Installation

EWB 4.1 is available in DOS, Windows and Mac formats, with only slight aesthetic differences between them. The Windows version requires Windows 3.1 or 3.11 and at least 4MB of RAM.

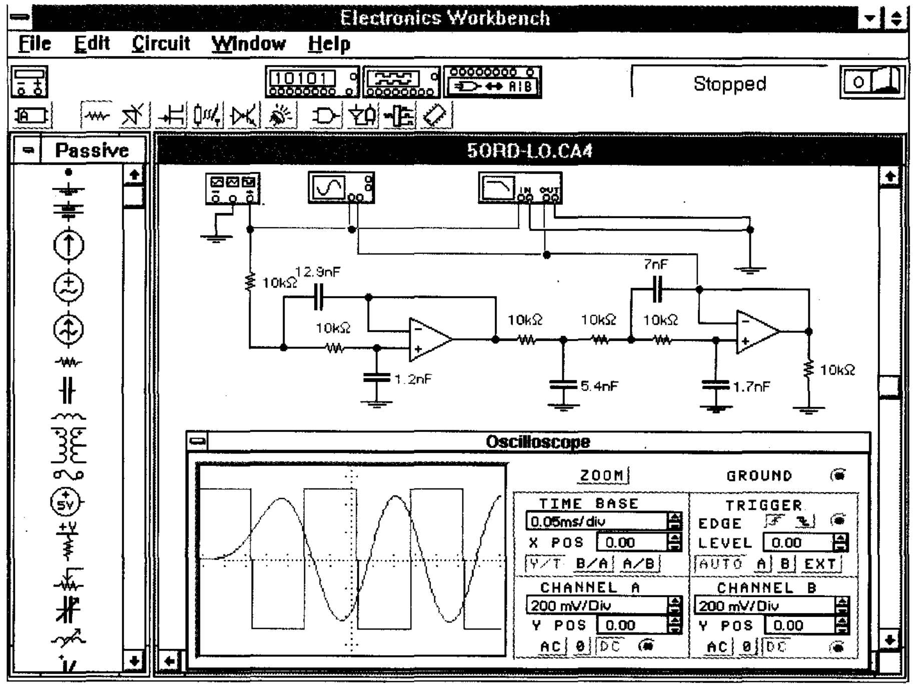
Installation is relatively quick and painless, running the usual 'Setup' program through Windows' Program Manager. ('Quick' is indeed the word here, with the drive chomping its way through the four disks in a disarmingly short time.)

If installed on a system running Windows 95, the 32-bit version is automatically installed, whereas you are given the option of running the 16- or 32-bit version under Windows 3.1x. (Win32s is also installed if you select the 32-bit version on a 16-bit machine, and you will need a total of at least 6MB to take advantage of any speed increase.)

One interesting point is that during installation you are given the option of setting either ANSI (American) or DIN (European) component symbols as the default style. While the DIN style is the official standard in Australia, the ANSI style is still more widely used (including here at *EA*). It's nice to see that Interactive (a Canadian company) took the trouble to consider the needs of international users.

When trying out software for the first time, I often gauge the 'user friendliness' of it by seeing how much can be achieved before resorting to looking in the manual. With EWB though, it turned out that I had to forego this test due to the form of copy protection implemented by Interactive Software.

The copy protection system prompts the user to enter the serial number of the software package, and to then enter the word printed in the users guide on 'Chapter 6, Page 33, line 8, word 4'. This I found a little petty, and somewhat reminiscent of older computer games. It turned out however, that this procedure need only be performed once on installation, and that any subsequent use of the program runs normally. So it would seem that this system gives a fair degree of protection to the publishers, with minimal user discomfort.



This screen shot shows the results of a circuit simulation, with the oscilloscope expanded to show the waveforms more clearly. The large on/off switch in the top corner allows you to stop the simulation at any time, and take 'instantaneous' readings.

First impressions

As you can see in the screen dump, the main work area is bordered on the left by a 'parts bin' containing an unlimited supply of components. A range of different parts bins are provided, each containing an assortment of components in 10 different categories: Basic (RLC components and sources), Active (op-amps, transistors, diodes, etc.), FETs, Control, Hybrid, Indicators, Digital gates, and combinational and sequential digital devices.

There is even a 'Custom' parts bin for user-defined components. However, user-defined components can only be created from combinations of existing component models. It would have been nice to be able to enter an equation for a custom component, allowing greater flexibility in design and testing...

To build a circuit, components are simply dragged from a parts bin to the work area, where they are assigned a (surprisingly sensible) default value. Each can then be placed into its correct position on the work area by selecting it with the right mouse button and dragging it into place.

You can also rotate a component, using the rotate function from the menu. A nice feature here is that this function will rotate all selected components in the circuit — and this holds true for other functions, including move and delete, with all selected components being affected.

Component values can be easily altered by double-clicking on them, whereupon a requester pops up, allowing you to change a variety of parameters depending on the component.

Once the components are in place, all that remains is to connect them together with wire. EWB's wire facility exhibits a fair amount of intelligence in terms of auto-routing, and all that is required on the part of the user is to drag a 'rubber band' line from one component lead, and drop it onto another. The wire is automatically placed so that it crosses as few other lines as possible, and the result is usually very tidy. But if you don't like the positioning of any wire in the circuit, it is a simple matter to click on it and move it to where you *do* want it, all quite painlessly.

Wires can have different colours (just like real ones!), and so by double clicking on a wire, you can choose from one of six different colours for that line — which lets you assign different colours to signal, power, and data lines, for example. This not only makes the circuit diagram easier to read, but also lets you determine the colour of the trace when using the oscilloscope. By connecting a red lead to one of the scope's inputs and a blue lead to the other, the scope will display each trace in its respective colour.

Test equipment

The array of test equipment available in EWB is quite impressive, and it is all quite easy to use as well. Interactive seem to have hit upon a good idea, in having items such as an oscilloscope and function generator sitting 'on the shelf' at the top of the screen. Like components they can be pressed into service by merely dragging them onto the work area and connecting them to the circuit.

Double clicking on an instrument causes it to expand to full size, revealing the various buttons and controls that you would expect, along with a few features that you'd normally only find on the most expensive models. Take the oscilloscope for example — as well as the usual timebase, amplitude and trigger level controls, you'll also find that it displays a pair of vertical markers overlaid on the graticule. These can be positioned anywhere on the displayed waveform, to give an instant reading of the time and amplitude of the waveform at that point, as well as the difference between two points both in terms of voltage and time.

Added to this is a feature that allows you 'look back in time'; a Windows scroll bar situated at the bottom of the oscilloscope screen lets you scroll back through the previous traces, looking at all of the waveform recorded since the simulation was started.

Of course EWB supplies you with more than just an oscilloscope. A number of other pieces of test equipment are available, including:

- A multimeter, measuring AC or DC current or voltage, as well as resistance and decibel loss.
- A Bode plotter, allowing you to plot a

circuit's frequency response over the range of 0.001Hz through to 10GHz.

