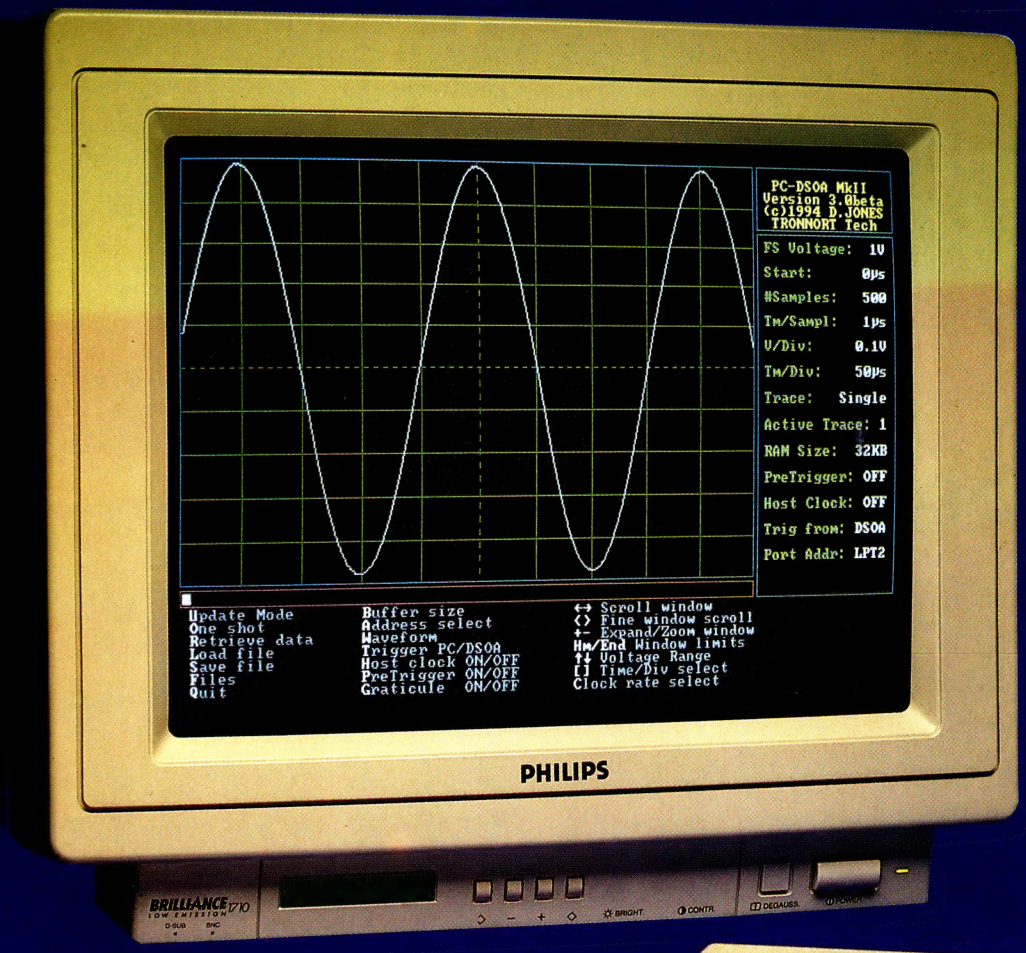
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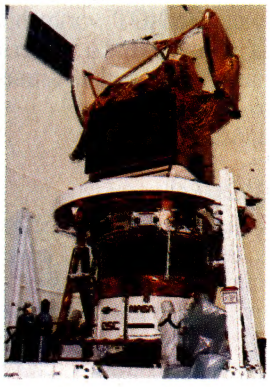
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Multimedia via CD-ROM



Whatever else multimedia software is bringing to our computers, it's certainly bringing a need for more storage capacity. So it's not surprising that so much of this new software is being distributed on 600MB CD-ROM discs, as Barrie Smith explains in his story starting on page 24.

NASA's ACTS project



Designed to allow the USA to regain the lead in satellite communications, ACTS will also show how best to use the 20 - 30GHz frequency band. Kate Doolan explains — see page 28.

On the cover

Our new DSO Adaptor Mk2 turns your PC into a very useful calibrated storage scope, with a bandwidth of over 100kHz, for only around $150. David Jones has also produced a matching version of his enhanced DSOA software, to make it really easy to use. (Pictures by Kevin Ling.)

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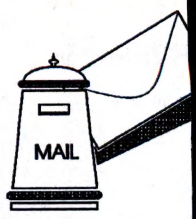
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Book Shop enquiries: phone (02) 353 9944
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Fax: (862) 890 4811, Adrian Batten.
ELECTRONICS AUSTRALIA is published by Federal Publishing Company a division of Eastern Suburbs Newspapers Partnership, which is owned by
General Newspapers Pty Ltd.
A.C.N. 000 117 322,
Double Bay Newspapers Pty Ltd.
A.C.N. 000 237 598 and
Brehmer Fairfax Pty Ltd.
A.C.N. 008 629 767,
180 Bourke Road, Alexandria, NSW 2015.
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No part of this publication may be reproduced in any way without written permission from the Publisher or the Managing Editor.
Printed by Macquarie Print, 51 - 59 Wheelers Lane, Dubbo NSW, 2830, phone (068) 843 444, for Federal Publishing Company.
Distributed by Newsagents Direct Distribution Pty Ltd, 150 Bourke Road, Alexandria, NSW 2015; Phone: (02) 353 9911.
ISSN 1036-0212
*Recommended and maximum Australian retail price.
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LETTERS TO THE EDITOR



Video copy protection

In regards to the anti-copy system, Macro Vision, being used by Roadshow and Fox Video on new releases rented through video outlets.

On communications with Fox Video I have expressed my dissatisfaction and the problems I am having in trying to view a video tape with Macro Vision system of anti-copy. My problem is that I get a series of white dotted lines appearing on the top left quarter of the TV screen for 15 seconds, then disappearing for 15 seconds; this continues throughout the trailers and the main feature. On investigation it effects different TV's in different ways, e.g., the contrast going from normal down to very dark, then back to normal. These flashes continue throughout the whole movie.

A representative from Macro Vision tested my video and TV and his conclusion was that my TV is 'too old', but I spoke with the TV manufacturer, who said that the TV is fine and they are aware of these tapes mucking up on new TV's as well as old ones.

At a rental fee of $6.00 per new release, the public expects high quality viewing with a clean, clear picture, which is not what is being received. In short I feel that the public is being discriminated against.

William Rea,
Mascot, NSW.

Tom's employment

Mr Moffat's article may have had an interesting headline, 'What IS unemployment, really', but I found the tone of the piece depressing. As usual he does have a gift of getting his story across, and I particularly liked his story about 'flubby', his mentor and hero. I also met a few 'flubbies' in my time, and I identified with the description.

Mr Moffat's sad experience of 'unemployment' is a bit hard to take. It was he who 'threw that all aside' and emigrated to Australia in 1968. It was he also, who threw aside the job in Melbourne and moved to Tasmania, 'for no other reason than the appeal of the place'.

In the backwaters, then, he worked on bright new toys, and did not look at the health of the industry employing him. No wonder he was surprised by the 'layoff' when it eventually came his way. Now he does freelancing work, has occasional jo as a musician, and writes. He seems to reminiscing about the days when he w fully employed, too.

It is a fact that it is almost impossible have a varied and colourful life, and i come, and full time employment, and work that is fascinating and fulfilling. M Moffat seems to have achieved this ai but at the cost of regular income, or som thing that is not quite clear from the to of his article. He did not answer the que tion that he posed in the headline, but h has caused the grey matter to activate.

Thanks for the input, Mr Moffat, apa from us all becoming carpenters, wou you consider continuing the theme in further article? Redundancies seem to be legitimate management tool these da and to hell with the loss of valuabl knowledge and experience. If I could, would like every person who has ex perience of a 'redundancy' to write to th powers that be and tell their tale.

From this might come some recognitio that 'redundancies' are NOT cheap for th enterprises concerned, are NOT the way t cut costs, and are NOT worthwhile for in dividuals who have no experience o money management and investment.

Andrew Hope,
Forrest, ACT.

Help needed

I need the help of an electronics en thusiast to develop an idea I have, involv ing electronics, light and music.

Therefore, I thought if you were kin enough to publish this letter, it woul enable a South Australian reader who i looking for a new and possibly profitable challenge to contact me.

Kerry Gray,
3 Myrtlebank Tce,
Stonyfell, SA. 5066.

Valve amp review

The Challis report on the Artemus AS60M stereo valve amplifier is certainly one of the most interesting technical articles published in recent times.

By comparison with valve amplifiers of 25 to 30 years ago, the performance is most impressive. The frequency response (probably better than really needed) is indeed a tribute to the designer of the output transformers. The complex construction

ssential to achieving such results is no doubt a major contributor to the high cost of the equipment.

Whilst some aspects of the report might have been anticipated, the very sharp rise in distortion approaching overload is rather different to that exhibited by most valve amplifiers of former times. With overall inverse feedback limited to 20dB or so by phase shifts at both ends of the audio spectrum, these earlier amplifiers were said to overload 'gracefully'. Such behaviour has been cited in some circles as a good reason for retaining valve amplifiers.

By comparison, transistor amplifiers without transformers but utilising 40dB or more feedback tend to 'crash' quite abruptly as overload is reached. Since the test results on the new valve amplifier under review indicate rather similar characteristics, is it likely that additional feedback allowed by the superior output transformers has changed one of the special features generally associated with valve amplifiers in former years?

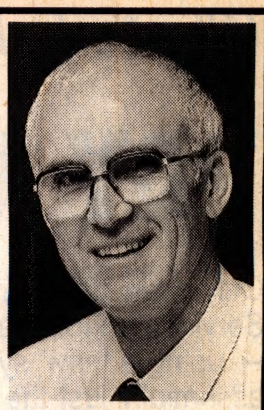
The comment by Mr Challis that 'valve amplifiers cannot currently produce power outputs comparable with the biggest transistor amplifiers' is no doubt in reference to valves intended for normal domestic equipment. In this regard, it is interesting to note that, during the 1960's, audio amplifiers using air-blast-cooled valves to produce up to 70kV output were being made in Australia for use in high level modulated radio broadcast transmitters. Their frequency response was within 1dB from 30Hz to 10kHz, with less than 2% total harmonic distortion at full output and residual noise 65dB down.

In conclusion, one might ask why return to valves for domestic audio equipment, when it can all be done as well or better with transistors at much lower cost and without the ongoing outlay for periodically replacing expensive valves? In this connection, I am reminded of the philosophical observations of an eminent engineer in the mid-1950's: "Within ten years there will be two civilisations; transistorised and non-transistorised. If we are going to belong to the latter, we had better start planting cabbages now!" Has anything changed?

Winston T. Muscio, MIE Aust. CPEng.
Leumeah, NSW. ❖

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

EDITORIAL VIEWPOINT



Another lurch forward towards Australia's Pay TV future

A few weeks ago, hitherto unknown firm Cable Television Services announced that in July it would begin 'broadcasting' 10 channels of Pay TV in Sydney and Melbourne, using a hybrid cable system based on Telecom's optical fibre network to the local exchanges and then via RF on coaxial cable, for the 'last mile' to the subscribers. As Stewart Fist notes in his feature article starting on page six of this issue, this looks to be essentially the same analog cable system which has been used in countries like the USA, since the 1970's.

It looks, then, as if some of us will have the opportunity to subscribe to Pay TV services sooner that it seemed. This will be good news for those in the areas concerned who are keen to extend their viewing (and to get a toehold on the 'interactive media' future), and will no doubt also be good for the economy — by generating more jobs for cable installers and technicians.

But at the same time it's also a bit confusing. For a long while the Federal Government seemed to be determined that when Pay TV came to Australia, it would use digital technology and be delivered by satellite. If it took a while for the technology to be perfected, we were just going to have to wait; Australia wasn't going to rush in and use the same obsolete technology as other countries.

The same basic argument was used last year, when it appeared that Australis Media was getting ready to begin transmitting Pay TV using microwave distribution (MDS) for the last mile — sooner than could be done by the firms who had paid hundreds of millions of dollars for the satellite distribution licences. MDS was 'inferior technology', said a Government spokesman, and should be delayed at least until satellite distribution was established.

Now, it seems, the commitments to both digital transmission and direct satellite delivery have been quietly shelved, and tacit approval given to use of a system that could have been used to bring Pay TV to Australia years ago...

This makes it pretty clear that the reasons for delaying the start of Pay TV here *never were* technical, but in reality based on politics, economics and media control. Presumably now things have changed, and for reasons most of us will never know the Government has finally decided to let it all happen, as soon as possible and using whatever technologies are available.

But despite the fumbling and obfuscation, I don't see any great problem if Pay TV finally starts here using analog transmission via a hybrid optical/coaxial distribution system. Analog VHF/UHF transmission by cable may be obsolete, but at least it's well proven. And once the cables are in the streets (which is the expensive bit), it shouldn't be all that difficult or expensive to change over to digital transmission.

Mind you, it's going to take a long time to lay cables to potential subscribers in even our metropolitan areas — as well as a huge amount of money. And subscribers aren't going to like throwing away their set-top analog decoder boxes later on, to replace them with the digital successors.

Frankly I still believe that for Australia a combined satellite/MDS delivery system will be significantly lower in overall cost. Digital video communications technology is now so close that launching with an analog system seems rather foolish.

But hopefully now that the Government is opening the door to competition, we'll soon be given the opportunity to choose an alternative digital/satellite/MDS system, if we wish.

Jim Rowe

What's behind this sudden decision to give us

PAY TV BY CABLE?

Only a few days before this issue went to press, Telecom Australia and a firm called Cable Television Services announced that they would be 'broadcasting' 10 channels of Pay TV in Australia, from July — using a 'new' system they described as 'hybrid optical-coaxial'. But is this system *really* new, or essentially just the same analog CATV system used overseas for at least a decade? Another obvious question is why Pay TV now looks like starting with cable, when until now the Government has been so determined to use satellite distribution. We decided to ask Stewart Fist for a quick background on the subject, and here's what he produced.

by STEWART FIST

The problem with talking about cable television is that it can mean any one of a number of totally different technologies — and this is a fact that hasn't escaped the public relations people at Telecom, whose job it is to put a 'spin' on various stories.

They've just announced, with much pizzazz and banner-waving, a 'totally new concept' in cable television which will be introduced into Australia this June. It's called a 'hybrid optical-coaxial' system, according to the handouts — and that makes it appear to be something like the 'fibre-to-the-home' which we've heard about *ad nauseum* for the last decade, or ADSL (Asymmetrical Digital Subscriber Line) which is the more recent proposal to shunt video over the normal copper-pair cables already in our streets.

But this isn't so. Don't be fooled by PR-invented terms: there's nothing being proposed here that is remotely like a switched telephone service for video, and nothing that hasn't been available in America for yonks.

'Hybrid optical-coaxial' is nothing more than the plain old 'Tarzan-cable' (coaxial which 'swings from pole to pole down your streets') system as used by every cable operator in the world, since cable TV first began back in 1948 as 'Community Antenna TV' (CATV). Telecom will admit this in private, but they are still publicly boosting the technology as a revolutionary change 'which will bring the data superhighway to our homes'.

And in this dog-eat-dog world of media monopolies, the sudden introduction of this technology after 50 years of government prohibition has allowed Telecom, CTS (Cable TV Services) and the PMT (Packer-Murdoch-Telecom) consortium to steal a march on the satellite pay TV licensees (who paid $200 million for the privilege) — and introduce a 10-channel pay network well ahead of their rivals. Packer and Murdoch haven't yet announced *their* plans, but they are waiting in the wings — and fighting legal battles to stall the satellite licences.

The real questions here are:

- Why has Telecom reversed its stance about using a switched telephone network for video? Why now a completely separate parallel network for video only?
- Why wasn't coaxial cabling permitted 10 years ago? What changed in the last few months to permit this to proceed? and,
- Why did the government offer 'exclusive' satellite licences to two American companies for $200 million; then stop Cosser's MDS plans from proceeding until after the satellite was in operation; then permit Telecom to break the prohibition?

In view of the much-touted new 'competitive' policy in telecommunications, we could also ask: Why is Telecom now being permitted to monopolise both forms of local-loop connection — telephone and cable? In the rest of the world, phone companies have long been prohibited from offering cable services, to provide competition in the local customer access network.

At the time of writing, Telecom still hasn't released tender documents for the new network and it won't comment on the technology to be deployed. But there are enough hints and facts to go on; so we have a pretty good idea of how they plan to proceed.

They say, for instance, that the cable

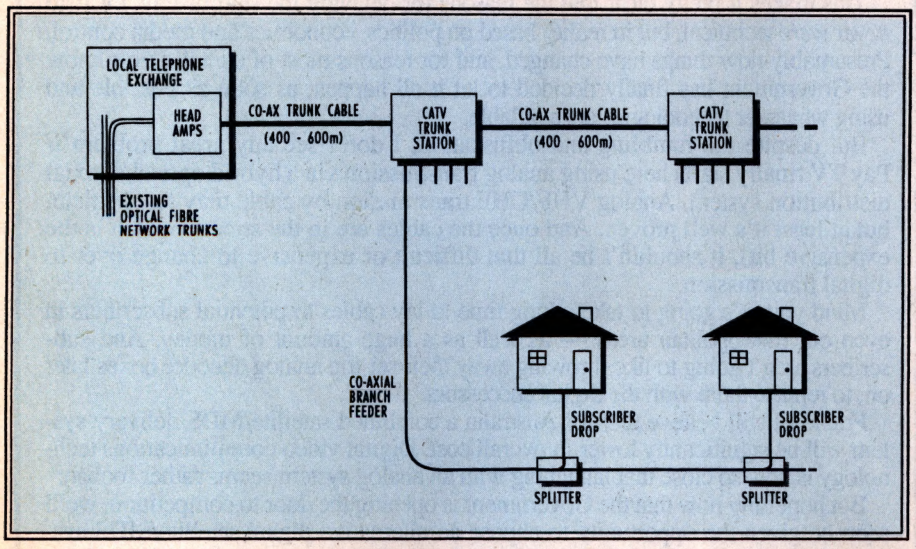


Fig.1: As far as we have been able to determine, the CTS 'hybrid optical-coaxial' distribution system uses the existing optical fibre network, and only as far as the 'headend' amplifiers at the local telephone exchange.

system will be mostly underground (which is a relief), since they already own the street ducting. Technical journalists have been told that their cable 'plant' can carry about 67 channels using 'headend' amplifiers installed mainly in local telephone exchanges. The 'hybrid-optical' part of the claim, we now know, comes from Telecom distributing the signals to these headends via the normal inter-exchange and intercity fibre-optic network — as does virtually every cable operation in the world. (Unless they use the far cheaper satellite; but here that's owned by Optus!)