- A function generator offering sine, square and triangular waves over the range of 1Hz to 999MHz, with controls for amplitude, duty cycle and DC offset.
- A binary word generator capable of generating 16 rows of 8-bit words, in either a step, burst or cycle mode.
- A logic analyser, displaying waveforms for up to eight digital channels, which also shows the decimal and hexadecimal values for each input; and lastly,
- A Logic Converter, something that doesn't exist in the real world. This amazing device lets you enter your own truth table (with up to eight inputs and one output), and converts it into a Boolean equation at the touch of a button. By pressing another button, the equation can be simplified, and to top it all off, you can then convert the resulting equation into an an actual circuit on the work area. The same process can also be performed, only instead of entering a truth table, the device can be connected to points on an existing digital circuit — enabling you to simplify some of your more convoluted digital logic creations.

Real life

The use of virtual test equipment in EWB is perhaps unique among circuit simulation software packages, allowing you to take readings in much the same way as you would in real life. If you want to see the waveform on a particular point in the circuit, you just move the oscilloscope probe to that node, and the scope's screen instantly starts displaying the waveform.

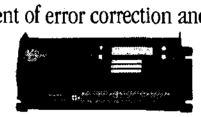
The same can be said for voltage or current meters, any number of which can be placed in the circuit to monitor signal levels. In fact all of EWB's test equipment behaves in the same way real test gear does — even down to the series resistance of ammeters and the loading affect of voltmeters on the circuit.

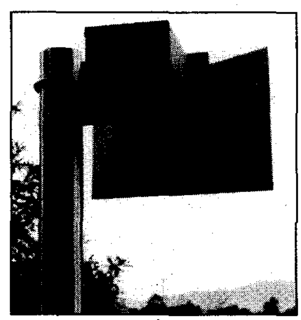
The down side of this instrument-based approach is that there doesn't seem to be any way to use the computer to analyse the readings and display them in another form — plotting supply current over frequency for example. There is a temptation here to compare EWB with the likes of SPICE-based analysis packages such as MicroCap *et al* where readings can be plotted on a graph to show almost any reading against any other, and this perhaps illustrates the way in which EWB differs from other simulation software.

Electronics Workbench in fact emulates a *real* electronics workbench — with the emphasis more towards learning about circuits, components, and how to use test equipment, rather than a more SPICE based, in-depth analysis of component and circuit operation. It takes a lot of hard work to teach electronics effectively, and this is perhaps EWB's strong point — it has evolved in the harsh environment of the classroom into a powerful, easy to use simulation system that is *easy to use*. And if you've ever tangled with a SPICE system you'll know that ease of use is a rare commodity in the world of simulation software.

Output

High quality printouts of almost all aspects of the circuit and its analysis are available, with EWB able to print the





schematic, parts list, model list and analysis options.

You can also obtain printouts of any or all of the test instruments used in the circuit, showing the range, scale and measurement at the time of printing. One useful option is the 'X,Y Plot' (which for some reason wasn't mentioned in the users guide). This option allows you to print the waveforms recorded by the oscilloscope, along with the scope's graticule and current settings.

While this is a very useful feature, it would have been nice to be able to select which part of the waveform you would like to print, as this function prints the entire output from the oscilloscope since the simulation started — which can amount to several pages of unwanted tracings.

EWB provides SPICE import and export facilities, using MicroSim's PSpice component models. If you intend to use EWB with other versions of SPICE, you may find that some components are not supported and the resulting text file will have to be altered to suit. This sounds a bit like hard work, but Interactive seem to have made the job easier by providing a complete breakdown, giving the SPICE format, syntax parameters and comments on each type of component.

Of course if you should ever want to build a circuit in the real world, using real components, you will probably want a printed circuit board to build it on. EWB can generate circuit netlists in OrCad, Tango and other popular formats, compatible with a wide range of PCB design packages.

Conclusion

One of the problems with writing reviews is that people expect you to come up with a good list of niggling complaints. The only problems I came across when reviewing this package were that while components can be rotated, they can't be flipped laterally — making it a little cumbersome to wire up asymmetric components such as transistors. Also, component labels can't be moved, so that if two labels overlap, you have to move the components themselves, instead of just the labels.

As you can see, these are small points, and are more than compensated for by the well designed user interface. Still, it would be nice to create a circuit that not only works, but looks good on paper.

All in all though, I would have to say that EWB is certainly the most friendly circuit simulator I have encountered, and although the $949 pricetag may put it out of reach of the average student, it does provide a unique environment for learning and experimenting in electronics.

Electronics Workbench is available from Emona Instruments, of 86 Parramatta Road, Camperdown 2050; phone (02) 519 3933 or fax (02) 550 1378. Quoted prices range from $510 for the Professional version, up to $949 for the Engineers Pack as detailed above. ❖

EA's READER SERVICE BBS

As part of its service to readers, *Electronics Australia* operates a Reader Information Service Bulletin Board System (BBS), which makes available a wide range of useful information for convenient access and rapid downloading.

The BBS is ANSI compatible and is currently operational for virtually 24 hours a day, seven days a week, on (02) 9353 0627. Use any speed to 28.8kb/s.

Special Feature:

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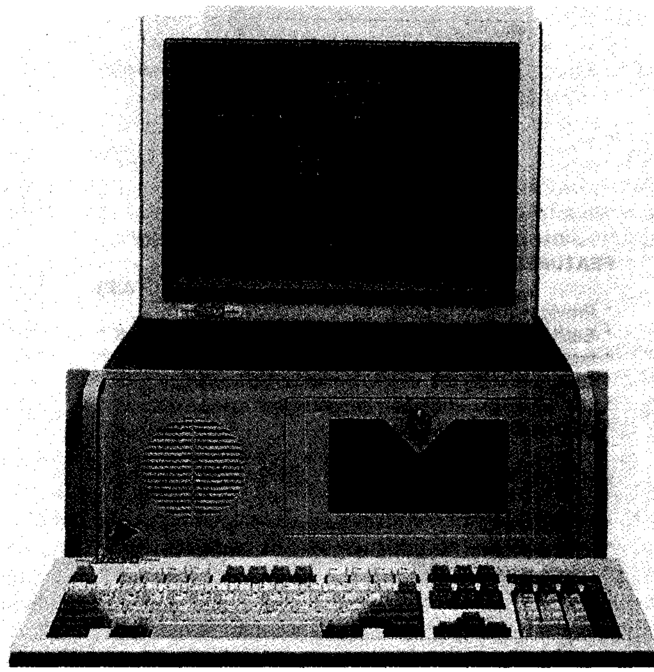
Plug-and-Play DAQ modules



A new family of data acquisition modules from Decision Data for the Plug-and-Play environment are especially designed for field use. Called the Pocket-ADDIO family, up to 16 modules can be connected to one notebook computer via its parallel port, thus eliminating the need for internal cards or PCMCIA connections.

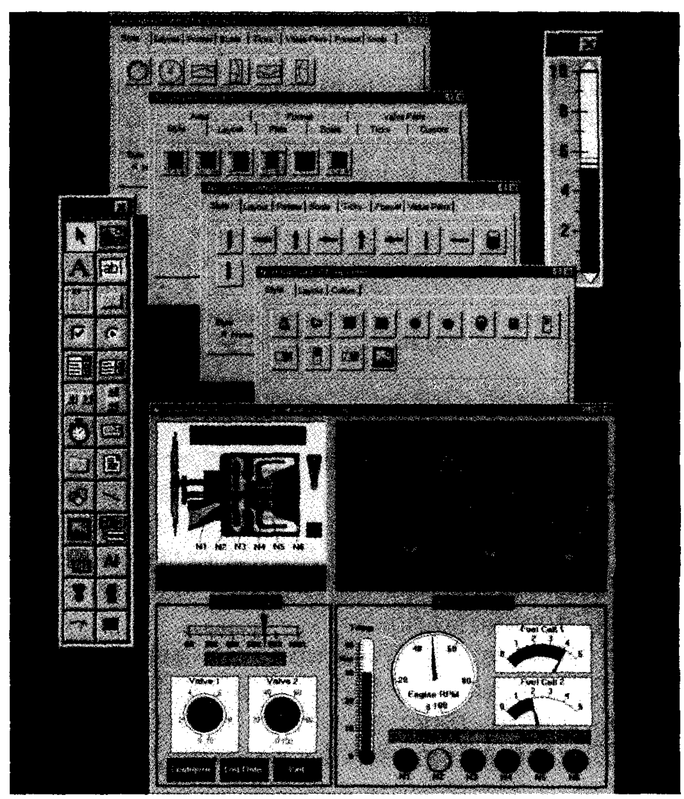
The 16 modules can be any combination of 10-bit A/D, 12-bit A/D, 16 digital inputs, 16 digital outputs or 8 digital inputs and 8 digital outputs.

The A/D modules can be supplied with either 0-5V or 0-10V channels. The digital I/O modules can be connected to a variety of interface modules with a selection of photo-isolated inputs, relay outputs or SSR logic outputs.

Any desktop or notebook computer (with a parallel port) using the modules can support up to 256 lines of digital I/O or A/D channels simultaneously, or any combination in groups of 16. Also available is a range of support hardware such as development boards for the A/D modules and terminal boards for both A/D and digital I/O modules.

For further information circle 201 on the reader service coupon or contact Nucleus Computer Services, 9B Morton Avenue, Carnegie 3163; phone (03) 9569 1388.

VB libraries support data acquisition



National Instruments has released a collection of virtual instrumentation add-on controls and libraries for Visual Basic. Called ComponentWorks, it has four major functional components: data acquisition (DAQ) controls, GPIB instrument drivers, analysis libraries and user interface controls for creating real-time graphs, meters, knobs, tanks, thermometers and gauges.

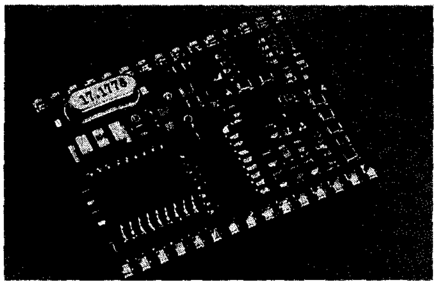
The DAQ controls include a series of 32-bit OLE controls for controlling National Instruments DAQ hardware. DAQ programming is achieved by setting a collection of properties. For example, you can add an analog input control and set properties for input channels, acquisition rate, triggering and timing signals. The control generates an event when the data buffer is full, passing the data to the Visual Basic source code for processing.

For GPIB control, the software has a collection of GPIB instrument drivers packaged as standard 32-bit DLLs for controlling more than 70 instruments from HP, Tektronix, Fluke and so on. The analysis library can perform statistical computations, such as mean, standard deviation etc.

To display data, the software includes a collection of user interface objects packaged as OLE controls. The interface controls are similar to those in LabView and LabWindows/CVI, and include knobs, meters, gauges and dials.

For further information circle 205 on the reader service coupon or contact National Instruments Australia, PO Box 466, Ringwood 3134; phone (03) 9879 9422.

RFID micro-reader has flexible capture



Designed for access control, position and presence detectors for factory automation, logistics and portable data collection, the new Texas Instruments TIRIS micro-reader allows the embedding of RFID capability into both new and existing systems.

The micro-reader has been designed for those applications that don't need the full performance range of the TIRIS series 2000 RFID reader. Fully compatible with all TIRIS low frequency transponders, it has smaller dimensions, lower power consumption, and is cheaper.

With a read-range of around 30cm, the new reader weighs 5g and is packaged as a dual in-line plug (DIL) solder-in module. It can be connected to a local or remote microcontroller via its standard 5V serial interface, and remote control is possible by mode input signals and/or serial commands.

The unit requires a single 5V power supply and has low standby and operating current consumption. It is specified to a standard industrial operating temperature, and can be used in outdoor environments. It suits battery-operated applications, it has no antenna tuning requirement, and features a simple method of synchronising the operation of multiple units.

For further information circle 207 on the reader service coupon or contact Texas Instruments, PO Box 63, Elizabeth 5112; phone (08) 255 2066.

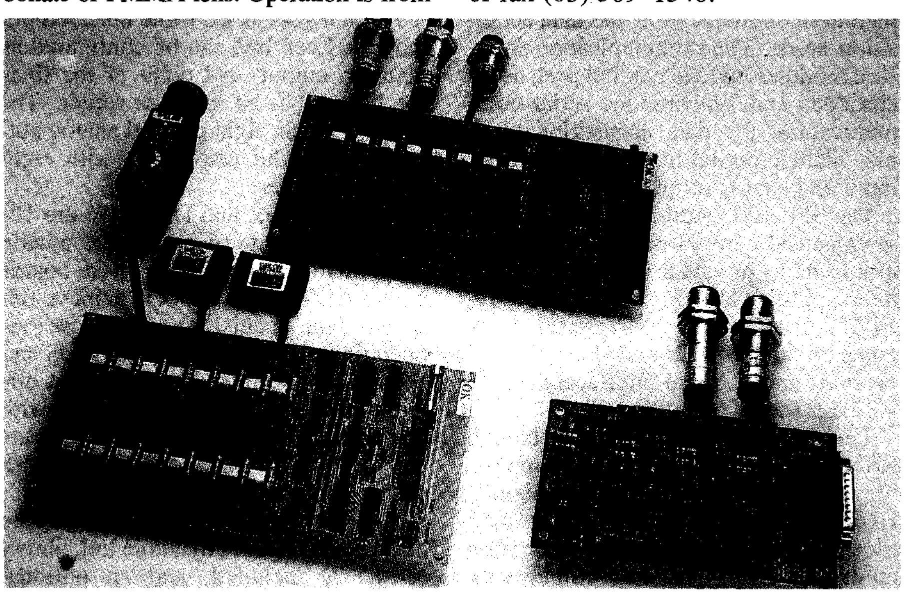
Photoelectric sensor system

Nucleus Computer Services has released a range of photoelectric sensors and conditioning modules, for data acquisition and control applications. The range includes sensors designed for through-beam, retro-reflective and diffuse reflective operation, using either separate or built-in infrared LED light sources operating at 940nm. Detection is via either phototransistors or photodiodes, according to model.

The sensors are sealed to conform with IEC standard IP66, and are housed in a nickel-plated brass housing with polycarbonate or PMMA lens. Operation is from 12 - 30V DC. Output switching is via an open-collector NPN power transistor with a load current rating of 120mA. Typical response time is less than 1ms. Many sensors have a built-in indicator LED and also short-circuit protection.

Included in the range are two models of mark sensor, which use dual sensing wavelengths (either green/red or yellow/blue) for enhanced colour discrimination. These sensors have small spot size and also continuously adjustable sensitivity.