Telecom says that it expects to spend $700 million on the new network in the next three years, and, in the process, they'll *pass* 1.1 million homes. They've also contracted with the program providers to *pass* 150,000 residences in the first 12 months, and they expect to sell connections (at a one-off price of $200) to one in three homes. I would have thought that two strong men and a trained chimpanzee could have threaded the coaxial *past* 150,000 residences in a *month*, if they were to start with high-rise apartment areas. But maybe it's more difficult than I imagine!

Subscription costs for the initial programming will be about $43 a month (with an extra charge for one or more pay-per-view 'premium' channels), for the first 10 channels. Some of this fee will be paid back to Telecom for maintaining the links. The first subscription service is to be run by a couple of ex-Channel Nine executives, using a company structure called Cable Television Services (CTS) which they say is 'quite independent of the PMT (Packer-Murdoch-Telecom) consortium'. I make no comment here!

Technical details

What you can deduce from the released network information is that Telecom's system is planned around the 10-year old technology developed in the US to carry 70 x 7MHz channels over a bandwidth from 54MHz to 550MHz. A lot of this second-hand cable gear, already equipped with amplifiers and all the other paraphernalia has suddenly come onto the market — and it's being flogged around the world at rock-bottom prices.

I have no evidence that Telecom will buy second-hand plant; but there's a lot of it now available cheaply — because many American cable companies are now converting to a later technology. This is now about two years old, and it extends the bandwidth up to 750MHz and 100 channels. These companies need to increase their channel capacity and boost the two-way facility of their networks, through upgrades. They know they've got to fight the Hughes DirectTV satellite project with 200 channels on offer, and be prepared to defend themselves against the mergers and takeovers of the regional phone companies.

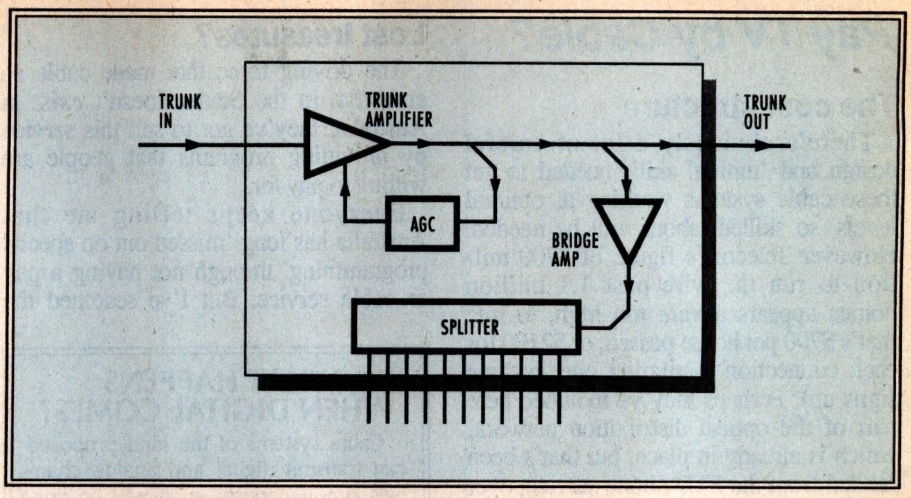


Fig.2: Inside each CATV trunk station, there is a trunk amplifier used to regenerate the FM signals (with AGC), and also a bridging amplifier driving a splitter to produce these signals for each branch feeder line.

'Interactivity' is also increasingly important in cable systems these days. Cable networks now reserve frequencies between 5MHz and 35MHz for a backward channel, and a crossover guard-band is then left from 35MHz to 47 or 54MHz. The useable video bandwidth then extends from this point up.

Downstream (video) amplifiers are spaced about every 400 metres along the cable (depending on the number of taps), and upstream amplifiers (for the interactive signals) are spaced at about 2km intervals. The home TV set needs to receive a signal level between 0 and +12dBmV.

While there's still a lot of interest in AM (amplitude modulation) for cable TV, most systems today use FM (frequency modulation). The cable 'plant' is a reasonably standard 75 ohm coaxial in street ducting, but special 'messenger' cables are required (with steel-support strength members) for pole-to-pole deployment.

As with all coax, attenuation is a function of the frequency (the higher channels lose more), and this introduces problems in terms of the linearity of the trunk amplifiers. It is also very important that all components of the system are matched in impedance to prevent standing waves, ghosts and picture degradation.

Larger diameter cable generally exhibits lower losses across the board. The two cable thicknesses most widely used in America are: '500' (actually 0.5" diameter) for branch lines along side streets, and '750' (0.75") for the main trunks. House-feeder connections ('drop lines') are thinner (RG59 and RG6) cables, tapped into these branch lines via splitters or directional couplers.

Signal levels along a cable network need to be carefully calculated and controlled at all stages. A splitter usually divides the signal power two ways, while couplers control the amount of signal passing across to the coupled port. Every house will usually have its own directional coupler to act as an isolator, and so prevent hash getting back into the system.

One characteristic of a cable network is that you can fill the available bandwidth with channels if adjacent channels are at nearly the same power level. Terrestrial television must leave gaps in the spectrum, because adjacent channel signals arrive at the home aerial at different strengths, and they will interfere with each other. For this reason adjacent channels are never used in the one location.

In cable systems every channel-slot can be used, because the headend amplifiers control the power output of each, and so any 'cable-ready' tuner (on a modern TV set or a decoder box) can make the distinction. To improve channel isolation it is also common for the carriers to drop the audio level by between 6dB and 10dB, since it is the audio which most often intrudes into the adjacent video.

WANT MORE INFORMATION?

The best source of information on PAL cable TV network design, construction and troubleshooting is the two-part *Coop's Technical Bulletin No. 9401*. This is available from New Zealand by faxing (64-9) 406 1083, or from local agent AV-COMM Pty Ltd, of PO Box 225, Balgowlah 2093; phone (02) 949 7417, or fax (02) 949 7095.

Pay TV by Cable?

The cost structure

There's obviously a lot of careful design and 'tuning' skills needed to get these cable systems working at optimal levels, so skilled labour will be needed. However Telecom's figure of $700 million to run the wire past 1.1 million homes appears a *mite* too high, to me: that's $700 per house passed, or $2100 for each connection (assuming one in three signs up). Perhaps they've included here part of the optical distribution network, which is already in place; but that's been funded from the STD phone service, over the last decade.

Perhaps it now becomes clear why Telecom has been so massively over-engineering its long-haul optical fibre network. Without cable TV, it is hard to work out why a town like Longreach (pop. 4000) in Far Western Queensland has access to a six-fibre trunk cable running at 565Mbps (megabits per second) — equivalent to 53,000 simultaneous telephone calls (using ADPCM).

The normal cost for the coaxial network in the suburban streets is more in the order of $100 per home passed, rather than the $700 figure that Telecom quotes. If they connect one-in-three homes, and collect a $200 connection fee, they'll only be $100 out of pocket plus the cost of the set-top decoder/convertor — and they'll soon pick that up through the monthly fees from the program providers. From their viewpoint, this must be a win-win situation.

But *will* they connect one-in-three homes? In most parts of the world the early success of cable TV has been directly related to the poor quality of over-air reception — due either to distance, geographical obstruction, or simple inner-city interference. So initially these US cable networks were community-antenna systems, just supplying amplified antenna feeds of the main broadcast networks.

Also, when UHF came along in the 1970's, many American TV sets weren't equipped with tuners that could handle the new service. Cable provided an alternative to buying a new set and installing a new antenna. In fact, all American cable licensees are subject still to a 'must-carry' rule, which forces them to carry all major 'free-to-air' channels as part of their unscrambled 'basic-rate' service. This rate is capped by the FCC (Federal Communications Commission).

So far, there's no suggestion that Telecom's cable network will carry free-to-air services — and there's little need for this in most areas of Australia anyway.

Lost treasures?

The driving force that made cable so attractive in the States doesn't exist in Australia; they've got to sell this service by providing programs that people are willing to pay for.

Everyone keeps telling me that Australia has long 'missed out on special programming' through not having a pay or cable service. But I've searched the world for the massive library of films and programs which must certainly exist after all these years of deprivation — and so far I've failed to find it.

It is important to realise that 'basic cable' in the US has nothing to do with 'pay TV'. The monthly fee (roughly $30 per month) you pay for your initial cable services in the States is for the supply of an amplified clean signal of what we would call 'free-to-air' channels. The programming is still financed, as in Australian commercial stations, by advertising revenues.

Premium cable services in the States are then special channels which cost you more (usually another $10 per month). This is the equivalent of our Pay TV concept. Normally only six pay-channel services are provided to most homes, and they are always scrambled to ensure that normal basic-rate subscribers can't watch the best movies, sports and events without paying the extra monthly cost.

A further and more recent development has been the addition of pay-per-view 'premium-premium' services. Here you pay a special one-show fee (US$45 for the Mike Tyson fight, for example) to watch a special film or sporting event. This is billed (usually) via credit card using phone authorisation. This service can only be offered where modern decoders can be individually addressed from the headend, and where an authorisation code can send permission to your unit to decode a special channel.

Pay-per-view will be offered as a premium service, Telecom says, so it must be planning to use either a back-channel on the coaxial cable, or force you to dial-up for permission to view. They won't say which.

The Australian proposal also links the cable-facility fee with the programming services (under the existing rules, advertising is prohibited from these channels for the first five years). CTS says that initially it will offer 10 channels for $40 per month, but some of these will be reserved for 'premium' pay-per-view.

Other providers will also soon be bidding for the other 60 channels — especially after CTS has broken the ground, taken the risks, suffered the high programming costs and low income returns, and established the market over the next two years.

When you project cash-flows for a cable company like this, you quickly discover that the first program-provider on a new network must lose about $100 million (projected Australia-wide) over the first few years, while the network is being developed. So the wise companies start second... ❖

WHAT HAPPENS WHEN DIGITAL COMES?

Cable systems of the kind proposed can transmit digital and analog channels simultaneously, so it will be possible for Telecom to progressively migrate the network to digital. It is generally held that a 7MHz wide analog channel can be subdivided to provide perhaps four digital channels, each using a dynamically-variable version of the MPEG-2 compression system. With pre-compressed movies (but not real-time programs), some experts think we might eventually jam as many as 20 digital signals into 7MHz of bandwidth.

During the transition, the set-top converters (now called 'translators') will be constructed to detect and unscramble either analog or digital signals, and automatically transmit any special billing information (such as pay-per-view purchases) over the back channel to the headend of the cable network.

Eventually, when all channels are converted to digital, we can anticipate the delivery of 320 television channels (assuming the four-times channel gain), or up into the thousands. But the term 'channel' then takes on a new meaning.

Many of digital signal-bands will, of course, be used for time-delayed replay of the same feature film, to provide a near-video-on-demand (NVOD) service. This is where, say, six or eight signal-streams are reserved for the one 'blockbuster' movie, which starts on each successive channel, at times 15 or 30 minutes apart.

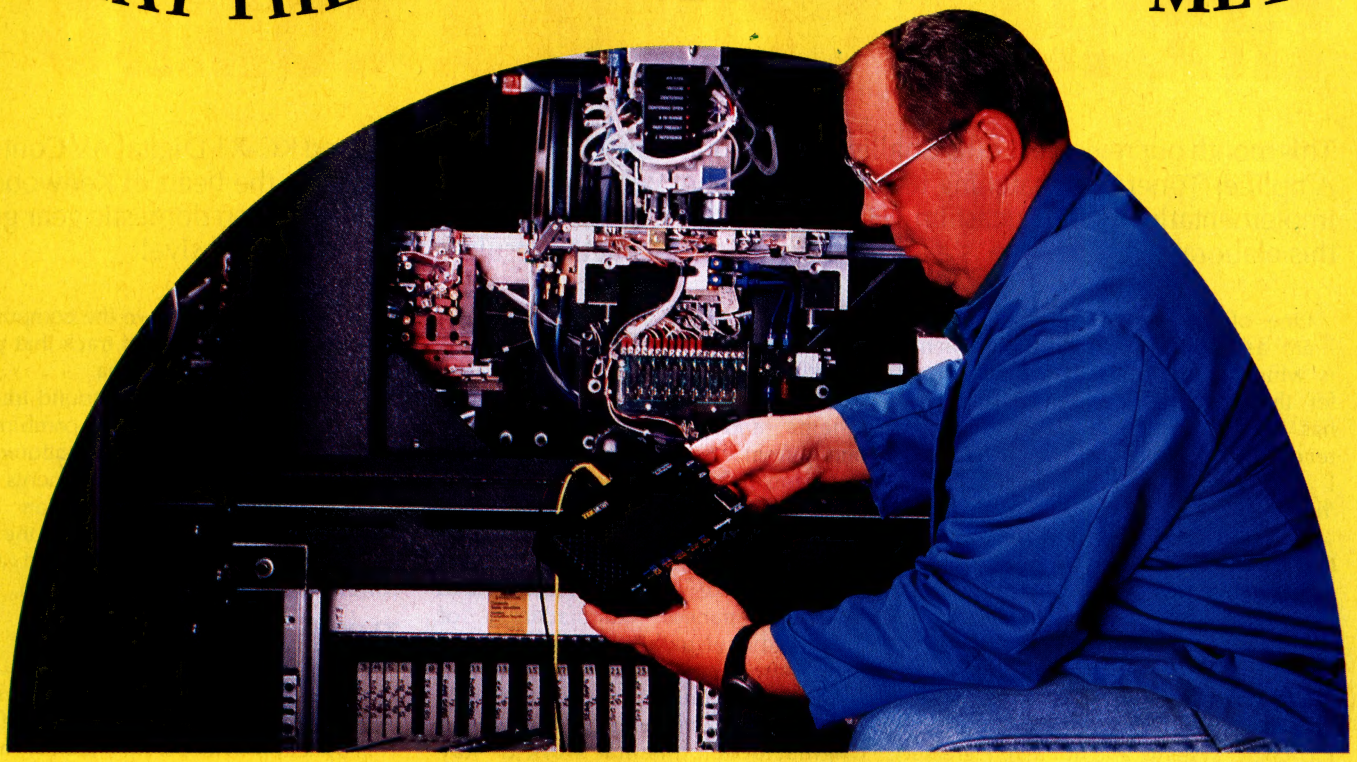
With 300 channels available, we can anticipate that up to 100 channels will probably be used for NVOD: the top 10 movies will be given say six or eight channels each and the second 10 say three or four channels each.

True video-on-demand (VOD = one-to-one transmission) may also be possible over, say, another 100+ channels, at a price set high enough to discourage any overload of the service. The remaining channels will carry both the normal 'common-denominator' material, and services for some of the more important niche markets — such as gardening, fashion shows, home shopping and the major sports.

This is the Brave New World.

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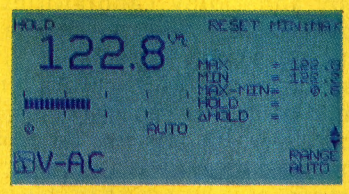


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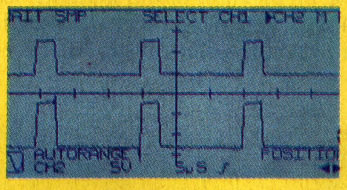
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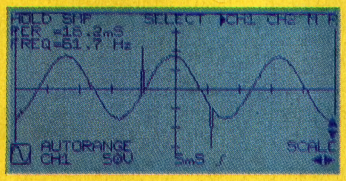




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READER INFO NO. 3

KENWOOD'S KC-X1/KM-X1 THX HOME CINEMA COMBO

This month our reviewer Louis Challis had the opportunity to try out the Kenwood KC-X1 Digital AV Contro Amplifier/Tuner and matching KM-X1 Six Channel Power Amplifier, which form the heart of Kenwood's implementation of the Lucasfilm THX Home Cinema System. He discovered that when domestic gear gets this elaborate, setting it up is a far from trivial task — but the results can be *very* impressive!

One of the most frequent questions I am asked by my friends and clients is which components they should buy for their home hifi systems. That task has been difficult enough, without the recently added dimensions (or should I describe it as complications), of 'home video'.

By now many of you will be aware that Dolby Laboratories (with their Dolby Pro-Logic System) and Lucasfilm (with their THX Home Cinema System), have developed the technology through which two sound tracks on a laserdisc (or on a pre-recorded VHS tape) may carry four channels of sound when using the Dolby Pro-Logic system, and for even greater excitement can now offer the added attraction of six channels when using the Lucasfilm THX system.

Whilst both the Dolby Pro-Logic system and the Lucasfilm THX system were initially developed for cinema use, those developments were simply re-worked to satisfy the requirements of the potentially unlimited dimension that home video systems would offer. The market was so large that Lucasfilm decided that there would be as much money to be made from home users as there would be from large cinemas. The home system was therefore designed to reproduce all of the exciting audio characteristics of a large cinema, and transpose you and your family from what would otherwise be a mundane living room, into some other place which would be perceived to be 'another world'.

Not so surprisingly, the foremost proponents of such systems have been the Japanese manufacturers of AV (audio visual) equipment. Those firms have been ably aided and abetted by Dolby Laboratories, and of course Lucasfilm, who have used the original developmental work of Ray Dolby and Dolby Laboratories to produce what is now seen to be an even more exciting system.

As I discovered, 'all is not what it may seem to be in a conventional film', and specifically when it comes to the content of the sound track. I was amazed by my discoveries as to how much trouble is ultimately taken by any major film studio in the preparation of the multiple sound tracks of a typical block- buster film. There can be as many as 10 different steps taken in laying down the composite audio signal, on the sound track that you ultimately hear in the cinema.

Because those composite sound tracks are separately, and carefully combined, as a result, it is relatively straightforward to separate out their components in such a way as to generate an optimum sound track which satisfies the requirements of a THX equalised and correlated sound track.

THX goes further

Whilst the Dolby Surround Sound Decoder system provides for a nominal four channel capability, the Lucasfilm THX system provides a significantly more potent performance because of its adoption of a six-channel system with two front or main speakers and two surround speakers, with one of those speakers at each side of the room.

The surround speakers have special dipole characteristics — so that they radiate both fore and aft, and they are supplemented by a centre speaker, whose primary function is to cater for the voice content on the sound track.

The THX system also goes one step fur-



ner with its provision of a sub-woofer hannel which provides the dynamic udible 'punch' which is required by explosions, crashes, and those sickening unches to the face and body which disurb my wife and family.

In order to extract the optimum acoustical signal, you must have appropriately elected speakers. I found it interesting to ote that Lucasfilm Limited actually icence various speaker manufacturers to roduce speakers with special characeristics, which have been carefully ailored to conform to Lucasfilm THX's nternal and well researched standards.

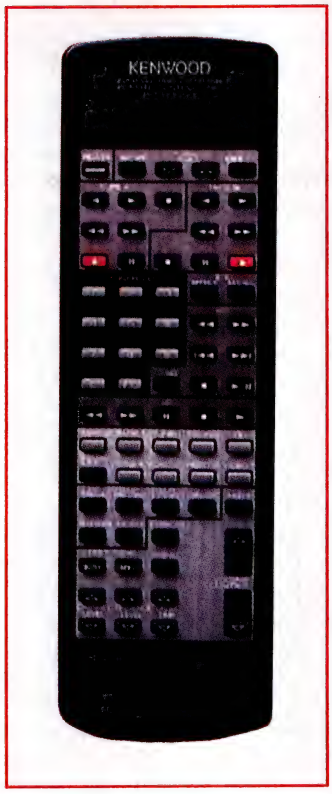
In a large commercial cinema, there re relatively few problems involved n installing and correctly aligning the ensitivities and level settings of ach of those discrete speaker systems. When they are correctly aligned, and ll relevant physical and acoustical arameters adjusted, they will then faithfully conform to the Lucasfilm requirements.

Those speakers individually produce the correct components at the appropriate point within the cinema, so as to envelope you in a sound field which is designed to produce a special brand of 'reality'.

You and the rest of the audience then become an integral part of the action — a bystander who has the uncanny sensation of feeling that 'you are there', with the actors on the set as the action takes place.

When however, you attempt to display that laserdisc or VHS tape in your mundane residential living room, you are likely to experience a variety of problems, so that even if you are a skilled home enthusiast, you could anticipate various difficulties in correctly aligning or adjusting the sensitivities of pre-amplifiers, amplifiers, and most particularly, those of the speakers.

The speakers in particular require very careful, if not critical placement, both in their plan positions, as well as in respect of their heights above the floor, in order to achieve an appropriate balance between each of those six channels.



The infrared remote control unit which comes with the KC-X1 becomes the control centre for your home cinema system. It has the ability to 'learn' the codes to control your signal source equipment, as well as the KC-X1.

A little more than a year ago, I evaluated one of the first generation Dolby Pro-Logic Home Video Surround Systems from Kenwood, and although I was impressed by its performance, I was critically aware of the magnitude of the complex adjustments required to cater for differences between the various loudspeaker sensitivities, their directivity and their placement, in my living room, in order to optimise the aural performance of that system.

On that occasion I used a sound level meter and various external test tone inputs — which proved to be relatively easy for me, but obviously would prove far more complex for the average home enthusiast.

Lucasfilm, their software licensees and the 'avant-garde' AV equipment manufacturers, like Kenwood, foresaw the intricacies of that problem. They joined forces to produce a new range of home video products, which removed most of the complexities associated with the alignment of a multi-channel system, and did so in what I regard as being a very practical way.

Because the acoustical characteristics of the system require specific parametric performance, they specified what those performance parameters should be, so that each of the licensees would produce decorrelation equipment in their primary hardware, which faithfully and accurately separates out the six channel data. They went further, and separately licensed speaker manufacturers to produce speakers dedicated to that task which when connected up to the multi-channel amplifiers which form part of the sound amplification and generation chain, would then produce the appropriate sound field characteristics in most, if not all residential living rooms.

Now it is most unlikely that you will have had the opportunity to experience the sense of realism, and the audible sensations which a well designed and correctly specified and installed home video system can provide.

The closest thing that you would have come to experiencing that sort of sound quality, would have been at your local cinema when you saw a film like *Terminator 2*, or *Hunt for Red October*. Both of those films offered exceptional sound quality, and *Terminator 2* cer-



tainly incorporated the Lucasfilm THX system to great advantage. As I discovered last night, anything that cinema can do a good home video system can do just as well — with the right hardware and software.

As you may recall, the sensation of audio realism achieved in *Terminator 2* owes as much to the Lucasfilm's THX system, as it does to the superb photography. The latest laserdisc version of that film also incorporates Dolby Pro Logic, supplemented by Lucasfilm THX Sound.

Without the appropriate Dolby Pro Logic decoder and the THX Sound decorrelator in an appropriate control amplifier, with multi-channel power amplifiers and matching speakers, you could not reproduce the essential aural and acoustical cinema quality sound in your own living room.

The Kenwood system

Kenwood Corporation of Japan was amongst the first Japanese high fidelity system manufacturers to take up the Lucasfilm THX licence, and they have now released a new generation of hardware which they claim to have designed to satisfy the requirements of the novice who has no pre-training or experience in this field.

The system with which I was provided for this review was a Kenwood KC-X1 Digital AV Control Amplifier and a KM-X1 Power Amplifier. Both of these items of equipment have a similar appearance, and are deceptively small when you consider that the KM-X1 incorporates no fewer than *six* separate 100-watt amplifiers. Because the acoustical characteristics of the surround speakers and the sub-woofer play a critical role, Kenwood also provided those items to assist in the subjective review.

The speakers that they provided were two 'Snell Multimedia' surround speakers and a 'Snell Multimedia' Sub Woofer, both of which I noted were manufactured under licence to Lucasfilm and conform to their demanding performance requirements.

Fortunately, I already had a Pioneer CLD-1750 single bit laserdisc player at home, and initially I used a pair of B&W 801M speakers for the important front channels. I supplemented those speakers with a single B&W DM110 for the centre speaker.

Whilst I was reasonably impressed by Kenwood's previous generation of home video equipment, the company's latest generation is even more impressive.

The KC-X1 Control Amplifier forms the heart of the system, and although this is intended to be simple and straightforward in its use, it incorporates a number of unusual features which the handbook does not explain quite as well as I would like. As I soon discovered, these may initially prove to be a trifle daunting.

Both the KC-X1 and the KM-X1 are incorporated in relatively large black cabinets, with lettering that can only be read under good lighting conditions — which is not necessarily the situation that prevails when using them at night time, in what is likely to be a poorly illuminated room. The backs of both units are well labelled, but incorporate an unbelievable array of video and audio terminals...

The task of interconnecting the two units can be tiresome if you attempt to do it with standard RCA patch cords. The task is however far easier if you use a single 8-pin DIN cable, or alternatively by means of a special 25-pin 'D' connector cable, for which sockets are provided on the rear panel of both units.

Fortunately, I was able to borrow a 'Monster Home Theatre Interlink' Type 406HT cable from Convoy Electronics, and that halved the time and complexity of interconnecting the units.

Regrettably, one still has to provide separate input cable connections from all of the peripheral equipment that you wish to connect to the control amplifier, and separately provide cables to interconnect the power amplifier to six sets of speakers.

Fortunately, Convoy lent me some additional Monster cables for connecting the speakers, and as the KM-X1 has 12 of the best 'universal' speaker sockets which I have yet come across — they accept both banana plugs, wires, spade lugs and proprietary speaker cord hooks — this again simplified the interconnection task.

Kenwood's original intention may well have been to produce a simplified system; but when you try to incorporate a many inputs and outputs as are presente by various terminals and connectors o the rear of the Kenwood KC-X1, then th chances are that you will misplace on or more of your interconnections.

So simplifying elements like the DB-2 interconnecting cable, or the 8-pin DIN cable are worth the time and trouble, i for no other reason than they simplify what would ultimately prove to be a 'birds nest' of wires and cables, behind and between the two primary system components. By using the Monster Home Theatre DB-25 Interlink, the interconnection task was 'dead easy', and in no time flat I had the THX system ready to roll.

Smart remote control

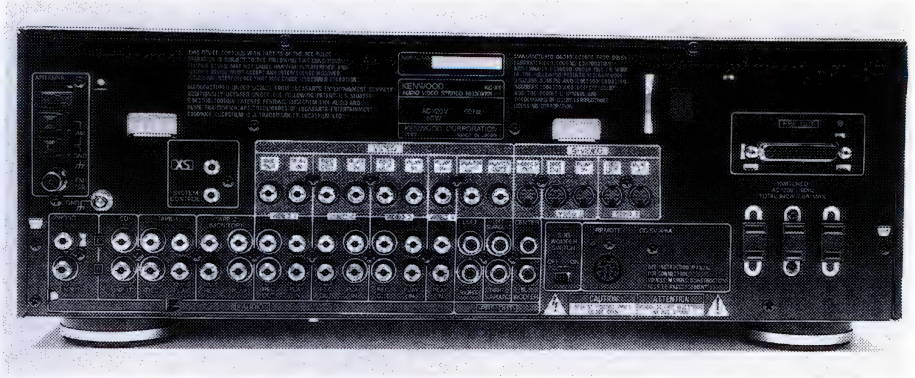
With the possibility of so many input and output connections, and with such a multitude of functional control variations, the front panel of the KC-X1-Control Amplifier might well have looked like the cockpit of a Boeing 747.

Kenwood's approach to resolve this problem has been to provide a 'Universal Programmable Remote Control Unit RC-R0900'. Frankly without that remote control unit, the operation of the Kenwood KC-X1 would have proven to be very daunting, and I have no doubt far too difficult for most people.

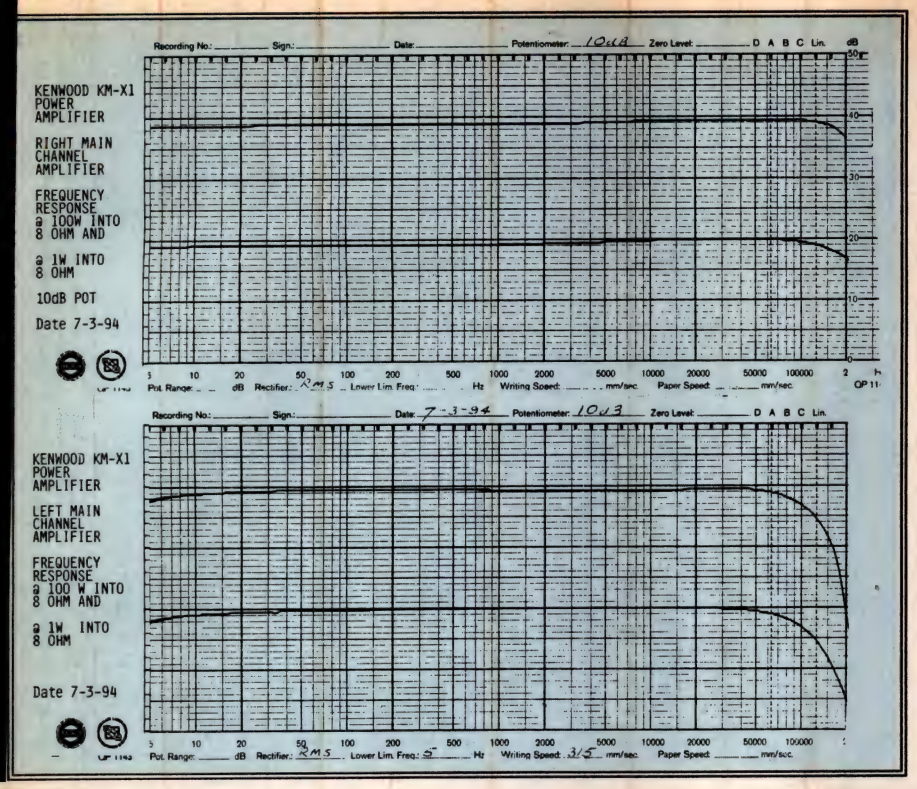
Because the Kenwood KC-X1 will interconnect with other manufacturer's VCRs, CD players, cassette decks and even video decoders, as well as either video or TV monitors, the magnitude of the control problem was even greater.

To avoid the need for up to six separate remote controls, Kenwood followed the lead of Yamaha and other manufacturers, and have provided a remote control which can learn the infra-red transmitter codes of the other remote controls you already have to operate other items of equipment, which you would undoubtedly wish to connect up to the KC-X1.

When switched to the normal TRANSMIT mode, the remote control can fulfil a



The rear of the KC-X1 control amp/tuner has a bewildering array of connectors, as you can see. Luckily, the interconnections with the KM-X1 power amplifier can be simplified using cables with either eight pin DIN or DB25 connectors.



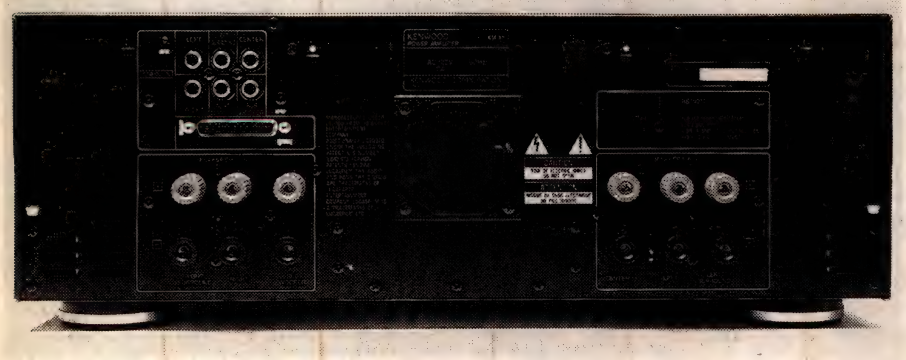
The frequency response curves for the KM-X1 power amplifier main channels, in each case operating at power levels of 100W and 1W into eight ohm loads.

multi-functional roll, and so instead of reaching for at least three separate remote controls, which I would have initially found myself doing last night, by appropriate interfacing of the other remote controls with the Kenwood RC-R0900, so that it would learn their functions, it learnt their roles and their instructions and it can now 'do it all'.

As I soon discovered, the RC-R0900 remote control mirrors all the important controls on the front panel of the KC-X1 — many of which are difficult to access without having the handbook by your side and following a step-by-step approach. The remote control provides a far more simple and straightforward means of accessing the relevant controls.

More importantly, it incorporates two sensible main pushbutton volume controls to increase or decrease the sound level, and separate push buttons for increasing or decreasing the channel level, presence level and delay time, as required.

The KC-X1 caters for more than just home cinema requirements, and inputs are provided for a standard magnetic phono cartridge, and for external cassette players, CD players and video recorders. The KC-X1 also incorporates a good stereo FM tuner with a reasonably good sensitivity, with a dedicated 75 ohm coaxial input, and an internal AM tuner, which has a rather limited frequency bandwidth and which I feel would most probably be only used to listen to the news. The AM tuner is however provided with an external loop antenna, which is quite effective.



The rear of the KM-X1 power amp, which provides no fewer than six 100W amplifier channels. The thermostatically controlled cooling fan only operates when the amplifier is worked hard for long periods.

Five modes

The strength of the KC-X1 is the breadth of its home theatre functions, and it provides five different modes of operation. The first of these is Dolby Pro Logic mode, and this is similar to the system used in most cinemas — providing a distinctive, and in some circumstances, an unquestionably powerful experience by expanding the 'spaciousness' of the sound.

This is achieved by decoding the signals embedded in the stereo sound track to provide five channels: two front and two rear, together with a single 'centre channel', which provides the spatial sound characteristics as typified by *Hunt For Red October*.

A test tone generator is incorporated in the KC-X1 to simplify the adjustment of the individual channel levels, so that they all have approximately the same level at the selected seating position.

The second system mode provided by the KC-X1 is Dolby 3 Stereo, which makes use of the two front speakers and centre speaker, with conventional stereo recorded material which has not been encoded with either Dolby Pro Logic or the Lucasfilm THX system.

The third, and prospectively the most important decoding mode in the Kenwood KC-X1 is the THX cinema system. This provides what Kenwood describes as being 'an uncompromising home cinema experience', and provides the enveloping realistic presence which only a six-speaker configuration with full surround can achieve.

The fourth mode is conventional DSP Logic decoding, of the type originally developed by Yamaha. This allows you to select a limited range of audio adjustments in the delayed sound, with adjustment of delay times of between one and 80 milliseconds, and to adjust the presence level for the delayed reflected sounds, over the 20dB range that the DSP system provides.

And finally the fifth mode is a conventional monophonic reproduction, intended to be used with old videos and films which have no stereo channel.

The KC-X1 is an unusually powerful piece of control equipment, but much of its strength and potency comes through the presence of the six-channel KM-X1 Power Amplifier, which would have to be the neatest 6 x 100W power amplifier that I have yet seen.

That Kenwood has been able to 'shoehorn' so many potent amplifiers into a package with the same dimensions as

the KC-X1 Control Amplifier is a credit to its designers. The problem of heat dissipation is obviated by a thermostatically controlled fan, which only comes into operation if, and when, the severity of duty warrants the additional cooling capability. As I subsequently discovered, it was no easy task to trigger that fan into operation, and during the whole period when I conducted my laboratory testing and subsequently my subjective evaluation of the system, the fan 'never blew in anger'.