Further information is available by circling 209 on the reader service card, or contact Nucleus Computer Services, 9B Morton Avenue, Carnegie 3163; phone (03) 569 1388 or fax (03) 569 1540.



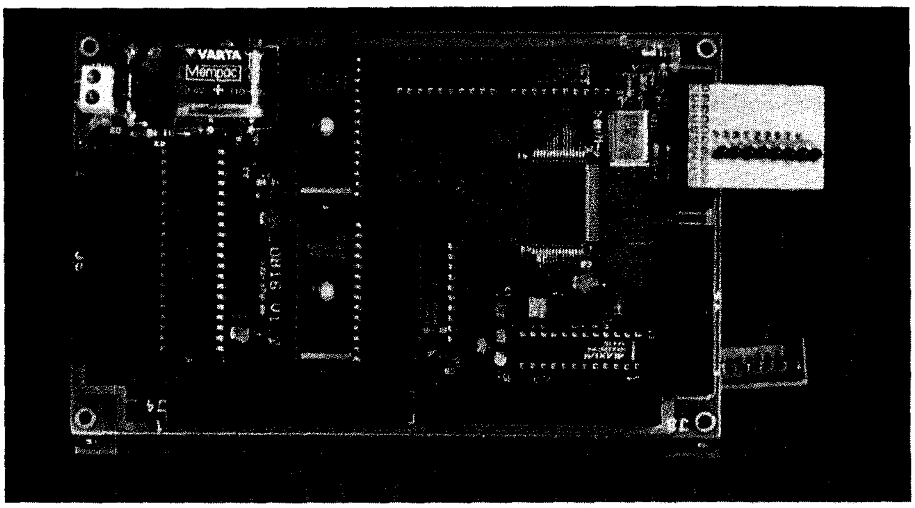
16-bit development kit has C compiler

Mitsubishi Electric has introduced the low cost DK16 Expert Designers Kit, enabling cost effective development of 16-bit microcontroller applications. The kit comes complete with the IAR C Compiler, Assembler and C-Spy Debugger and is simply installed on a PC with a text editor.

Heart of the kit is the DK16 Expert Designers Board, which incorporates an M37702S1ASP chip. This is representative of Mitsubishi's 16-bit range and boasts the widest range of features. The on-board device operates in microprocessor mode and together with an M5M82C55 I/O extender mapped in zero page preserves the I/O operations by replacing the ports used as data and address buses. Ample space is provided for user software by 64KB each of EPROM and battery-backed RAM. A decoder chip select is also provided.

The DK16 Expert Designers Kit operates from 5V supplies and comes complete with serial cable and 9-to-25 way adaptor, comprehensive documentation including Mitsubishi's 16-bit User and Software manuals. The 100 x 160 x 20mm high PCB based system typically consumes only 40mA, including battery recharging.

For further information circle 210 on the reader service card or contact the Semiconductor Department, Mitsubishi Electric Australia, 348 Victoria Road, Rydalmere 2116; phone (02) 684 7777 or fax(02) 898 0484.



PCMCIA interface cards

The Quatech range of PCMCIA cards includes communication and data acquisition cards. The communication interface modules include parallel port, asynchronous and synchronous serial communication; the data acquisition modules include digital input/output, analog input and analog output modules.

The SPP-100 module is a bi-directional enhanced parallel port (EPP) configurable at any base address and using any interrupt selectable from IRQ 3-7, 9-12, 14-15. The asynchronous serial cards come in both single and dual channel versions and optional interfaces include RS-232, RS-422 and RS-485.

The MPAP-100 is a single channel RS-232 synchronous module supporting asynchronous, monsync, bisync, HDLC and SDLC protocols. It uses the Zilog 85320 serial communication controller chip. The card comes with Syncdrive, a frame level HDLC and bisync software driver.

The IOP-241 is a 24 line buffered I/O module. Each line can be configured as input or output, and eight of the lines can be used as an interrupt source. The DA8P-12 is an eight channel analog output card (12-bit resolution) with eight digital I/O lines.

The DAQP-12 and DAQP-16 are 12-bit/100kHz and 16-bit/50kHz analog input boards respectively. These boards have a 512-sample FIFO to achieve full speed data acquisition under various operating platforms, including DOS and Windows. The modules have eight differential or 16 single analog inputs with a programmable gain, four digital inputs and four digital outputs. They come with driver software support for Microsoft C/C++, Borland C/C++, QuickBasic and TurboPascal. A dynamic link library (DLL) is included, and an optional

Visual Basic Controls (VBX) is also available. All boards are Type II cards and come with PCMCIA card services.

For further information circle 202 on the reader service coupon or contact Interworld Electronics & Computer Industries, 1000 Glenhuntly Rd, Caulfield South 3162; phone (03) 9563 5011.

DAQ software for education

Intelligent Instrumentation has announced version 3.0 of its educational version of Visual Designer, a low-cost version of the company's Visual Designer application generator software for PC-based data acquisition and control. Visual Designer is a Windows-based application generator that allows users to develop custom applications by drawing a block diagram (flowgram) instead of coding the application with a programming language.

More than 20 new function blocks expand the program's application capabilities. New *select...case* and *do...while* blocks allow conditionals and looping structures to be implemented in an application. The new *subgram* block nests a diagram within the primary diagram which can be cut, copied, pasted and minimised to a single icon. New *string* blocks ease processing of character string data, simplifying I/O to and from serial devices. The new *equation* block performs virtually any mathematical function by typing in the equation. Memory and I/O blocks provide direct access to memory and I/O-mapped hardware.

The software supports an extensive variety of data acquisition hardware from Intelligent Instrumentation. It is available on CD-ROM and includes a Getting Started manual in electronic format. Also included are dozens of examples showing how to get applications running.

For further information circle 203 on the reader service coupon or contact Kenelec, 2 Apollo Court, Blackburn 3130; phone (03) 9878 2700.

400kHz DAQ board

The DAQ-1200 range of data acquisition boards from Quatech includes the DAQ-1201 and DAQ-1202 with programmable gains of one, 10, 100, 1000 and one, two, four and eight respectively.

These boards offer 16 channel single-ended or eight channel differential-ended analog inputs with 12-bit resolution and a maximum sample rate of 400kHz. The input voltage is jumper selectable for either unipolar or bipolar. Data acquisition is supported beyond the normal 64KB DMA boundary with two alternating DMA channels. Analog expansion up to 256 channels is by jumper selection.

The analog I/O includes eight digital I/O through the main DB37 connector, with a further 24 digital I/O available through a secondary DB37 connector. Two 12-bit D/A and three 16-bit counter/timers are also provided.

The boards can be installed in any available I/O base address location without conflict with other devices.

The software drivers provide support for various programming languages such as Microsoft C/C++, QuickBasic and Turbo Pascal. A dynamic link library (DLL) is supplied for all kinds of programming languages under Windows. An optional Visual Basic Controls (VBX) is also available and third party software such as Labtech Notebook and Snap-Master support the DAQ1200.

For further information circle 204 on the reader service coupon or contact Interworld Electronics & Computer Industries, 1000 Glenhuntly Road, Caulfield South 3162; phone (03) 9563 5011.

PCMCIA FFT analyser

Data Physics has released ACE, claimed as the fastest, smallest PCMCIA FFT analyser designed for a notebook PC. It can also be used with desktop and other computers with PCMCIA ports, and is claimed to give a laboratory standard FFT analysis instrument capable of refined measurements, data acquisition and report preparation, literally anywhere in the field.

ACE uses two new generation 16-bit sigma delta analog to digital converters which each provide very high sample rates. It has two input and two output channels on a type III PCMCIA card with 20kHz real time tri-spectrum average (cross spectrum and both auto spectra) with multiple bandwidth steps and a dynamic range in excess of 100dB.

The device provides a true 32-bit Windows 95 analyser including a 32-bit 50MHz floating point DSP processor with 900 lines resolution. A full array of measurements are provided including power spectrum density, frequency response function, coherence, correlation, real time zoom, disk throughput, replay analysis and disk playback.

For further information circle 208 on the reader service coupon or contact Kingdom P/L, PO Box 483, Blacktown 2148; phone 02 9975 3272. ❖

Silicon Valley NEWSLETTER

NEC targets 0.07um, US lab achieves 0.1um

In one of the world's most ambitious semiconductor R&D programs, NEC has announced plans to spend about US$2 billion over the next 10 years to build a massive new semiconductor R&D centre aimed at bringing NEC's chipmaking technology down to the 0.07 micron level. Meanwhile, a major US government-owned research lab announced that it has built transistors measuring just 0.1 micron, meaning 1000 of them could be laid next to each other in the width of a human hair.

The NEC program to develop 0.07um process technology would achieve a nearly five-fold improvement over today's leading-edge 0.35 micron production capabilities. At 0.07um, chips such as 64 gigabit DRAMs will be feasible.

NEC's new facility will measure nearly 300,000 square feet spread over three stories. It will be located in Sagamihara, Kanagawa Prefecture, and include a 50,000 square foot cleanroom.

The first phase of the project, scheduled for operation in October 1997, will include a pilot production line capable of producing up to 5000 wafers with ICs featuring 0.15um design rules. Most of the output will be on 200mm wafers, but plans call for early implementation of 300mm wafer development. Additional phases will aim for 0.1um and 0.07um generations slated for production application between 2000 and 2003.

The 0.1um transistor achievement by the US was accomplished at the Sandia National Laboratory in Livermore, near Silicon Valley. Researchers used an ultraviolet light source to perform the critical lithography function to create the chip. Last year, Sandia showed it could use conventional optical lithography sources to build circuits with 0.13um features.

China's drive for chip development

China's political leadership has put their country's '909 Project', a major effort to develop advanced chip manufacturing capabilities, at the top of their list of economic priorities. China's President Jiang Zemin and Prime Minister Li Ping have rated the 909 Project the "emphasis of emphases" among Chinese economic stimulus programs — giving it an importance equivalent to the country's atomic bomb project in the 1950s.

The 909 Project calls for China to become a world-class chipmaking nation, particularly in the area of CMOS devices such as ASICs and DRAMs. Among the applications for the chips are the Golden Card project, which is aimed at developing widespread use of smart cards throughout China.

One of the problems facing the Chinese is that the West currently prohibits the exports of certain critical tools, including lithography stepper systems capable of better than 0.7um production. China's best hopes for getting permission to purchase higher level machines is that Motorola is getting ready to install equipment capable of 0.5 micron production in its US$720 million Fab 17 facility in the XeQing Economic Development Zone in Tianjin, near Beijing. So far there have been no indications that Motorola will not obtain the permits to bring the equipment to China.

Japan says no to new chip trade deal

Prospects for a new US-Japanese chip trade agreement dimmed considerably after representatives from the US chip industry and Japan's electronics products sector were unable to agree on the need for a new deal, in the wake of dramatic marketshare improvements that US and other foreign chip companies have achieved in the Japanese market during the past three years.

Representatives from the US Semiconductor Industry Association (SIA)

US firm Tellabs International used the recent CommunicAsia 96 Show in Singapore to launch its Martis DXX GMU, first product in the firm's SDH (synchronous digital hierarchy) system for managed access and transport network systems. Vodaphone Australia is using the Martis DXX system to monitor and control its nationwide GSM mobile phone network from a single point.

and the Electronics Industry Association of Japan (EIAJ), along with top executives from the largest chip and electronics manufacturers from both countries, met in Hawaii in late April to try to lay the groundwork for a new agreement. The US side was pressing for a new deal, fearing Japanese electronics companies may retreat to past trade barrier policies when the current chip trade agreement expires in July.

In a joint statement, leaders of the two groups said that while they "disagree on the involvement of governments", they reaffirmed their desire to continue the spirit of cooperation between the two industries. "Both sides have recognised the need for a transition plan to secure the US-Japan semiconductor relationship toward the 21st century."

US negotiators are keen on getting a new agreement, which they say will be crucial in continuing the opening of the Japanese market to competitive foreign products. Foreign marketshare in Japan's semiconductor market rose by more than 3% in the fourth quarter, resulting in a 29.5% foreign share and an overall 1995 share of 25.4%.

The Japanese, on the other hand, believe the success of the chip trade agreement sets a dangerous precedent that may force them into accepting similar deals in other protected markets in future trade dispute cases.

"Our hope is that the United States will come to its senses and understand that a new government agreement is not in the cards", said Stan Anderson, counsel for the EIAJ.

Huge interest in Internet show

Last year, Meckler Media's Internet World trade show and conference was so small that it was quietly tucked away in less than half of one of the exposition halls in the San Jose Convention Center. Exhibitors were largely unknown, the press room was largely devout of reporters and there appeared to be more exhibitors walking around than prospective customers.

In contrast, this year's show attracted 40,000 people, a press room bulging with journalists from around the world, exhibitors sporting the biggest names in the computer, software and communications industries, and booths spilling out into hallways, lobbies and even tents out in front.

"I have never seen anything like this," commented Dave Bursky, one of the key editors of *Electronic Design News* (EDN) magazine in the United States, who reviews close to 100 trade shows and conferences a year. And most of the 'big boys' were there: Oracle's Larry Ellison, Java co-developer and legendary Sun Microsystems co-founder Bill Joy, and even Bill Gates — who addressed the crowd via satellite link. Gates apologised that he couldn't make it in person, just days after his wife gave birth to his first child (widely referred to as 'Infant 96').

The explosive growth of the Internet World show is indicative of the huge impact the worldwide computer and communications network and its World Wide Web are having on the computer industry. In many cases, the Internet has forced key industry players to dump entire long-term product and technology strategies that were not sufficiently focused on where the real action is now seen to be: the Web. The industry is also changing so fast that even today's most popular Web-surfing products such as browsers face becoming obsolete in just a few months.

Gates went out of his way to assure the thousands of Net junkies that his company will keep up with the pace of change in the Internet market. He went as far as to openly admit that last year's critics were right when they scolded Microsoft for being asleep at the wheel when it came to the Internet.

"The impact of the Internet revolution deserves to be compared with TV, radio and the telephone", Gates said. "What we need to do is make sure the Net and the PC are integrated so they work together well."

Other highlights of the Internet show included:

- Netscape launched a new browser, Netscape Navigator 3.0, which allows users to play sounds and video clips.
- Apple Computer said it has licensed the Java programming language from Sun Microsystems, to allow software developers to create programs that can be stored on one computer and run via the Internet or a network on another computer. Apple's move came just a week after Microsoft made a similar endorsement.
- Bill Joy, co-founder of Sun and one of the creators of Java, said that the language had gained so much support during the past year that it was becoming the 'lingua franca' of the Internet. Some 40 universities will begin teaching Java programming this fall, which will lead to more Java-like applications on the Internet.