Objective testing

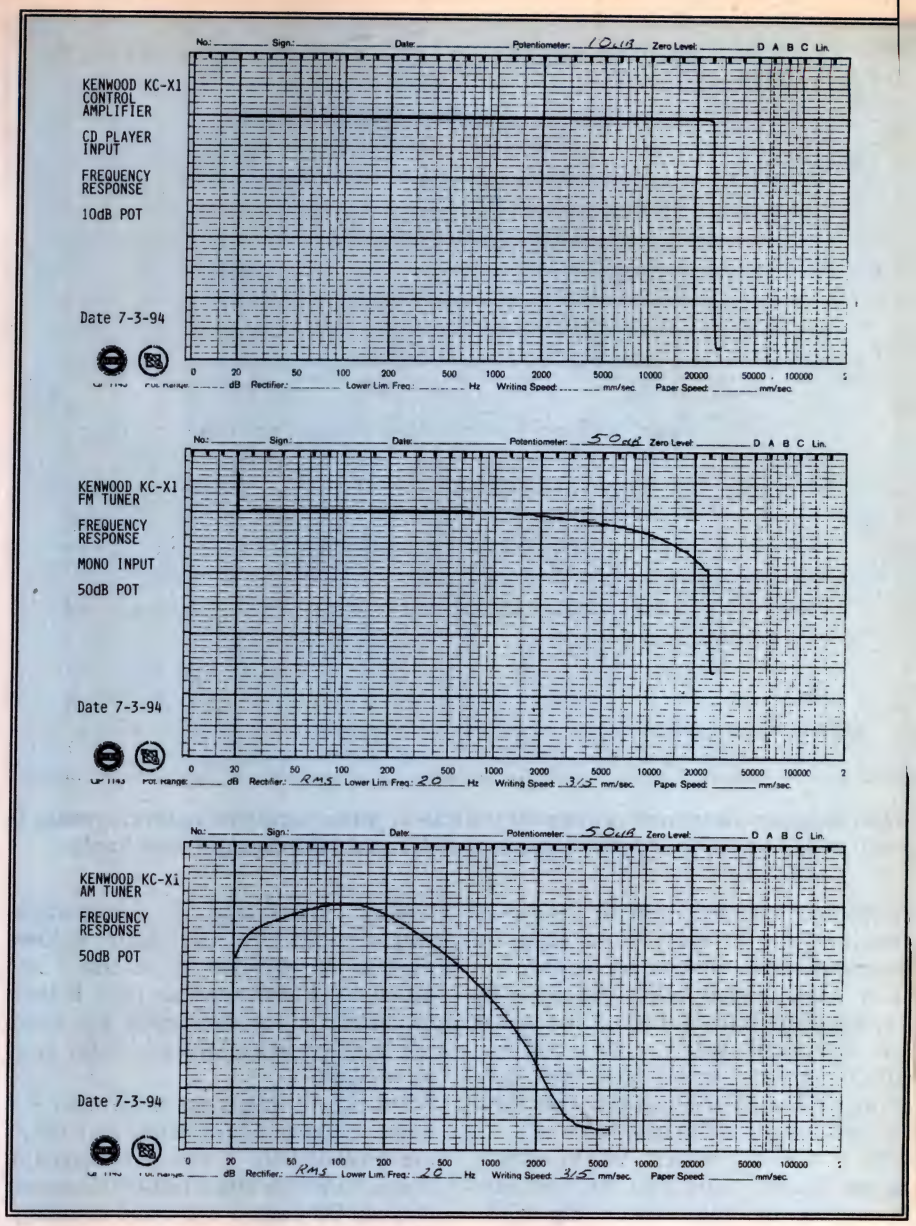
The objective evaluation of the KM-X1 Multi-Channel Power Amplifier proved to be a relatively straightforward task, and not only was the frequency response as good as the manufacturer claimed, but it proved to be exceptionally flat all the way from below 5Hz to well beyond 100kHz. As I discovered, the shape of the response curve doesn't really change with different power levels, and all six amplifier channels provide superlative sound quality.

What I did discover, however, was that different channels have slightly different upper frequency responses. Thus for example, although the left channel was down 3dB at 200kHz, the right channel was down only 0.7dB at 200kHz. Those differences are of course not significant, and don't affect the quality of the sound.

Each of the six amplifier channels is designed for a minimum impedance of six ohms, and although the individual channels will work with a four ohm load connected, with six loads each of four ohms impedance connected, the current demands could be somewhat onerous. The current drawn from the transformer and the mains could well prove to be excessive. I suspect that is the reason why Kenwood have specified a six ohm minimum load impedance.

I evaluated the IEC total difference frequency distortion measurements of one channel of the amplifier over its full range, and was pleasantly surprised at how low the distortion levels were, over the main portion of the operating range. Surprisingly the distortion levels are lower at maximum power output than they are at half power output, although under both conditions the distortion is really insignificant. Once the output voltage rises to 34 volts with an eight ohm load, the voltage peaks approach the upper and lower rail voltages, and the amplifier starts clipping.

The objective testing of the KC-X1 Control Amplifier/Tuner proved to be similarly straightforward, as the measured parameters all conformed reasonably closely to the manufacturer's published specification.



These further response plots show the performance of the KC-X1 for its CD player input, FM tuner and AM tuner. As you can see, the AM tuner response scarcely qualifies for the description 'hi-fi'.

The frequency response of each of the audio channels is extremely flat, and the measured distortion levels proved to be very low, and well below the .03% total harmonic distortion (THD) figure quoted by Kenwood in its literature. The measured signal to noise ratio of the left main channel of the amplifier was 106dB(A) relative to the 100 watt power output level.

My examination of the FM tuner, and in particular its frequency response, revealed that it was not quite as flat as I would have expected. The response droops by -3dB at 10kHz, as opposed to the manufacturer's claim of -2dB at 15kHz. The FM sensitivity and performance is however excellent, and the useable sensitivity is 11dBf, which is 1 microvolt into 75 ohms. The measurement of the AM tuner's frequency response revealed that it was the narrowest I have yet seen. The tuner is clearly designed to satisfy Japanese requirements, and the -6dB points were 25Hz and 400Hz! An examination of the AM tuner's frequency response curve reveals that the high frequency continues its dive down to a -25dB level response at only 2kHz.

Subjective tests

Kenwood was kind enough to provide me with a demonstration laser disc entitled 'WOW', which was prepared by Lucasfilm. The disc was clearly designed to assist in marketing the product, using demonstration material on side 1, and

then to assist in setting up the system using alignment test signals — some of which are on side 1, but with the majority on side 2.

I set up the KC-X1 and KM-X1 combination on a low bench on one side of my family room, which I selected for this role as its dimensions are reasonably close to those which would be found in most living rooms, apartments or small houses. I initially placed my B&W 801 monitor loudspeakers 3m apart on each side of the bench, and placed the Snell sub-woofer under the bench. Then I placed the DM-110 loudspeaker beside the sub-woofer under the bench and positioned the two Snell surround speakers on chairs on both sides of a low settee, where one of my regular panel auditors and I sat. The Sony Profeel monitor was elevated above its normal position so that it was at eye level, on the opposite side of the room.

I was glad that I had borrowed the Interlink DB-25 Monster Cable, because it simplified the set-up task so that I spent only half an hour installing and interconnecting what was a relatively complex system, (and which I now realise, was a relatively rapid set-up time).

When I loaded the 'WOW' demonstration disc into the laserdisc player, I immediately had a superb picture, but no sound. After a moment's thought, and a brief inspection at the rear of the KC- X1, I discovered my cabling error, and 30 seconds later we were up and running. My initial impression was one of mild disappointment, and there had to be a reason why.

So I sat down and evaluated the controls settings, and then proceeded to perform the THX Cinema adjustments as specified in the manual; adjusted the volume balance, pressed the mode key with a test tone, to test the individual channels, set the delay time to 15 milliseconds and set the centre mode to wideband. Then there was a dramatic change in the quality of sound. For the next half hour, I was mesmerised by a video and audio display, the likes of which I have not previously experienced at home. If I had had any previous qualms about the merits of THX superimposed on a Dolby Pro Logic system, they were immediately dispelled.

More significantly, the 'WOW' demonstration disc provided an 'in-depth' expose on how film sound tracks are produced, which I found to be both intriguing and educational. Then the disc proceeded to provide test software, with which I could evaluate both the THX Home Cinema System and its wide ranging acoustical interactions with my family room — which proved to be equal to the task, happily.

Of course few people are likely to use main speakers of the quality which I initially used, and few prospective purchasers are likely to have $15,000 to spend on a complete system of this type. Accordingly I tried removing the B&W 801M monitors and replaced them with a pair of B&W DM110 speakers, which were inexpensive and with no significant output below 90Hz. As I soon discovered, this demonstrated that the sub-woofer fulfils the low frequency requirements of the system. So expensive speakers are by no means absolutely essential to achieve reasonable quality sound and the subjective impression of 'being there'.

Summary

The lasting impression I have of the Kenwood KC-X1 and the KM-X1 is that Kenwood have achieved extremely favourable results with the electronic side of the system. The replay performance with laserdiscs, CD's and FM tuner is excellent. The performance on records is good, but not outstanding, whilst the performance of the AM tuner is mediocre to say the least.

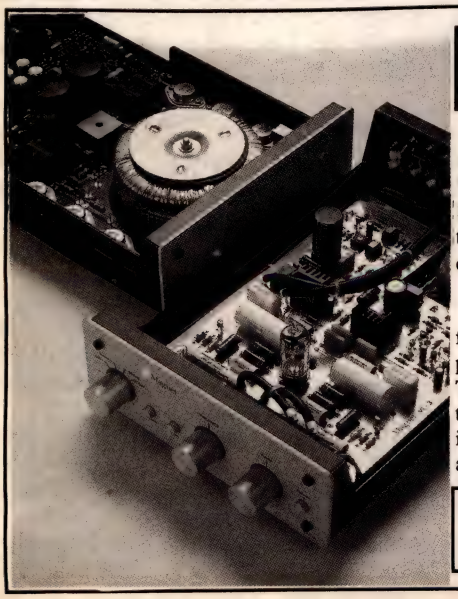
If you are fortunate enough to purchase the Kenwood KC-X1/KM-X1 system, it is unlikely that you will purchase it for its AM performance; nor would you be likely to purchase it for its record playing potential.

If you should purchase this system, my strong recommendation is that you should be careful and sure to purchase appropriate surround speakers, for without the broadband dipole characteristics of the type displayed by the Snell speakers (which Kenwood provided for my assessment), you are unlikely to develop the full potential of the system when replaying THX or Dolby Pro Logic encoded material.

Whilst I know that many people purchased hifi systems to impress family and friends, none of those systems could ever really compare with the impact that you will have on those people when you use (or demonstrate) this system, with appropriate THX encoded software and the right choice of peripheral hardware. The title of the Lucasfilm demo disc encapsulates it very well: WOW!

The physical dimensions of the KC-X1 Control Amp/Tuner are 400mm wide by 380mm deep by 161.5mm high, and it weighs 10.5kg. Similarly the KM-X1 Power Amplifier also measures 440 x 380 x 161.5mm, but weighs 20kg. The RRP for the combination is $3798.

Further information is available from Kenwood Electronics Australia, 8 Figtree Drive, Homebush 2140; phone (02) 746 1888. ❖



Magnet

'Music speaks louder than words'

The **Magnet VL-3** is a hybrid vacuum tube stereo line-amplifier. It uses JFET at the input stage and vacuum tube at the output stage. This combination helps in long life and better music quality. The VL-3 has CD, Tuner, Video, Tape and Aux inputs. The output stage uses a cathode follower vacuum tube which makes a low output impedance. It has a three-part regulated power supply which reduces the modulation distortion. the circuit uses polypropylene capacitor, REL - cap Wonder cap, Monster cable and 1% metal film restorers.

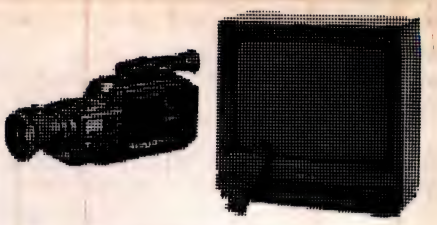
The **Magnet MA-3** is a 120 watt rms/ch into 8-ohms stereo amplifier. The circuit is based on a fully complimentary symmetrical push-pull design with direct coupling between stages. the input and pre-drive stages use JFET cascode with BJT to give a very wide frequency response up to 180KHz. The output uses two pairs of transistors per channel to give continuous high output. The MA-3 uses a toroidal transformer to supply high power and to reduce the interference. A DC fault protection circuit is fitted to protect itself and the speakers. The MA-3 uses 1% metal film resistors, WIMA capacitors and Monster cable.

A-ONE ELECTRONICS Pty. Ltd.
432 - 434 Kent Street SYDNEY 2000

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READER INFO NO. 4

What's New in VIDEO and AUDIO



High quality speakers from new firm in SA

South Australian firm Sonique Audio was formed recently, to develop, manufacture and market a range of sonically accurate loudspeakers which are also affordable, for both the Australian and international markets. The firm's founders, Greg Walden and Steve Lund, are well qualified: both were both formerly with Duntech — Mr Walden having been responsible for R&D and QC, and Mr Lund for manufacturing and then marketing.

Sonique has now released its new range of high quality loudspeaker systems, consisting of three monitor-style models and one floor standing system. All systems use time-aligned (within 8us) coherent loudspeakers, and all deliver flat impedance, frequency and phase response. The crossover networks all use first-order filtering and use high voltage polypropylene capacitors, air cored inductors and high power resistors exclusively. All systems use a bass reflex configuration and have bi-wiring capabilities.

To complement the high sonic performance of the systems, the enclosures are finished to a very high standard in natural timber. The standard finish is American Oak, hand polished with a Jarrah colour. The grilles are upholstered in a fine black, acoustically transparent cloth.

The Sonique model 3.5 system is the smallest in the range, with a two-way two driver configuration in each 285 x 266 x 174mm enclosure. The 110mm woofer has a magnesium basket and vented voice coil, and is teamed with a 25mm tweeter with double chamber and ferrofluid suspension. Rated response (+/-3dB) is 60Hz to 20kHz; nominal impedance is six ohms, with a sensitivity of 86dB (rel. 1W/1m/8 ohms).

Next in the range is the model 4.5 system, with a two-way three driver configuration using two symmetrically placed 110mm woofers and a 25mm tweeter in each 410 x 262 x 230mm enclosure. Rated response is 55Hz - 20kHz, with a nominal impedance of four ohms and a sensitivity of 88dB.

Big brother to the 4.5 is the 5.5 system, again using a two-way three driver configuration but with two 130mm woofers in each enclosure with the 25mm tweeter, for enhanced bass response. The enclosures in this system measure 442 x 284 x 248mm. The rated response is 50Hz - 20kHz, with a nominal impedance of four ohms and a sensitivity of 87dB.

Top model in the range is the 6.5 system (pictured), which uses two 170mm mineral filled polycone woofers plus a 26mm ferrofluid tweeter in each enclosure, with a symmetrical configuration. Each floor standing enclosure is 1054 x 268 x 216mm, and has adjustable steel locking spikes. The rated response is 42Hz - 20kHz, with a nominal impedance of four ohms and a sensitivity of 89dB.

Prices of the new systems in Australia range from $995 for the 3.5 system to $2295 for the 6.5 — which compare very well with competitive systems.

Further information is available from Sonique Audio, 14 Kindale Court, Pooraka 5095; phone (08) 262 7911.



Professional power amps from Celestion

The new Celestion SRA Series Professional Power Amplifiers are designed for uncompromising performance and reliability in professional recording studios, concert sound reinforcement and commercial audio systems.

The new SRA Series all feature Celestion's dual-rail 'soft-switch' output stage, employing linear, output-derived Class G amplification. The soft-switch design means that the switch to the upper rail is inaudible and seamless, to the point of being invisible to distortion measurement. It provides all the advantages of dual-rail operation, such as a dramatic increase in efficiency and a corresponding reduction in the generation of heat, without the distortion generated by fast-attack rail switching.

Balanced drive comes from a current mode input stage. Rather than the input stage controlling the output, the output assists the input in producing the purest possible signal. This results in a dramatic reduction in internal clipping, making clipping difficult to detect by conventional means. As a consequence, direct monitoring of the status of the output devices has to be used to give an accurate indication of clipping.

All SRA Series amps feature a heavy-gauge steel chassis coupled to a transverse heat sink to add rigidity. Reliability is further ensured by an elegant circuit topology reducing the complexity of interconnections, and by a continuously variable cooling fan temperature controlled from the heat sink. A direct result of this design approach is a significant reduction in physical weight.

Presently, two SRA models are available: the SRA1000 and SRA1600. The SRA1000 delivers 510W into four ohms, or 320W into eight ohms, per channel, or 1020W into eight ohms bridged.

The SRA1600 delivers 815W into four ohms, 530W into eight ohms or 1620W into eight ohms in bridge mode. This is for 0.1% THD; THD 20Hz - 20kHz is less than 0.05%, while the frequency response (-3dB) is 5Hz to 50kHz.

For further information circle, 181 on

One button' camcorder as LCD viewfinder

Sony's new 'Handycam Vision' CCD-SC5 is claimed be the first camcorder to combine the recording nvenience and instant playback on a 75mm (3") colour CD monitor with one-touch, point and shoot simplicity. With the colour screen, Handycam Vision offers a whole w way of shooting videos. Simply point at the subject u want to shoot and view it in the in-built display — tiny eyepiece to squint into — anyone can use it anytime d anywhere," said Sony's Visual Product Manager, uzanne Hume.

"Aim at the subject and record simply by pressing one tton. Playback is just as easy; the LCD screen allows you to atch what you have recorded instantly — no need for a levision. The LCD screen allows you to view your memories the spot, no matter where you are."

The Handycam Vision is expected to be particularly popular ith those people that wear spectacles or sunglasses. The camorder need not be held against the eye and so it is not only more omfortable, but allows you to see more of the subject that is eing recorded.

The high resolution 76,000 pixel active-matrix screen also llows recordings to be viewed instantly in vivid colour and ith excellent clarity. The CCD-SC5 also features mono Hi-Fi FM) recording and a built-in speaker with volume control for layback anywhere.

Handycam Vision is claimed to be the most compact camorder available, weighing just 640 grams. It is comfortable to old in one hand and easy to carry in a purse or travel bag. It lso features fully automatic one touch recording for 'point and hoot' speed and simplicity. High quality recording is achieved y a newly developed 1/4" CCD with 320,000 pixels, and sensive low light capabilities (five lux minimum).