Memory prices may drop still further

DRAM memory prices may not have reached bottom yet, as 4Mb chips can be bought in Silicon Valley for between US$4.90 and $5.25, much less than the $6-7 level analysts have been quoting as 'rock-bottom'.

In early May, 16Mb memory chips were selling for around US$20 on the spot market, compared with $25-$30 three weeks earlier. Some chip brokers think they may not settle down until prices reach around US$15, with 4Mb chips going down to around $4.50.

Lower DRAM prices do appear to be moving the industry to a higher memory per system level. According to Hambrecht & Quist in San Francisco, average memory per PC increased from 10.6MB last October to 15.8MB in April. This trend is critical to chip makers, who are switching to 16Mb and 64Mb DRAMs. Without a rapid switch to the 30MB per system average, the ideal level to operate Windows 95, the supply of chips will far outstrip demand, causing prices of even the most advanced memory circuits to remain depressed.

LSI exec new National Semi chief

Two months after its chief executive unexpectedly resigned and moved over to Apple Computer, National Semiconductor had a new CEO — Brian Halla, 49, previously Wilf Corrigan's deputy at LSI Logic. The announcement came as a surprise to many industry observers, who had expected National to pick one of its own.

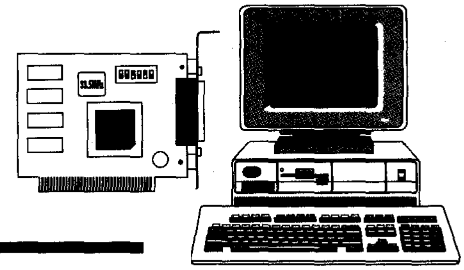
Halla will be only the third chief executive of National, following Gilbert Amelio who took over in 1991 from industry legend Charlie Sporck. Other candidates for the position were National's chief operating officers Kirk Pond, Ellen Hancock and Richard Beyer. The three COOs will continue to operate 'the office of the president'.

National regained its profitability and made strides under Amelio, adapting its product line to account for declining military sales and increasing replacement of analog chips with newer digital technology. But slumping PC and cellular phone sales forced it to report disappointing results for the past couple of quarters. It recently laid off 400 workers, and expected its results for the quarter ending May 26 to be disappointing.

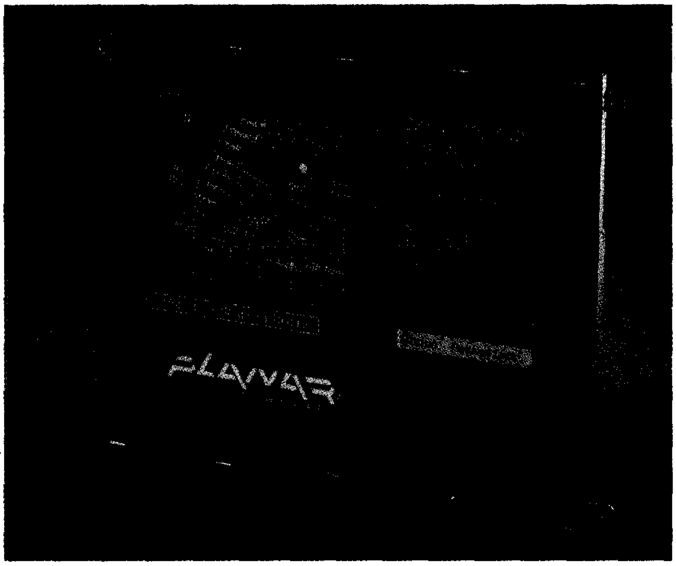
Halla has worked at LSI since 1988, most recently as executive vice president. He has been instrumental in engineering LSI's rise as the world's largest maker of ASICs. Before joining LSI, he worked at Intel.

LSI officials credit Halla with playing a big role in the company's reorganisation in 1992, when it decided to focus on the consumer, computer and communications markets. The company reached US$1 billion in sales last year, thanks to increasing revenues from its Coreware technology, which allows LSI to put entire systems in a single custom chip.❖

Computer News and New Products



EL panel offers multi-colour VGA



The EL640.480-AA from Planar is a multi-colour, high resolution, high performance electroluminescent (EL) flat panel display claimed to offer exceptionally clear, high contrast images in distinct colours using hues of red, green and yellow, plus black. Its high brightness and contrast, along with a viewing angle of 140°, allows data to be seen even at a quick glance, according to the manufacturer.

The display incorporates integral contrast enhancement (ICE), allowing it to perform in a wide variety of ambient light conditions without the use of filters. Unlike CRT and LCD technologies, Planar's EL displays are claimed to retain substantially more than 75% luminance after 125,000 hours at 60Hz, the equivalent of 60 working years.

Being a solid state device, electromagnetic immunity is inherent in EL displays. As well, the display has a very low radiated electromagnetic energy.

Features such as fast response time, low power consumption together with standard interface options, normal EL interfacing, VGA feature connector interfacing and TFT type interfacing allow the unit to be easily integrated into a system.

For further information circle 160 on the reader service coupon or contact Amtex Electronics, PO Box 285 Chatswood 2057; phone (02) 805 0844.

Monitor has new CRT design

Claimed as the most important development in CRT display technology in years, NEC Home Electronics Group has introduced a new screen technology for computer monitors, called Cromaclear. The new CRT is fitted to the MultiSync M series, a new family of desktop multimedia monitors from NEC. The new models include the 15" MultiSync M500 monitor and the 17" MultiSync M700 monitor, and feature integrated speakers and microphone.

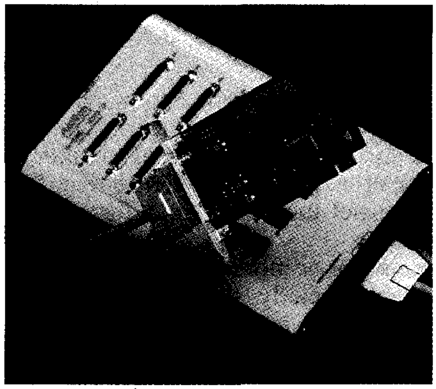
The new CRT has a different type of shadow mask that gives elliptically shaped phosphor patterns, compared to the usual round or strip phosphor patterns. The monitors also include 'video boost', claimed as an innovation in the monitor industry. This feature, according to NEC, maximises contrast and brightness to closely approximate the image brightness of video and television. A special window, size adjustable in 25% increments, can be set to appear in the middle of the screen to view video.

The integral sound system is controlled by an on-screen digital control system, and includes volume and performance controls for the inbuilt speakers. A separate mute control is also provided. The integrated microphone is front-bezel mounted and its omnidirectional range is claimed to allow the user to talk into the microphone without needing to lean towards the monitor.

Other features of the new monitors include five user selectable colour temperatures and an on-screen display in six different languages (selectable). The monitors are priced at $1350 (M500) and $2150 for the M700. Both models have a three year warranty.

For further information circle 164 on the reader service coupon or contact NEC Australia, Home Electronics Group, PO Box 443, Epping 2121; phone (02) 868 1811.