The special dual lens system allows users to choose instantly between telephoto and wide angle perspective. The telephoto setting (12mm) is ideal for close-ups, while the wide angle setting (4mm) is best for interior shots and group portraits. Both lenses are fixed focus.



The Handycam Vision also features the NP-500 environmentally friendly lithium ion battery. Smaller and lighter than conventional NiCad camcorder batteries, it can also be fully recharged while inside the Handycam Vision by connecting the unit to the supplied AC adaptor/charger. A battery meter appears on the LCD screen to indicate the amount of remaining power. The CCD-SC5 runs for about 45 minutes on a charged NP-500 with the LCD display on, or over 60 minutes with it turned off.

The Sony Handycam Vision CCD-SC5 records up to two hours on a single 8mm video cassette. The Flying Erase Head provides noise free picture transitions between scenes, for a better result.

The CCD-SC5 has a recommended retail price of $2499.

ne reader service coupon or contact mber Technology, Unit B, 5 Skyline lace, Frenchs Forest 2086; phone (02) 75 1211.

Next generation' synthesiser

Yamaha Music Australia has unveiled he first synthesiser to employ Virtual Acoustics (VA), a physical modelling ystem which generates waveforms by way of a computer model of the physical haracteristics of actual instruments.

VA simulates in software the very omplex vibrations, resonances, reflections and other natural acoustic phenomena that occur in a real acoustic instrument. While this method of sound generation had previously been impossible in a real-time situation, Yamaha research and development in computer based physical modelling since 1987, combined with recent advances in computer processing power and speed, have made real time Virtual Acoustic Synthesis a reality.

The first Virtual Acoustic Synthesiser, the Yamaha VL1 (standing for Virtual Lead), is scheduled for release in Australia in March 1994, and will feature a VA subset called S/VA (self-oscillating VA). S/VA is ideal for simulating instruments that vibrate through the continuous application of a constant pressure — namely wind and bowed string instruments. It has no oscillators, no preset waveforms and no samples — in fact, none of the sound generation concepts employed in conventional synthesisers.



Physically, the VL1 is a performer's instrument, best suited to solo performances, and is equipped with a 49-note keyboard with two-note polyphony and an integral breath controller. The VL1 is said to be truly responsive and 'alive', offering an unprecedented level of musical expressiveness and realism. It provides the performer with control over the subtle nuances which affect the instrument's timbre, such as the effects of note-to-note transitions and breath or reed pressure.

For further information circle 100 on the reader service coupon or contact Yamaha Music Australia, on (03) 699 2388 or fax (03) 699 2332. ❖

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Continuing our look at

THE 'CURRENT' PUSH IN ELECTRIC VEHICLES - 2

In this second article about electric vehicle technology and its present status, the author looks at the two basic types of EV, and then at the development of EV's to date by many of the larger manufacturers. Finally, he looks at the challenges facing the industry before EV's are likely to make any real market impact.

by PETER KILLIN

There are two distinct types of EV's — the pure electric and the *hybrid* vehicle. According to my dictionary, the term hybrid means 'anything of mixed origin', and in this case it refers to more than one, or a mixed source of power. A hybrid has a small supplementary engine (usually, but not necessarily internal combustion), as well as an electric motor.

1. Pure electrics

The pure electric EV is simply a vehicle with lots of batteries powering an electric motor. This sounds pretty simple and essentially it is, except for the vehicle range. Currently the range is limited, due to battery energy storage density, and also the batteries are very expensive.

Drive configurations here vary greatly. One motor driving two wheels through a differential unit is common, but a concept that is gaining wider acceptance is the use of two motors, each driving an individual wheel. This eliminates the mechanical differential, whilst electronic control could simulate the required differential action.

The ultimate application would be one of a motor integrated into each wheel; since a driving wheel has less rolling resistance than a non-driving one, this would be more efficient. It would also be an ideal application for traction control and regenerative braking.

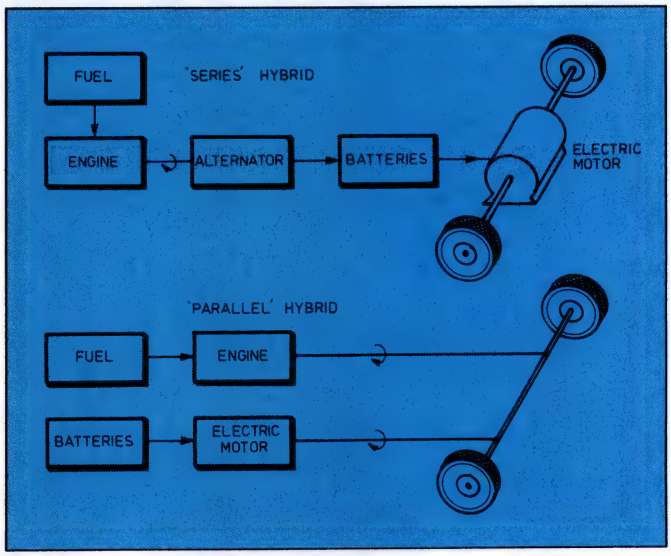
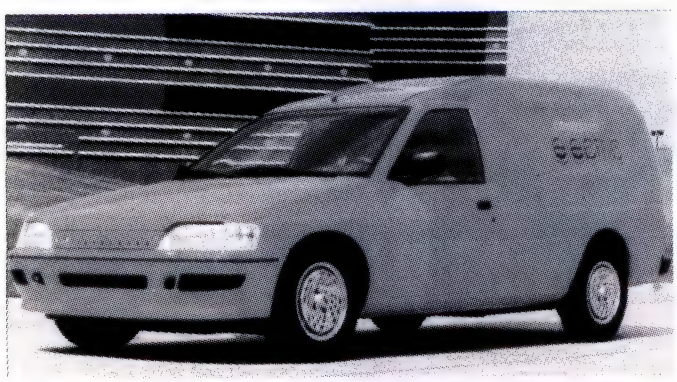


Fig.1 (top): A 'series' hybrid EV uses an engine and alternator to charge the batteries. Fig.2 (below): A 'parallel' hybrid EV uses a separate drive from the engine.

2. Hybrids

There are two potential configurations for hybrid EV's: *series* and *parallel*. This refers to the way the two power sources are employed.

Series hybrid: A series hybrid employs two different devices to store energy in series with the power train. (Fig.1). The engine, which can be IC or gas turbine, steam or what-have-you, drives a generator or alternator, sending electricity



The Ford 'Ecostar' van, using a sodium/sulphur battery.



GM's new all-electric car, the aluminium body 'Impact'.

into the batteries. These in turn are used to power the final electric motor which drives the wheels. So with this system the auxiliary engine is used only for charging the batteries.

The conversion of energy in this manner — from a solid/liquid/gaseous fuel, to heat, to rotary motion, to electricity and finally back to rotary motion again — is inefficient. With each of the four steps in the conversion of energy, there are inevitable losses; which means that a lot of the energy which could have been used to push the car is wasted.



Mitsubishi's ESR hybrid, which uses alkaline batteries.

Parallel hybrid: To get around this problem, a parallel hybrid has a duplicated powertrain. (Fig.2)

The supplementary engine can drive the wheels directly when the electric motor is switched off. The small IC engine would be about 30hp or less. This is a much more efficient method of energy conversion, but has the additional weight and complication of two power trains.

Expensive and complex electronics are needed to monitor driving conditions, gauge available battery power and switch between the different drive systems at the most appropriate time.

Of course there is nothing new about the hybrid idea; diesel/electric locomotives and conventional submarines have used this technique for decades. However until now, its weight, complexity and cost have made it unsuitable for light vehicles.

Lower cost electronics have led the way towards experimenting with hybrids, since they offer greater consumer convenience than a pure electric vehicle can currently provide.

The hybrid provides a greatly extended range and the ability to travel for long distances at highway speeds, outside of environmentally sensitive areas.

Hybrids can provide significantly lower emissions than vehicles powered exclusively by IC engines. When battery power drops, drivers could get home on power from the supplementary engine. This becomes a range extender, from say 80 - 160 kilometres to around 400km or more.

The 'Big Three' motor vehicle manufacturers are pressuring CARB to allow hybrids as an alternative to pure electric vehicles. They claim that California would be better served by hybrids than by pure electrics.

At present the response from CARB has been that 'any relaxation of the ZEV standard would slow efforts to reach the ultimate goal of practical electric cars'. It seems that where the right sort of pressure is applied, perhaps anything can be developed (or at least CARB seem to think so).

'Come 1998, there could be some difficulty with batteries for a totally electric vehicle market', says CARB. 'Hybrids have a role to play after the market is completely saturated with pure EV's'.

At present, hybrids will not count in CARB's 2% - 10% ZEV requirement.

Now let us look at the involvement of the various well-known motor vehicle makers in EV development to date.

General Motors

GM's first EV was the HX-3 hybrid, which was unveiled in 1991. More recently, GM announced a two year/30 car test program to evaluate its new all-electric car, the 'Impact'. One hundred commuters will drive the cars for two to four weeks at a time, keeping logs of their impressions while on-board computers record details of their driving. This pilot program is expected to cost around $32 million.

The Impact is an all-aluminium car, which has a 0 - 100kph time of eight seconds. It has a range of 110km in the city and around 140km on the highway. It takes two to three hours to recharge the batteries at 220 volts, and 8 - 10 hours at 110V.

GM engineers feel that customers will find Impact more valuable than a petrol car, despite the need to replace the US$1700 battery pack every 40,000 kilometres. While the price of Impact is not yet set, it is expected that it will sell for around US$25,000 (remember, this is twice what consumers would expect to pay for their next petrol car).

Ford

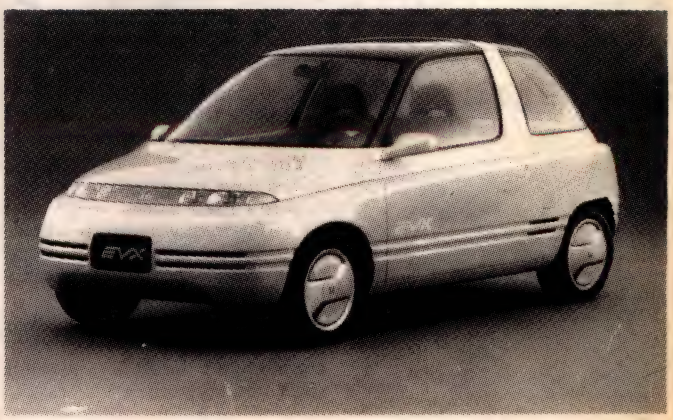
Ford has produced 105 electric 'Ecostar' vans which it will lease to 12 utility companies in both the US and Europe. It will cost $100,000 for the three-year lease and all this is far less than what it cost Ford to supply each van. Batteries are included in the price — each one costing $46,000 to make.

The sodium/sulphur battery pack weighs 350 kilograms and pumps out 330 volts, which is converted to AC for the three-phase electric motor.

The Ecostar has a governed top speed of 110kph, a range of 170km and can accelerate from 0 to 100kph in around



GM's HX-3 hybrid, which was unveiled in 1991.



The Honda EVX Concept vehicle, using lead acid batteries.

The 'Current' push in Electric Vehicles - 2



Charged batteries sitting on pallets at the Phoenix Raceway, ready to be used to 'recharge' one of the racing EVs.

12 seconds. The battery charging time is around six hours.

It is expected that the Ecostar will cost around $35,000 to produce, a little further down the track.

Chrysler

Chrysler's Dodge Caravan Electric was the first US-made EV to be certified by CARB as a ZEV. Chrysler have produced 50 of these minivans, for various trials during 1993. The purchase price is US$120,000 (A$177,000!), which is seven times the cost of the standard petrol equivalent model.

It is expected that this price will drop to around US$100,000 when (if?) serious production begins in 1995.

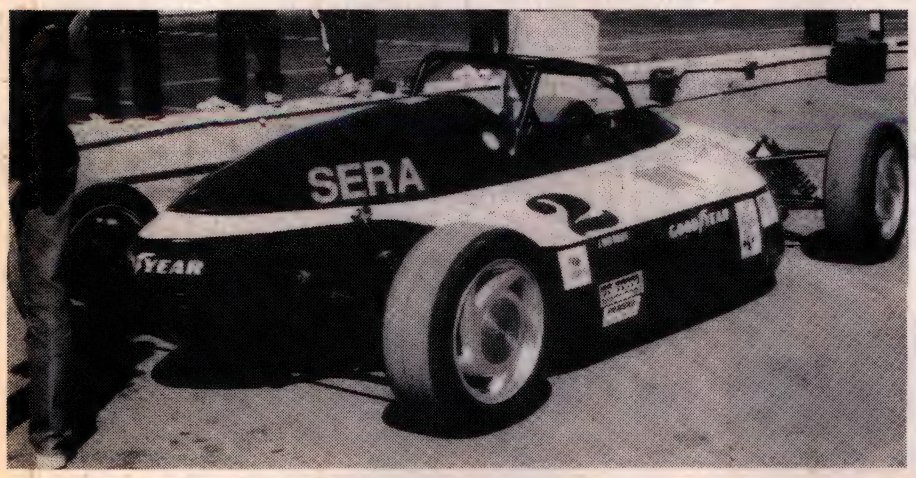
The Caravan Electric is powered by thirty 6V nickel/iron batteries and will travel between 80 and 145 kilometres per day. All up, the Caravan Electric weighs 2676 kilograms.

Honda

Honda have reassigned 100 of their engineers from Formula One to EV development. This has resulted in the development of the EVX concept vehicle, which will travel 150 kilometres on one charge of its lead/acid batteries and has a top speed of 130kph. Additional electric power is supplied by solar panels in the roof, and this is also used to either chill or heat drinks in a special built-in cup holder.

Mitsubishi

The Mitsubishi ESR hybrid will travel 490 kilometres at a maximum speed of 40kph. Alkaline batteries are used to power the electric motor.



The car which won last year's 'Arizona Solar and Electric 500', at the Phoenix International Raceway. It reached 160kph.

Daihatsu

Daihatsu currently produce most of the EV's now in use in Japan. The EV Sedan hybrid uses nickel/metal hydride batteries and a three-cylinder 660cc engine to drive a generator for recharging. It can travel 450km at 40kph on one charge and one tank of petrol. Maximum speed is 125kph.

Toyota

The EV-50 Toyota is powered by lead/acid batteries and will travel for 109km with a top speed of 114kph. At a lower speed of 40kph on the open road, the range increases to 250km.

Suzuki

The Suzuki EE-10 hybrid uses sodium/sulphur batteries and a three-cylinder four stroke engine running on methanol.

BMW

BMW's E1 concept hybrid has an aluminium frame and panels. It will travel for 265km with a maximum speed of 125kph on one battery charge.

Volvo

The Volvo EEC hybrid is powered by 120 volt nickel/cadmium batteries. A small gas turbine engine is used to recharge the batteries for longer distance highway travel, providing a total range of 670km.

Racing EV's

Motor racing has been used from the very beginning to speed up development of certain vehicle technologies, and this carries over to EV racing also.

For the last three years, the Phoenix International Raceway has conducted the 'Arizona Solar and Electric 500'. Here all sorts of people, from students to large companies, spend three days racing anything from electric scooters and 'electrified' production cars to purpose-built electric racing cars.

During the 1992 race, the leading car had a failure that caused the whole race to be stopped short. It seems its zinc-bromide battery lost coolant and overheated. This caused it to spew out bromine gas, seriously burning the driver's lungs and burning the eyes and throats of many of the spectators.

So bad was the mess that a 'hazardous incident response team' was called in to clean up. All up, it was quite a learning experience!

Last year's race was won by a 160kph

racer which looked a lot like a conventional race car.

Apart from the lack of exhaust noise, the next obvious difference was seen at the pit stops. Here, instead of taking on large quantities of liquid fuel, pallet loads of charged batteries were used to 'refuel' these racers.

Engineers from the major car makers were all there — keeping a low profile, making notes and talking to competitors. I guess we won't see them racing until they are sure they can win!

The bottom line

How are customers going to be convinced to buy EV's when 1998 arrives? A Ford official has apparently said that they would have to increase the price of every petrol powered car they sell in California by around $1500, to make up for losses in EV sales.

One insider at GM has commented that it would be much cheaper to pay a US$25 million annual fine than to continue to develop and sell their 'Impact' electric vehicle. There have been many other proposals, such as increasing petrol prices to subsidise the purchase price of EV's.

The state of California is considering exemption from state sales taxes for EV purchases. This could amount to savings of up to $1500 on the purchase price.

Further incentives cited include special treatment for parking. In crowded places like Los Angeles this could be worth around a few hundred dollars per month. Other suggestions have been dedicated freeway lanes for unobstructed travel, or even higher speed limits for EV's.

A possible benefit of the need to charge batteries at special charging stations, from the state's point of view, is the ability for authorities to monitor the whereabouts and other information relating to any particular vehicle. Suppose while your EV is parked during work hours and being charged, an additional data line identifies it as your car and allows the cost to be charged to your account. Now if your EV is stolen, it would be a simple matter for it to be 'found' next time it is plugged in somewhere else for a recharge!

Or how about an on-board system that records the last few days of vehicle operation and actually discloses your EV's maximum speed. Once this is communicated during recharge, a speeding ticket could be on its way to you in no time!

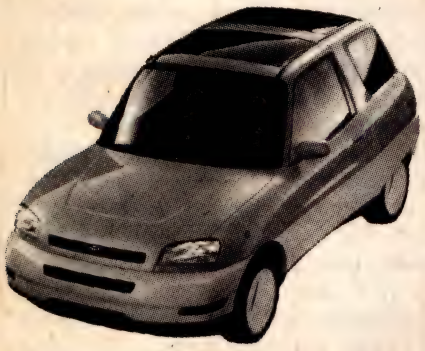
One way of reducing the impact of battery costs is for utility companies to own and lease them to owners of EV's.

Perhaps a chain of service stations that are set up to replace leased batteries in around the same time it takes to fill up with petrol will be a better way to go about the charging dilemma.

There are many issues regarding industry standards. A standard electrical fitting for recharging will have to be agreed to by all manufacturers and utility companies.

One suggestion put forward is for a 'paddle shaped' inductive coupling, which would be much safer than a conventional three-pin plug.

It is anticipated that once an efficient infrastructure is in place, it will cost about $15 to recharge quickly during the day — compared to 60 cents to recharge slowly at night.



Toyota's EV-50 which is powered by lead/acid batteries and has a top speed of 114kph.

Conclusion

It seems the key issues in the acceptance of EV's will be: price, range, recharging time, price, ability to heat and cool and price (not necessarily in that order). Clearly, a lot more work remains to be done in many areas, in order to bring the EV to the average driver later in the decade.

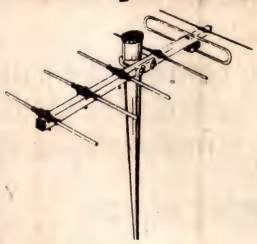
Of course solar powered cars are also in the news, and that is a separate subject of its own. I guess a lot of efficiencies have to be found in solar cells in order to provide sufficient electrical energy to propel the kind of car the consumer is used to, rather than the 'racing cockroaches' we have seen to date.

Whilst we may never be driving pure solar powered cars, the technology developed will no doubt be used to enhance the kind of EV's that we will see soon or ultimately drive.

One thing is quite clear. If technology doesn't rapidly improve, the manufacturers will soon have to offer cars that people do not want, at prices they won't be too happy about either... ❖

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READER INFO NO. 5

Computers and 'Multimedia':

ARE ALL ROADS LEADING TO CD-ROM?

Whether we may like it or not, the hottest game in computer circles at present is 'multimedia'. And, despite controversy as to whether it is the most ideal agent for delivery of this new aggregation of multiple forms of media, CD-ROM is the current platform.

by BARRIE SMITH

Just three years ago the first whispers of 'multimedia' as a usable technology were heard in this country, when a demonstration was held in Sydney of new US software able to drive an array of AV (audio-visual) hardware. The software was *MacroMind MediaMaker*. MediaMaker ran on a Macintosh IIci computer, an Apple CD-ROM drive and internal hard drive; outboard were a Sony video disc player, a camcorder and a VCR.



Testing new discs at Distronics' CD plant in Victoria.

Marius Coomans, MD of Firmware Design (the software's distributors) foresaw the rise of a new technology in multimedia. In specific terms, MediaMaker collected a variety of media inputs (video images, audio clips or graphics) and allowed the operator to connect and combine them into a replayable sequence.

A number of systems followed — hybrids of analog and digital technologies, generating digital text and graphics, combined with audio and video signals sourced from serially controlled analog laser disc players and VCRs. Recently, CPU's and RAM have become cheaper and more powerful, more efficient data compression techniques have arisen — and CD-ROM has emerged as a practical, capacious and cheap medium for program distribution.

Today, a single 120mm CD-ROM disk of 650MB gross capacity can store 300,000 pages of text, 8000 colour images, 16 hours of voice quality audio or one hour of full screen/full motion video.

CD-ROM is the Philips/Sony base standard for data encoding. Approximately 600MB of usable data is available from a total capacity of 650MB — the remainder being taken up by control codes.

The medium is only effective for multimedia applications when a fast processor and large amounts of RAM (generally a minimum of 8MB) are available, allowing decoding and display synchronisation.

Today, CD-ROM drives in Australia cost less than $500 (in PC format), while the disks themselves can be pressed for less than $2.



A blank recordable WORM disc — used to make test CD-ROMs before going to the full pressing operation.

Mike Steele, Sony multimedia specialist, recognises that the largest installed base of CD-ROM drives is in the corporate and government sectors, adding: "The home market is growing, but is unlikely to really take-off until the price of a fully integrated Multimedia computer system falls below $1500".

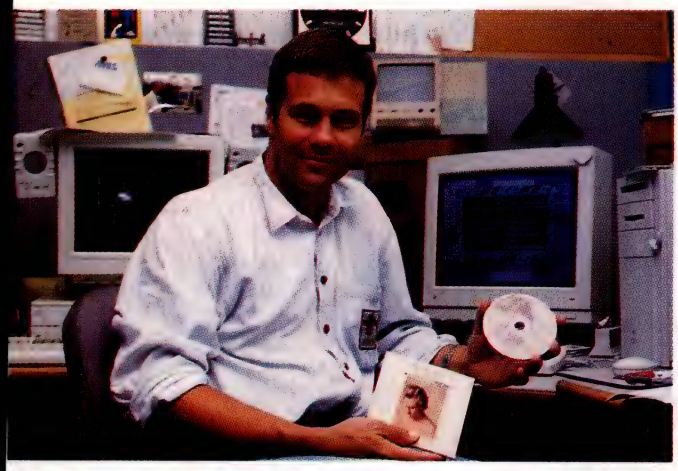
Steele adds: "Since the inception of the CD-ROM drive in 1986, there are now estimated to be five million installed units and four thousand titles available worldwide".

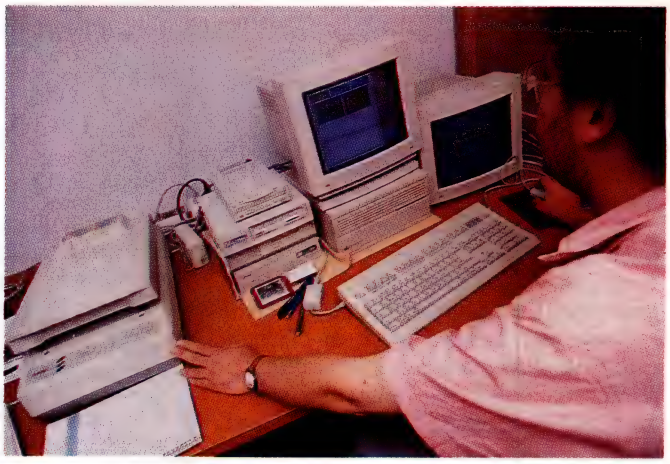
Since 1992 the annual drive production has doubled to 1.6 million units annually, likely to rise to 6.5 million per annum in 1995. At the time of writing the Australian CD-ROM drive population is estimated to be 40,000, but is also expected to have increased to 150,000 as you read this.

There is a danger of the technology outshining its original purpose. Sydney CD-ROM developer Peter Dodds believes the questions are: "What is it? What can I do with it? What benefits am I going to get?"

He adds, "We should sell the sizzle, not the sausage — and I think *that* at the moment is the biggest challenge. It's only another way to entertain and inform".

Sony Australia is aware of Australia's considerable experience and expertise in software development, film and television production and publishing industries, and believes we have the skills necessary for creating CD multimedia titles. Early in 1993 it announced plans





At left, Mike Fronzek with his hybrid audio CD/CD-ROM 'Pools of Reflection'. A Mac Quadra was used as the authoring station. At right is Peter Dodds of Brilliant Interactive Ideas who used a UMAX scanner to digitise hundreds of transparencies for the Hunter Douglas CD-ROM.

to assist and encourage local software developers to launch a locally derived market in CD-ROM titles. For "various reasons", Mike Steele admitted, "this hasn't happened".

Nevertheless, there is now a vibrant and exciting industry rising on our shores. In contrast to the specialist labour skills required and economic hunger of the film industry, CD-ROM is a relatively low-investment based activity. Some software developers operate from their homes. Others work from commercial premises, but with a small and specialised workforce.

Required are: one or two computers (the Mac has general preference), plus auxiliaries: a scanner, video and audio devices, access to a WORM drive to 'burn' test disks — and a personnel team, able to create and execute concepts as well as offer programming skills.

It is generally accepted that the main software packages required to 'author' and orchestrate the multitude of visual and audio files typically found on a CD-ROM disc are *Authorware Professional* and *Macromedia Director*.

BRIGHT FUTURE PREDICTED

Peter Dodds of Brilliant Interactive Ideas is confident that "the future is exceptionally bright for CD-ROM, irrespective of whether it's Mac or DOS or Windows".

He adds, "I think it's over-priced at the moment. It's going to drop down to less than the cost of books and audio CDs. You'll end up buying CD-ROMs at your local service station: you'll go in for the milk, a can of Coke and the latest talking book or the latest science encyclopaedia".

The developers

Erica Dale, once a teacher, is currently a graphic designer with a high tech Sydney digital animation company. What has kept the candles burning late in her Sydney home over the last 18 months has been the creation of *Playtime in the Park*, a CD-ROM aimed at youngsters of 4 - 5 years.

The disc is a virtual kids' TV show, 'on demand'. The stars are five bears: a mouse click on each takes the child through spelling, pronunciation and numeracy exercises. The program is cute, clever, entertaining and full of life — there's rarely a dull frame on screen, even when the furry five are in 'wait state' for a mouse click: a hand waves, or a head nods — sure signs that some intricate programming has taken place. Erica's partner Mark Tolhurst is a computer programmer and it was he who devised the disc's routines.

The program occupies only 100MB of disk space, enabling both Mac and Windows versions to be written to the same disc. Erica explained the program was "aimed at the lowest level platform —





At left is a screen dump showing the opening title from Erica Dale's CD-ROM 'Playtime in the Park'. At right is a screen dump from the Hunter Douglas interactive training CD-ROM. Immensely complex in structure, the two discs in series cost $300,000 to produce.

Are all roads leading to CD-ROM?

we've actually kept the file sizes as low as humanly possible, especially the sound files". The components are text, graphics and animations. The pictures numbered in the hundreds. Erica hand drew most of the graphics, scanned them in and then reworked them on the computer. Clean lines were created in *Freehand*, then filled with colour.

Other software, such as *Fractal Painter* and *PhotoShop* were used in the rendering, while the animation structures and final assembly were produced with *MacroMind Director*.

The busy audio tracks were recorded in analog form, then digitised with *MacRecorder SoundEdit Pro*. A Macintosh IIfx with 8MB of RAM, plus 700MB of drive space took care of the authoring hardware, while a Sharp JX-300 scanner took care of the hand-drawn input.

Part time, the venture took 18 months for the pair to complete. "A longer development time than is ideal", Erica admits, adding "It cost us blood, sweat and tears, grey hairs, and (if budgeted realistically) not much under $150,000".

Problems along the way were mainly related to the current limitations of CD-ROM: slow access forced the pair to limit file sizes, necessitating audio files be linked rather than embedded in the document. Interestingly, *QuickTime* was not used to trigger the various video and audio effects, the authoring software being used to link and activate the files.

The commercial future for the $79.85 disk looks bright: a Japanese version is under way, with a US adaptation reaching completion as I finished writing this story.

Art directory

Calling for graphics at a different level is the series of discs produced by Martin Shub of Discover Media in Sydney.

Martin has already amassed a great deal of experience with delivery of the second edition of his company's disc — AVAD. The acronym stands for Australian Visual Arts Databases and pulls together 15 Australian art databases, complete with biographies, catalog indexes and auction records. Most major arts libraries in Australia use the disc, despite its $1499 price.

He is now on a new project, intended as a tutorial and database for the education market and, hopefully, export. Included in the disc are more than 400 colour images of important Australian works of art.

The big hurdle of copyright took some heavy negotiation, but the disc should be on sale by the time this story appears in *EA*.

It took eight months just to settle on the content of the CD-ROM. The images themselves were scanned in from slides using a Nikon Coolscan; quality had to be sufficient only for screen display, not for reproduction. This was deliberate, so that people couldn't use them for postcards!

Despite this, the average file size was around 3MB (before compression) for each image. This level of resolution took a large amount of scanning time added to which was work in enhancement with *PhotoShop* to remove spots, adjust colour display, and resize to suitable screen proportions.

Decor training

At a more mundane level in the visual world is the series of discs produced during 1993 by Peter Dodds of Brillian Interactive Ideas.

Hunter Douglas (of Luxaflex and other fame) had need of a training regime to lift the company's performance, and needed to take the skills of their franchisees with them. The company has 45 sites around the country. Personnel training, to cope with the problems of geographic isolation, was required to get the same information to all the people.

Peter Dodds explained there were a number of other requirements:

"One was the ability to handle photo-realistic images, due to the decorative nature of the product. Sound was also a prime requirement — to get around the problems of people's reading and literary skills. A basic requirement was that the program resemble something familiar — a TV programme."

"Within the package the interactivity is basically making menu choices and then undertaking self assessment modules. The product information modules for instance are very much like looking at a VHS tape — basically linear."

"Progressing through the training package and becoming more familiar with the idea of using the computer, they actually get into quite sophisticated levels of branching, so they can virtually go anywhere they want to within the program."

The interactivity relied on the help of the host computer's hard drive, tracking the 'student' wherever they went, how long they stayed there, what assessments they did, etc. This data is stored in a special folder (file) on the hard drive, which collates all the user records. Late in 1993 the programs were being as-

HYPERMEDIA THE NEXT STEP?

Multimedia is moving very fast. So fast, it is likely to be overtaken by Hypermedia.

In their book *Understanding Hypermedia*, authors Cotton and Oliver predict Hypermedia 'will dominate mass culture in the twenty-first century'.

In hypermedia, the raw ingredients of images, sound, text, animation and video can be brought together in any combination. Added to this random accessibility is the increasingly wide range of sources available: satellite data, ISDN, fibre optics, etc.

UNREALISED POTENTIAL?

Many people can see the potential for PC-based multimedia, but at present far fewer are prepared to invest money in it. This 'wait and see' approach seems to be limiting growth.

One observer believes the CD-ROM industry is "a one billion dollar industry with a one million dollar turnover". Martin Shub of Discover Media feels that unless the funding problem can be solved, it may one day be "a trillion dollar industry with a three million dollar turnover"!

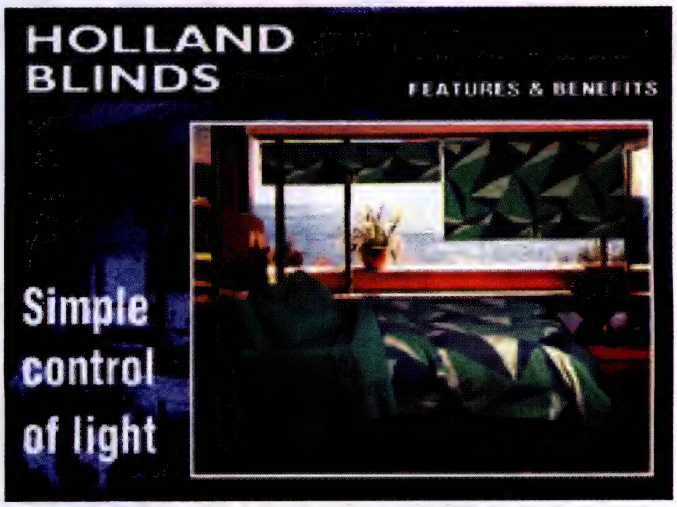


Photo-realistic graphics were an important consideration in the Hunter-Douglas CD-ROM.

MM AUTHORING SOFTWARE

The two most used software programs in Multimedia production are *Authorware Professional* and *Macromedia Director*.

Authorware uses object authoring, allowing the user to experiment with interactive design, rather than focusing solely on media content. The program is Mac/Windows compatible, supports Mac screen fonts and TrueType fonts. Graphics formats supported include BMP, DIB, PCX, TIF, EPS, PICT. Sound imports include PCM or AV files. Playback video is provided for Windows (AVI) and QuickTime for Windows.

Macromedia Director offers timing control of animation, hifi sound, QuickTime movies, video, text, graphics and interactivity. File imports include: AIFF, SND, SoundEdit, GLUE, MacPaint, PICS, PICT; and video input devices such as laser disc players and VCRs.

Courses in this software are regularly offered by the distributors, Firmware Design. Phone (047) 21 7211, or fax (047) 21 7215.

sessed for possible use in the company's overseas centres. This year the discs will be produced in cross-platform versions.

I asked how complex was the program structure. Peter replied that on one disc alone there were "1274 photographs, 800 sound files, 3700 graphic components, 19 sound loops, 179 Authorware files, over 100 MacroMind Director files and 400 questions — as well as around 12 minutes of live action movies". It's designed to operate on base level systems — a disc can run on a Mac LCIII with CD-ROM player, 12MB of RAM and hard drive. Production of the two discs took a year, using Mac Quadras, a IIci with 128MB, and other CPU's. Control was handled in *Authorware Professional*, with purpose written C routines used for special commands. Using two UMAX scanners the picture input consumed an inordinate amount of time. Asks Peter: "Do you know how long it takes to scan in 1274 photographs?"

Image input will in future be handled with Photo CD — a technology which Peter admits to 'being in love with'!

On the calendar for 1994 is a series of five CD-ROMs based on the Channel 9 programme *Sex*. A US distribution guarantee already covers development costs for 25,000 units — with a likelihood of 100,000 being pressed.

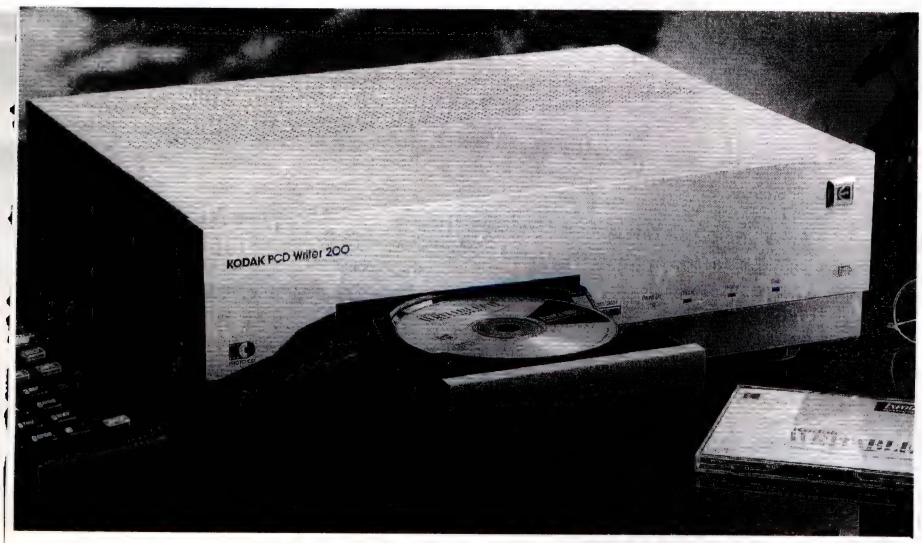
Music CD-ROMs

David Bowie and Billy Idol have made one; so has local Peter Gabriel. All have made CDs carrying various levels of interactivity. It is believed Gabriel's disc cost half a million dollars to produce overseas — and 18 months elapsed before it came to market.