PCI serial adaptor



Stallion Technologies has released a new multiport serial adaptor for the PCI bus. The product is a PCI version of the company's EasyConnection 8/32, and Stallion claims it is the first PCI-based multiport adaptor of its kind in Australia.

The adaptor features significant performance enhancements over previous cards, with a claimed 30% increase in performance over equivalent non-PCI adaptors. According to the company, the performance increases of EasyConnection for the PCI bus are of particular benefit to remote access environments, where high speed modems place an overwhelming burden on traditional serial port technology.

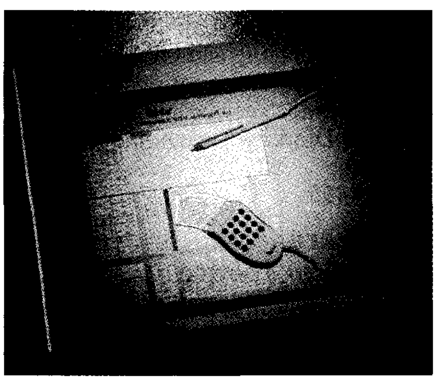
Stallion worked with many OEM vendors, including Olivetti, Digital, AT&T, Acer, AST, Compaq and IBM in developing and testing the adaptor. EasyConnection supports Windows NT, SCO OpenServer R5, UnixWare and XENIX, Novell NetWare, OS/2, UNIX SVR4.x, Linux and DOS. The PCI version is priced from $1545 (ex tax) for an 8-port model.

For further information circle 162 on the reader service coupon or contact Stallion Technologies, 33 Woodstock Road, Toowong 4066; phone (07) 3270 4242.

High resolution digitiser tablet

The NewSketch 1212HR Digitiser Tablet is the latest addition to the Genius range, and offers a resolution of 2540 lines per inch — making it well suited for design and drafting applications. The new tablet is compatible with the Summagraphics MM series, Mouse Systems and Microsoft mode. All that is necessary to change mode is clicking in the mode area of the template, to select the corresponding driver.

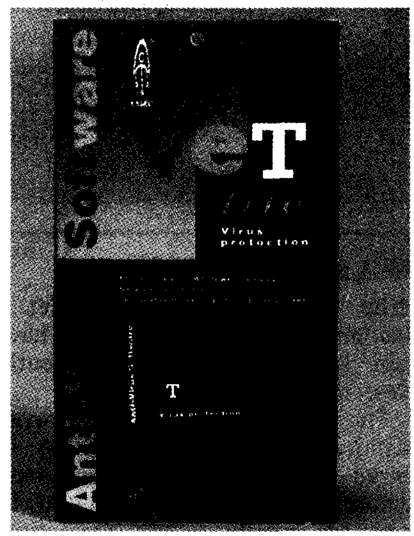
The tablet comes with KeyCAD Complete, an easy to use package which runs under Windows and provides facilities for drawing, editing and design.



The NewSketch 1212HR is priced at $425.00 including sales tax. For a limited period, the package also includes the program Virtual Tablet Interface, valued at $95.

For further information circle 168 on the reader service card or contact Genius Australia, 4 Briar Court, Fulham Gardens 5024; phone (08) 235 2388 or fax (08) 235 1756.

New 'Lite' VET



Melbourne firm Cybec, which produces the highly regarded VET Anti-Virus Software, has now released a 'lite' version. This is a fully functional virus detection and removal product, but users do not automatically receive the regular upgrade and support service which Cybec provides for the full VET package.

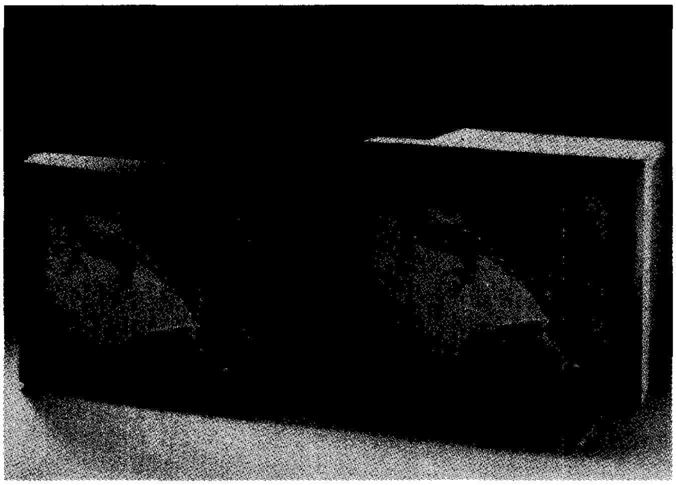
VET Lite comes complete with a manual and on-line Help. The pack includes versions of the software for Windows 95, Windows 3.X and DOS. The Windows 95 version automatically checks for viruses when users download files from the Internet or from bulletin boards.

Cybec says that VET Lite provides an opportunity for users to try VET effectively before they buy the full subscription, as well as providing an effective product at a low up-front cost. However it stresses that users should ideally obtain a new version every three months or so, to maintain fully effective virus protection.

VET Lite is priced at $29.95 and is available through Cybec's national dealer network.

For further information circle 166 on the reader service card or contact Cybec, 350 Hampton Street, Hampton 3188; phone (03) 9521 0655 or fax (03) 9521 0727.

Industrial colour monitors



Barco Display Systems has released a new range of colour monitors specifically designed for industrial applications where there are difficult environmental conditions such as vibration, shock or magnetic interference. Fan-free desktop, industrial and panel mount versions for console integration are available.

For 24-hour process control or monitoring operation, the ICD 321 monitors have specially designed circuits to improve stability and provide automatic environmental light control (ALC) as well as automatic degaussing. These functions extend tube life and reduce life cycle cost. Each monitor carries a two year warranty.

Equipped with multisync circuits, the ICD 321 automatically accepts signals from most computer platforms and offers a maximum resolution of 1600 x 1280 pixels.

For further information circle 167 on the reader service card or contact Trace Pacific, 8 Prohasky Street, Port Melbourne 3207; phone (03) 9646 5833 or fax (03) 9646 5887.

HP LaserJet 5

The Hewlett-Packard LaserJet 4 Plus and 4M Plus laser printers have been superseded by the recently released 5 series.

The new printers offer improved graphics printing and useability in shared workgroup environments. Features include a throughput of 12 pages per minute, 600dpi resolution, and when compared to the 4 series, a faster return to application, faster output of complex graphics and improved graphics print quality.

The printers also have a new industrial but sleek design, fifth-generation HP JetAdmin software and a higher duty cycle.

Three models are available: the LaserJet 5, 5N and 5M. All are designed for small workgroups (one to 10 users). The 5N is 'network-ready'; the 5M includes PostScript and extra memory.

The new printers are the first to use HP PCL 6, HP's next-generation printer language. PCL 6 offers a number of benefits including faster graphics printing, improved graphics print quality and better WYSIWYG printing. The latter is achieved by a new, advanced font-synthesis technology that generates fonts on the fly. PCL 6 incorporates PCL 5e, for backward compatibility with existing software applications.

The printers have a 33MHz Intel i80960 JF RISC processor for faster printing, making them 32% faster than the LaserJet 4 Plus printer. They also have a new flash-memory option (2MB or 4MB modules) that offer permanent storage of forms, fonts and signatures. There's also a new infrared port for wireless printing, in which communication between computer and printer is via an infrared link (distance of about one metre).