Now, a local company — Pacific Advanced Music Studio — headed by Mike Fronzek and Peter Higgs are offering groups the chance to make their own CD/CD-ROM discs for a production cost of $20,000.

To prove their approach, the group produced an interactive disc late in 1992 —*Pools of Reflection*, featuring performer Guy Delandro. The disc is interesting in that it contains around 46 minutes (nine tracks) of normal stereo audio plus 150MB of CD-ROM material.

The CD-ROM track does not replay on a CD player of course, but once it's loaded into a CD-ROM player and fed into a PC a whole bundle of information about the material can be enjoyed.



Kodak's 'PCD Writer 200' WORM drive — able to write up to 99 tracks in any industry standard format.

LOCAL PRESSING PLANTS

There are currently two CD-ROM disk pressing plants in Australia, one in Sydney and the other in Melbourne.

Sony recently completed a new facility at Huntingwood, in western Sydney. At this point the glass masters used in the pressing process are made overseas; it is hoped that this function will be offered in the local plant later in 1994.

Disctronics operate their complex — handling everything from mastering to pressing — in the Melbourne suburb of Braeside. Production figures for CD-ROM disks in recent months have been high: over 50,000 per month.

There are 20 minutes of video, shown on screen in a 70 x 50mm panel; you can access essays on the music, view the sheet music and lyrics while a track is playing — even dump MIDI music files into a home sequencer. To accompany the interactive files all tracks can be replayed from a separate, lower quality (8-bit, 22kHz sampled) partition on the disc.

According to Mike Fronzek, who put the album together, "We've done all these things to make the music more accessible. One of the problems the music industry has got is that sheet music is a thing of the past. What we're saying is that the music is here, whichever way you want to listen to it, or play it".

At this stage the company is preparing a 'second edition' for Mac and Windows, accessible from the same disc. The software used to put the album together was *MacroMind Director*, but Mike explained that "Eventually we will move everything across to *Apple MediaTool*, allowing us to compile a runtime engine that will run on both Mac and Windows". Hardware used was a Quadra 800 with 8MB RAM, feeding to 1.5 gigabytes of hard drive storage. Adds Mike: "We back up everything onto DAT as well, because when you're dealing with the raw movie files they tend to be gigabytes in size!"

The project took between five and six months to finish and was estimated to have cost about $100,000. The pair self-funded the project.

Mike: "There's been a lot of interest from overseas. Unfortunately, the Australian record companies are so used to looking to their parents overseas for guidance that they find it hard to conceive that there may be an answer right here."

But he doesn't see CD-ROM as 'the end of the chain' — it is, he says, more "the stepping stone towards home entertainment, via home-type CD-ROM players". ❖

NASA's new thrust in satellite communications:



NEW ACTS IN SPACE

After allowing itself to fall behind in the area of satellite communications technology, the USA has made a new effort to regain the lead — with its new Advanced Communications Technology Satellite, launched last September. Among other things, the ACTS will be used to gain more knowledge about using the 20 - 30GHz Ka frequency band...

by KATE DOOLAN

Up until 20 years ago, the United States of America was the undisputed world leader in the field of satellite communications. But this leadership ceased in 1973, when the National Aeronautics and Space Administration (NASA) eliminated funding for telecommunications research and development — leaving the Europeans and Japanese to pour billions of dollars into this highly competitive and lucrative field, in an attempt to dominate the fast growing (and very profitable) international satellite market.

In September 1993, the Advanced Communications Technology Satellite (ACTS) was launched into orbit by the space shuttle *Discovery*. The ACTS program will be used to provide for the development and flight testing of high-risk advanced communications satellite technology. By the use of sophisticated antenna beams and advanced on-board switching and processing, ACTS

will pioneer new initiatives in communications satellite technology.

Back on 12 August 1960, NASA launched *Echo 1*, which was the first communications satellite. *Echo 1* bore little resemblance to the communications satellites of today, as it was a spherical balloon with a metallised surface. Once it was placed into orbit, the balloon was inflated until it reached a diameter of 30 metres; it was then used as a reflector to bounce radio signals across the world's oceans.

The *Echo* spacecraft was simply a radio mirror in the sky, and its efficiency decreased as the gas which inflated the balloon escaped. *Echo* then lost its shape before it was burnt up as it re-entered the Earth's atmosphere on 24 May 1968.

This launch inaugurated a historical era of telecommunications research and development, as well as marking the beginning of the American satellite industry.

The second *Echo* was launched on 25 January 1964. This was a rigidised sphere with a diameter of 45 metres, and it conducted passive communication experiments using radio, teletype and facsimile. Excellent results were obtained in these experiments and the data was exchanged with the Soviet Union's space program.

In the years that followed, NASA developed and launched the Syncom series of satellites. These satellites demonstrated the feasibility of having satellites in a geosynchronous orbit, and they were the first to deliver video images that were acceptable for television transmission.

The next steps were the launching of six Applications Technology Satellites (ATS), between 1966 and 1974. This series of satellites introduced and verified new technologies, such as despun and unfurlable antennae as well as the design and use of multiple frequency satellites.

The ATS series developed and demonstrated many new satellite capabilities such as direct broadcast networks; land, aeronautical and maritime mobile communications; and search and rescue systems. These experimental satellites also facilitated the development of smaller, low cost earth stations capable of sending broadcast quality signals.

On 17 January 1976, the joint US-Canada Communications Technology Satellite (CTS) was launched and for the next two years demonstrated direct-to-home broadcast communications as well as providing television and other services to small, low cost ground terminals in remote areas of both the US and Canada.

Budget cuts

By the beginning of 1973, NASA's space communications research and development funding had been eliminated on the assumption that private industry would take up the slack and continue that work. It was at that time, following the Apollo moon landings, that NASA were still in the process of suffering severe budget cuts, forced upon them by the hostile Nixon adminstration. Five years later, it became evident that private industry had been unwilling or unable to continue NASA's work, and the once dominant US satellite industry had declined as a result.

To remedy this, NASA began to conduct market demand studies for a 30/20GHz communications system that would lay the groundwork for the ACTS program. By 1981, Proof of Concept studies began and in 1983, the program was restructured, its scope reduced and it was then christened the Advanced Communications Technology Satellite.

In 1984, NASA awarded the main contract for the design, development and construction of the ACTS spacecraft to the firm General Electric Astro-Space (now Martin Marietta Astro-Space) which is located in Princeton, New Jersey.

The total cost of the ACTS spacecraft was approximately US$300 million, which did not include launch costs.

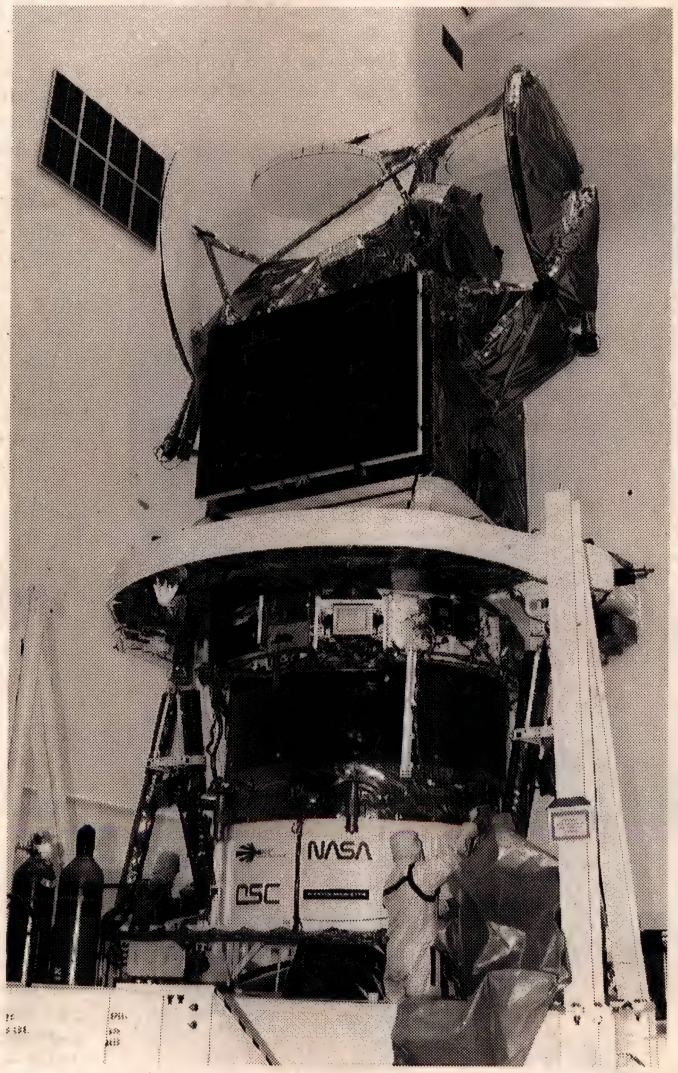
ACTS package

The Advanced Communications Technology Satellite consists of a spacecraft bus which contains basic housekeeping functions, and a multibeam communications package. ACTS weighs in at 2771kg and measures 14 metres in length, from tip to tip of the solar arrays, and nine metres across the main receiving and transmitting antenna reflectors.

The spacecraft bus structure is a rectangular box with a cylindrical centre section which houses the Apogee Kick Motor (AKM). The multibeam antenna subsystem is mounted to the Earth-facing panel of the spacecraft bus. The north and south sides are both divided into three panels, which are used to mount most of the spacecraft bus and the multibeam communications package (MCP) electronics equipment. The bus provides support functions for the MCP such as attitude control, electrical power, telemetry transmission, command reception and propulsion for station keeping.

The ACTS Attitude Control System (ACS) uses a momentum-biased, three axis control system with magnetic torquing and wheel speed modulation as the primary control mechanism. This system is augmented by a monopropellant hydrazine system which will be used during transfer orbit and station-keeping operations. The hydrazine Reaction Control System (RCS) also serves as a backup for the spacecraft's primary magnetic system. The RCS also uses 16 catalytic rocket engine assemblies, all of which operate within the 20 - 500 gram thrust range. The apogee injection manoeuvre to circularise at geo- synchronous altitude is accomplished by a Thiokol Star 37FM Apogee Kick Motor (AKM).

Electrical power for ACTS is provided by two solar arrays and backup batteries. The solar arrays, which total 42 square metres, consist of four panels



The Advanced Communications Technology Satellite (ACTS) transfer Orbit Stage payload is prepared for hoisting into a test cell inside the Vertical Processing Facility.

New ACTS in Space

(two on each side) and are maintained in a stowed position until after the Apogee Kick Motor burns out. Two nickel-cadmium batteries which each have a total of 19 ampere-hour capacity are used when required.

Thermal control for the spacecraft is achieved by surface finishes, coverings, heaters and heat pipes. Proportional heater control is used for the batteries, thrusters and propellant tanks while the heaters for the Apogee Kick Motor, propellant lines and travelling wave tube amplifiers are commandable.

Advanced comms

The 'advanced communications' of ACTS is the Multibeam Communications Package (MCP). The MCP operates in the Ka-band frequency range and consists of three active transponder channels, each of which is driven by a 40-watt travelling wave tube amplifier. Command, Ranging and Telemetry (CR&T) functions for ACTS during the geosynchronous transfer orbit operations are provided by a C-band command receiver plus high and low beacon transmitters.

CR&T communications occur through two C-band omnidirectional antennae, one of which is mounted on the back of the transmit reflector and the other is a deployable antenna on top of the antenna support assembly — which is deployed after the Transfer Orbit Stage solid rocket burn.

Once on station in geosynchronous orbit, the ACTS CR&T communications are provided by a Ka-band command receiver and high and low beacon transmitters. The ACTS interfaces to the space shuttle orbiter command and telemetry systems via the Command Master Unit (CMU) and to the shuttle direct current power systems through the Power Master Unit (PMU). Both the CMU and PMU are located in the Transfer Orbit Stage's airborne support equipment area.

The MCP performs receiving, switching, momentary storage, selectable coding and decoding, amplifying and transmitting functions for Ka-band time division multiple access (TDMA) communications signals. The Multi Beam Antenna (MBA) has both fixed beams and hopping-spot beams, which can be used to service traffic needs on a dynamic basis.

In addition, the receiving antenna provides signals to the autotrack receiver, which generates input error signals to the attitude control system for spacecraft pointing operations. Beam forming networks use hopping beams to provide independent coverage of east and west scan sectors, plu coverage for isolated locations outside each sector.

The MBA also has three fixed spo beams. A steerable beam antenna has bee incorporated into ACTS to provide anten na coverage of the entire disk of the Earth as seen from 100° West longitude and to any aircraft or any spacecraft (includin the space shuttle) which is within the view of ACTS.

Control, monitoring

The ACTS mission telemetry, tracking and command (TT&C) control and monitor functions are distributed between two locations NASA's Lewis Research Centre located in Cleveland, Ohio and the Martin Marietta Satellite Operations Centre (SOC) in East Windsor, New Jersey. The SOC is used to control the ACTS housekeeping functions during both the transfer orbit and geosynchronous phases.

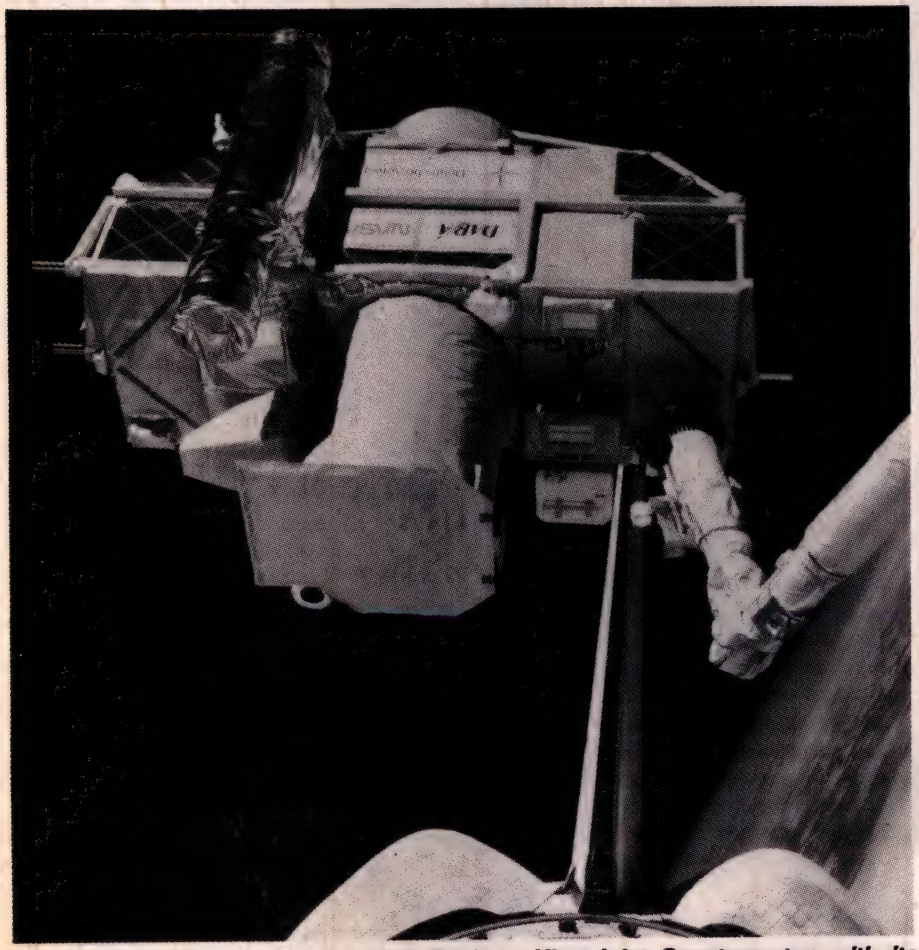
During the journey from the transfer orbit stage to the final geosynchronous orbit, the SOC controls the spacecraft through C-band ground stations located on the island of Guam in the Pacific Ocean and in Carpentersville, New Jersey. During the geosynchronous phase, command parameters generated at the Satellite Operations Centre are routed through landlines to the Lewis Research Centre to be uplinked to ACTS via Ka-band. Status information is displayed at the ACTS master ground station at Lewis.

The ACTS ground segment comprises the ACTS master ground station, the Satellite Operations Centre and experimenter terminals. The ACTS master ground station is located at the Lewis Research Centre and includes the NASA ground station which consists of a Ka-band radio frequency terminal, two traffic terminals and a reference terminal. It up-converts signals for the baseband processor mode of operations to 30GHz for transmission to ACTS, and amplifies and down-converts the 20GHz baseband processor modulated signals received from ACTS. Modulation and demodulation of the baseband communications signals are performed in the NASA ground station. It also transmits and receives signals in support of the command, ranging and telemetry functions for ACTS.

A master control station provides network control for the spacecraft baseband processor and backup to the Satellite Operations Centre for configuring the multibeam communications package. The master control station also enables experiment execution and telemetry collection.

The microwave switch matrix link evaluation terminal provides the capability for in-orbit testing of the microwave switch matrix and the multibeam antenna. It also conducts wideband communications experiments.

Command, ranging and telemetry equipment interfaces with the NASA ground station at intermediate frequency, and



The Orbiting Retrievable Far and Extreme Ultraviolet Spectrometer, with its Shuttle Pallet Satellite carrier is held on the end of the Remote Manipulator System arm prior to its final berthing on the eighth day of flight.

exchanges command, ranging and telemetry information to and from the master control station, the Satellite Operations Centre and the microwave switch matrix link evaluation terminal.