Recommended retail prices, including sales tax, for the HP LaserJet 5, 5N and 5M printers, are $2996, $3838 and $3487 respectively.

For further information phone HP on 13 1347. Information can also be found on the World Wide Web at http://www.hp.com.

PCI frame grabber

The Pulsar-LC from Matrox is a PCI grabber providing analog and digital acquisition and real-time transfers. It is designed specifically for imaging applications that require powerful acquisition and transfer with no display. The card is priced at $2457 and is a lower cost version of the Matrox Pulsar.

The card captures from non-standard video sources such as high resolution frame scan cameras at resolution up to 1K x 1K x 8-bits at 30 frames per second, or the equivalent.

The board digitises 8 or 10-bit data at up to 45MHz. It comes with a 16-bit TTL interface for digital acquisition; an optional module is available for up to 16-bit RS-422 data.

The frame grabber also features programmable gain, offset, references, synchronisation and control, an external hardware trigger and exposure control. The Pulsar-LC is a PCI bus master for transfers of up to 60MB/second to system RAM.

It comes with a C development library for board control that supports Windows 3.1X, Windows NT, 32-bit DOS extenders and Windows 95. MIL, an extensive imaging library, is sold separately for $2138.

Device-independent MIL contains highly integrated commands for image processing, blob analysis, pattern matching, gauging and OCR (optional).

For further information circle 161 on the reader service coupon or contact The Dindima Group, PO Box 106, Vermont 3133; phone (03) 9873 4455.

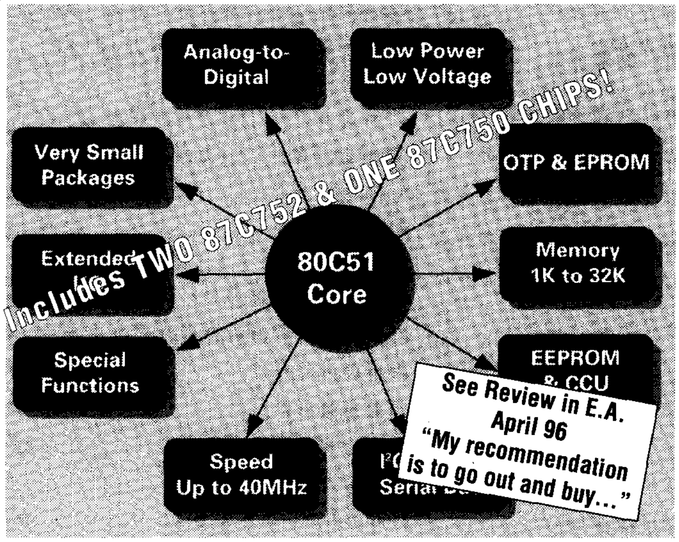
Freeware payroll software

The Logisoft Payroll Series software is claimed to offer a flexible range of awards and pay rates, for enterprises with one to hundreds of employees. All programs in the series include comprehensive human resource management functions and electronic funds transfer.

The series has been available nationally since 1987 and is marketed directly, and through a network of dealers. It is widely used in many industries, from mining to tourism.

The Logisoft Payroll Series for Windows 95 is a freeware release, and suits a small business with one to 12 employees. It can be obtained by contacting Logisoft Australia, PO Box 59, Sherwood 4075; phone (07) 3379 1200, or fax (07) 3379 1253. ❖

FOR CHIPS...WOOD FOR CHIPS...WOOD FOR CHIPS...WOOD FOR CHIPS...WOOD FOR CHIPS...WOOD FOR CHIPS...WOOD FOR CHIPS...WOOD FOR CHIPS...



Ever wanted to try out the new generation of microcontrollers?

Well here's the low cost way to do it with the DS-750 Development Kit from Philips for only $159.90!!

The DS-750 features:

- **Emulates 87C750 Microcontrollers in Real-Time**
- **Programmable Clock up to 40MHz**
- **Built-in Programmer for 87C750/1/2**
- **High-speed Hardware Simulator**
- **Source-Level Debugger for C, PLM and Assembler**
- **24-pin DIP Emulation Header**
- **Serially linked to IBM PC at 115 kBaud**

APPLICATIONS

The main applications of the DS-750 Kit are: -

Evaluation of Philips microcontrollers
Demonstration of microcontroller capabilities
Development of microprocessor based systems
Hardware and software debugging purposes
Training in the field of microprocessors
Programming of Philips microcontrollers

The Ceibo DS-750 supports 87C750 Philips microcontrollers at any frequency allowed by the devices. It is serially linked to a PC/XT/AT or compatible systems and can emulate the microcontrollers using either the built-in clock oscillator or any other clock source connected to the microcontroller.

The clock oscillator generates 40MHz, 20MHz, 16MHz, 10MHz and 5MHz. Emulation is carried out by programming an 87C752 microcontroller with the user software and an embedded monitor program. The DS-750 provides the on-board programming capabilities and locates the monitor in the upper 1K that is not available for the 87C750.

Three working modes are available: real-time, simulator and simulator plus. In the real-time mode the user software is executed transparently and without interfering with the microcontroller speed. Breakpoints can be added to stop program execution at a specific address. In the simulator modes, an additional microprocessor is used to take control of the 87C750 lines and to simulate its operation but not in real-time.

This operating mode allows access to all the microcontroller functions (I/O, timers, etc.) and interacts with the hardware according to the user software execution or directly by means of emulator commands sent from the host computer. The combination of the two available working modes allows an easy way to debug hardware and software functions. The software includes C, PLM and Assembler Source Level Debugger, On-line Assembler and Disassembler, Software Trace, Conditional Breakpoints and many other features.

EXPERIMENTS

Five experiments demonstrate the capabilities and advantages of the 80C51 device and its derivatives. Completing each of the experiments will provide the user with more knowledge and experience.

1: Getting to know the DS-750

This experiment carries out several exercises to describe the functions of DS-750.

2: Data Transfer Instructions

This experiment helps you to understand the different addressing modes of the devices, writing programs that use the data transfer instructions, and transfer data and code to and from different memory types.

3: Input/Output Ports

This experiment shows how to manipulate Boolean variables, use the input/output capabilities of the microcontrollers, and how to assemble programs that use the ports of a microcontroller.

4: Arithmetic& Logic Functions

This experiment will help to make calculations with the microcontroller, replace logic circuits by microcontroller functions, and to write programs that use arithmetic and logic instructions.

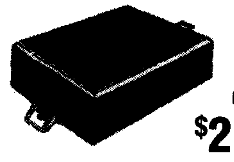
5: Control Transfer Operations

After completing this experiment the user should be able to understand the stack operations, write programs that use the control transfer instructions and pass control to subroutines.

The DS-750 system is supplied with a User's Manual, debugger and application software (including Cross Assembler), microcontroller documentation (huge databooks!), two samples of the 87C752 and one of the 87C750 (all windowed EPROM microcontrollers), RS-232 and interfacing cables and a power supply.

All you need to get up and running for just **$159.90**

Handy Bulkhead Box



only $2.75

Black ABS measures 87x67x30mm (ext). Internal 80x60mm approx pcb mounting. 11mm hole in long side for cable entry (non trap). Baseplate is recessed for easy sealing. Moulded-in mounting brackets. Ideal for car alarms and outdoor projects.
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