The Satellite Operations Centre has the primary reponsibility of generating flight systems commands and for analysing, processing and displaying flight system telemetry data. Orbital manoeuvre planning and execution are also handled by the SOC. The primary housekeeping function is performed at the SOC which is linked by landline to the Ka-band command, ranging and telemetry equipment at the ACTS master control station.

The Ka-band experimenter network comprises of a variety of ground stations to be operated by universities, industry and government organisations. These ground stations have varying communications services ranging from High Data Rate (HDR) of one gigabit per second to the Very Small Aperture Terminal (VSAT) at 1.5Mb per second, aeronautical and ground mobile voice and data at 500kbps and Ultra Small Aperture Terminal (USAT) data at 4800bps.

Experiment program

In August 1992, NASA selected 31 experiments from the public and private sectors for inclusion in the ACTS program. Over the two year experiment period, ACTS will be offering a unique opportunity for commercial, academic and government organisations to experiment with and validate new communications satellite technology. Sixty experiments have been approved to use the ACTS system and those experiments represent 86 investigators from over 60 organisations.

A formal two year experiment program is planned and has four major objectives:

- To demonstrate the commercial viability and market acceptability of new voice, data and video networks and service with ACTS.
- To verify the in-orbit performances of the advanced technology components of the ACTS flight system.
- To demonstrate and evaluate the system networking aspects of the switching and processing technology.
- To characterise the Ka-band transmission medium and develop techniques to combat signal fade and attenuation.

Some of the organisations which are conducting ACTS experiments include several NASA field centres, the National Institute of Health, the US Army Space Command, Motorola Incorporated, the Public Broadcasting Service, the Mayo Clinic, American Express and the NBC television network

Carried higher by TOS

NASA is using the Transfer Orbit Stage (TOS) to boost ACTS from low Earth orbit into a geosynchronous orbit of 35,000km. The TOS was first used in September 1992 on the ill-fated *Mars Observer* mission, and this was the first time it has been used on a space shuttle flight.



The Advanced Communications Technology Satellite with its Transfer Orbit Stage, leaves the cargo bay of the Earth orbiting Space Shuttle Discovery.

The Transfer Orbit Stage was developed by the Orbital Sciences Corporation and constructed by the Martin Marietta Astronautics Group. It is a single stage, solid propellant rocket system and is constructed of high strength aluminium alloy. The TOS weighs 9426 kilograms (including the solid propellant fuel) and measures 3.3m long, with a diameter of 2.3m. ACTS is mounted on top of the TOS and portions of both are covered with gold foil multi-layered insulation for thermal protection from the Sun.

An ORBUS-21 solid rocket main propulsion system manufactured by United Technologies Chemical Systems Division will give primary thrust for 110 seconds of powered flight. To provide the 262,445 Newtons which are needed to inject the satellite towards its geosynchronous orbit, the motor will use 8171 kilograms of the solid rocket propellant *hydroxyl terminated polybutadiene.*

Pitch and yaw of the spacecraft will be controlled during the burn by gimballing the nozzle of the solid rocket motor with two thrust vector control actuators. Roll control is provided by the reaction control system during the motor burn.

Guidance and control avionics for the TOS are based on a laser inertial navigation system. This acts as the 'brains' of the spacecraft, computing location and providing signals to the propulsion system to maintain a proper trajectory. All operations for TOS are performed autonomously, with no ground control instructions required. The guidance system uses laser gyroscopes with no moving parts — which reduces the chances of the system failing in orbit. A telemetry and encoder unit records performance data from all on-board electronics and transmits it to ground controllers at the Kennedy Space Centre in Florida.

A reaction control system thruster assembly correctly positions the TOS and its payload, based on data received from the laser inertial navigation system. The three-axis control system uses 12 small manoeuvr-

ing rockets, which rely on decomposed hydrazine as their propellant, to fine tune the orientation of the spacecraft. The reaction control system also turns TOS and ACTS for thermal control to avoid overheating from the Sun. Before the TOS is separated from ACTS, it makes final attitude adjustments.

Fifth time lucky!

Getting ACTS off the ground was a major headache for NASA. The crew of STS 51 made four attempts before having a launch success, and by the time the space shuttle *Discovery* had launched, the crew were referring to themselves as 'astro-nots'! Commanding the crew was Frank Culbertson with pilot Bill Readdy, both of whom had flown on the shuttle previously. The three Mission Specialists — all selected as astronauts in 1990 and making their first flights — were Dan Bursch, Jim Newman and Carl Walz.

The first launch attempt was on 17 July, when the countdown was halted 20 seconds before launch due to problems with the firing circuits of the solid rocket boosters. A week later on 24 July, the countdown was cancelled 19 seconds before launch when it was discovered that there were again problems with the solid rocket boosters. This time an auxilary power unit in the right solid rocket booster was to blame, and was replaced.

The following launch attempt was out of the hands of NASA. The Perseid meteor shower was taking place, and shuttle managers decided to delay the launch from 11 August until the following day to avoid having the *Discovery* in orbit during the peak period of the meteor bombardment. The next day, the countdown stopped three seconds before launch when the shuttle's number two main engine shut down. This led to a delay of a month whilst all three main engines were replaced...

During this period, the *Mars Observer* spacecraft stopped communicating with Earth controllers, and a National Oceanic and Atmospheric Administration (NOAA) weather satellite also went silent. As both of these satellites had been constructed by Martin Marietta Astro Space, as had ACTS, it was decided by NASA to examine ACTS in detail to determine whether it could be affected by the same problems as the other two spacecraft.

The examination of ACTS found that there were no major problems with the spacecraft, and on 12 September the space shuttle *Discovery* was launched from Pad 39B at the Kennedy Space Centre at 5:45 am (local time). Eight and a half minutes later, the shuttle and its crew were in orbit and preparations were made for the deployment of ACTS, six hours into the flight.

Communications glitch

The first attempt to deploy ACTS was delayed by the crew, when two-way communications were lost with Mission Control at the Johnson Space Centre in Houston, Texas for 45 minutes. To remedy the problem, the crew changed *Discovery*'s S-band communications system to a lower frequency, which restored communications with the ground.

Two hours later than scheduled, Carl Walz activated a pyrotechnic system which released the ACTS/TOS configuration from the orbiter's payload bay. The ACTS/TOS then coasted for 45 minutes while the shuttle manoeuvred away, to avoid a collision or damage from the firing of the TOS' solid rocket motor. The TOS then fired its motor, which accelerated it to a speed of 36,000 kilometres an hour and successfully boosted ACTS into geosynchronous orbit where it underwent a comprehensive checkout and testing period before beginning operations.

The following day, the STS 51 crew prepared to deploy the Orbiting and Retrievable Far and Extreme Ultraviolet Spectrometer-Shuttle Pallet Satellite (ORFEUS-SPAS). This German developed and designed spacecraft was built to be exclusively launched, deployed and retrieved by the space shuttle. ORFEUS/SPAS was an astrophysics mission designed to investigate very hot and very cold matter in the universe. For six days, the spacecraft would fly free from the shuttle.

Day five of the flight saw the final in-orbit rehearsals for the Hubble Space Telescope (HST) repair mission. The six hour spacewalk by astronauts Jim Newman and Carl Walz would be evaluating tools, tethers and a foot restraint platform planned for use on mission STS 61 in December. This was the third spacewalk in 1993 used to gain experience for the HST repair, the other spacewalks taking place on STS 54 in January and STS 57 in June.

The two astronauts successfully completed the spacewalk ahead of schedule, the only problem occurring when a stubborn tool box lid refused to close. This added another 45 minutes to the spacewalk, as the astronauts had to pry it free and close the lid. Eventually Newman and Walz logged seven hours and five minutes of spacewalk time.

After six days of flying free from the *Discovery*, astronaut Dan Bursch used the orbiter's Remote Manipulator System arm to grapple the ORFEUS/SPAS and latch it successfully back into the payload bay. During this time, Bursch successfully moved the arm through a series of 11 different positions, to allow a large format IMAX camera mounted on ORFEUS/SPAS to film the *Discovery* from various angles, as part of a new IMAX film release scheduled for 1996.

Following a delay of 24 hours for bad weather, *Discovery* made the first night shuttle landing at the Kennedy Space Centre at 3:56 am (local time) after a flight of 10 days, 9.6 million kilometres and 158 orbits of the Earth. As soon as the astronauts had left the shuttle, preparations were being started for *Discovery*'s next flight — a joint flight that would contain the first Russian cosmonaut to fly on the space shuttle, which is currently scheduled for late January 1994.

In closing, the author wishes to thank Debbie Dodds of the Johnson Space Centre, and Kay Grinter of the Kennedy Space Centre, for their assistance in the completion of this article. All photographs shown are by courtesy of NASA. ❖

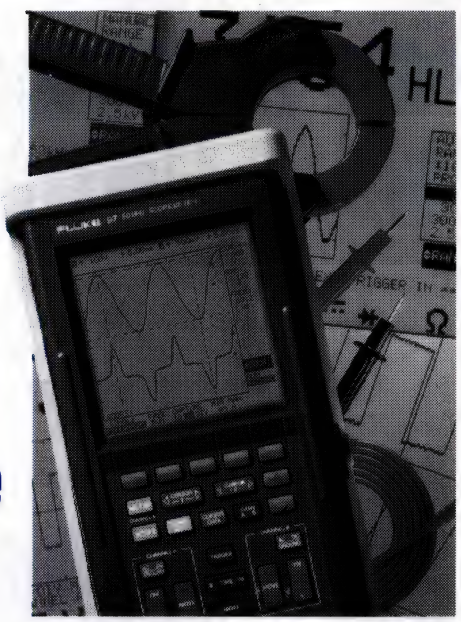


From left to right, the five crew members for STS-51 are astronauts William F. Readdy, Daniel W. Bursch, Frank L. Culbertson Jr., Carl E. Waltz and James H. Newman. Culbertson is mission commander, with Readdy serving as pilot and the others are mission specialists.

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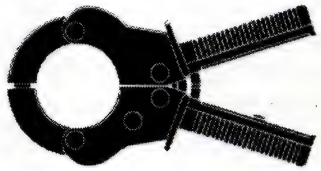
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Research & Development Update:

AUSTRALIA'S PHOTONICS RESEARCH WELL UNDER WAY

Set up as a joint enterprise by the Universities of Sydney, Melbourne, NSW and the ANU, together with the CSIRO and their industry counterparts, the Australian Photonics Cooperative Research Centre has already chalked up some significant achievements in this rapidly-developing area of technology. Here's a look at what has been achieved to date, and an insight into the future benefits for Australia if this initiative can be maintained.

by EVA S. DIAZ

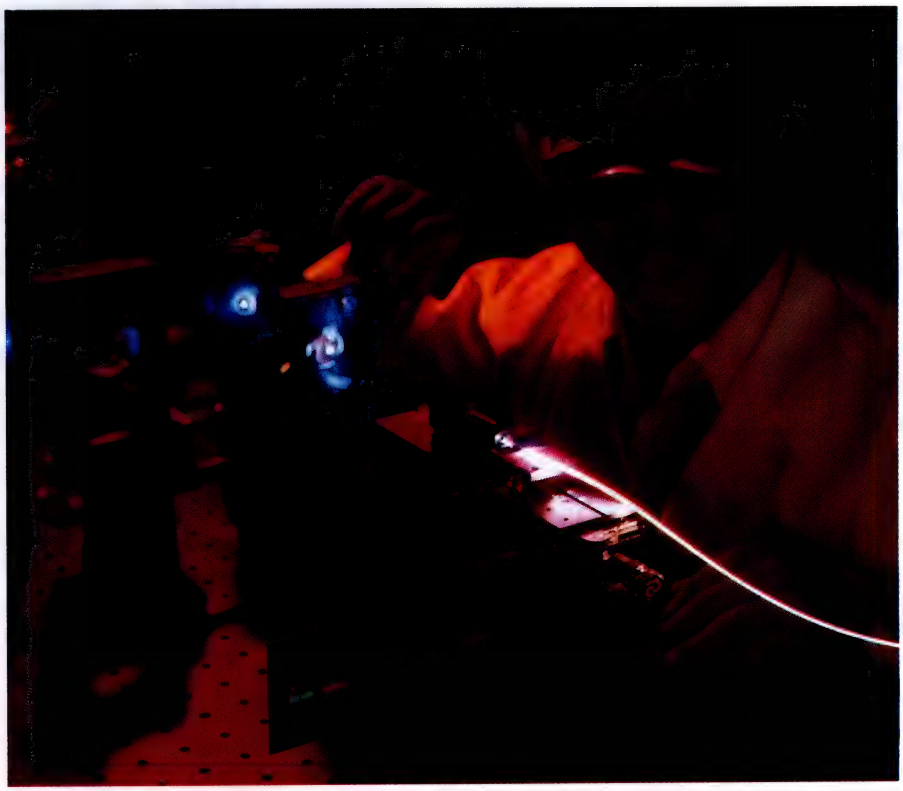
Photonics, or the control, manipulation, transfer and storage of energy and information using *photons* (the fundamental particles of light) instead of electrons, is projected to play a vital role in the emerging world of multimedia and the rapidly changing communications and telecommunications environment.

In a move to boost Australia's bid for a strong hold on this lucrative market, the Australian Photonics Cooperative Research Centre (APCRC) was established with several major participants including telecommunications companies, manufacturers and research institutions. Dr Mark Sceats, Director of the Centre said the coming of the centre "will assist Australia in capturing markets in the next phase of the fibre optic revolution".

Dr Sceats said that if the growth of photonics is to echo that of electronics, "photonic systems designed to customer requirements and complex photonic, opto-electronic and lightwave systems comprising hundreds of interacting photonic components will emerge".

The Centre boasts of a wide network of collaborating experts, from the Optical Fibre Technology Centre (OFTC) at the University of Sydney, the Photonics Research Laboratory (PRL) at the University of Melbourne, the Optical Sciences Centre (OSC) at the Australian National University, the University of New South Wales and their industry counterparts from Telecom Research Laboratories, Pacific Power, Fibernet Pty Ltd, NEC Australia, Siemens and CSIRO.

The Centre's six program areas, namely Fibre and Device Fabrication, Devices for Communication, Systems and Networks, Photonics CAD, Industrial Instrumentation and New Photonics Technologies have already reached technological milestones, considered either world firsts or comparable to world standards.



Yuxing Zhao, a researcher at OFTC working at the visible laser project.

Some of the technological advances and research projects being pursued by the Centre include:

- Custom fabrication of optical fibres and their application in communications systems. This is led by the OFTC, which has established a worldwide reputation for the fabrication of high quality Application Specific Optical Fibre.
- One Application Specific Optic Fibre being produced by at OFTC is the PF-1 High Numerical Aperture Fibre, now commonly used for pigtailing 980nm semiconductor diode laser pumps for erbium-doped optical fibre amplifiers.
- Another fibre type which has been developed is a novel form of rare-earth doped fibre, with a high concentration of element phosphorous in the fibre core. Other fibre types developed include Ultra-High (>0.3) Numerical Aperture, High Numerical Aperture Matched Cladding fibre for fused-taper couplers and Erbium-Doped Fibre.

Dr Simon Poole, Technical Director of OFTC, said the Centre is dedicated to pursuing the production of specialised fibres. He said while other countries have already made advances in other areas of optic fibre technology and

opto-electronics, "we want to give our best and still improve on what we are doing now, because this is the only way to get hold of a niche market in this area".

- To date the Centre is pursuing at least three main areas. One is the use of in-fibre gratings, as dispersion compensators, wavelength filters and line-width selection elements. The second set of projects is the application of active fibre devices — fibre lasers and amplifiers, as in-line components in communications systems. The third set investigates the use of planar waveguide devices, particularly for application in the Customer Access Network.
- The Centre is also involved in a joint project with Siemens in a GIRD collaborative program focused on the development of single port twin-core devices, for application in wavelength division multiplexing and wavelength filter applications — e.g., 1.3 microns for telecommunications and 1.5 microns for high bandwidth video.

To fabricate these fibres, OFTC had to develop a novel fibre fabrication technique based on a high temperature flash-condensation reaction of a phosphoric acid within a porous silica frit. The phosphoric acid, when heated, undergoes a reaction in which water is eliminated to produce the phosphorous glass, and this allows the incorporation of up to 17 mol% of phosphorous in the core of a silica fibre. Any combination of rare-earth ions can be incorporated for the fabrication of fibres for optical fibre amplifiers and lasers.

- The OFTC has also demonstrated the first stage of a visible laser fabrication which produced a blue high frequency laser in the 400 - 650nm range. To do this, OFTC scientists used an 835nm laser passing through an optical fibre treated with Praseodymium (Pr3+). This process led to the production of the high frequency laser which is being used in data storage, laser displays and laser printing technology.

Dr Poole said in producing the 480nm range laser from the 835nm range, the data storage density can be drastically increased by about four times. Citing the importance of this high frequency laser, Dr Poole said this development could be a big step for Australia as it tries to carve a share in the growing market for communications and consumer items using laser technology. He said the popularity of consumer items including laser printers, CD players, microwave ovens and multi-media facilities mean more and bigger demand and usage of lasers.

Melbourne node

The Melbourne node of the CRC, headed by the Photonics Research Laboratory at the University of Melbourne, is also reaping successes in various fields like instrumentation, photonics CAD, packet switching and fibre-optic video distribution to name a few.

In a joint project with BHP Research, PRL developed a prototype rangefinder system which will operate with targets having low reflectivities at high temperatures. Already being used in surveying to measure long distances and in laboratories to achieve great accuracy under controlled conditions, the laser-based metrology technique is predicted to break new ground in laser technology.

The system uses a laser beam which is directed at the object being measured. The light reflected by the surface of the object is then detected by the instrument and converted into a range measurement.

Dr Rodney S. Tucker, PRL's Director, said the rangefinder offers a remarkable combination of speed and accuracy at extended ranges. He said this was made possible by exploiting advanced photonic techniques from optical telecommunications systems and the development of a unique operating principle.

To date, an extension to the system which will provide a scanning mode is already being considered. The added feature will give an extra dimension in the measurement, and will expand the range of applications. With the scanner, a 3D picture of moving targets can be obtained.

The Photonics Research Laboratory at the University of Melbourne has developed a computer-aided design software package which it says will bring similar benefits to photonics as CAD did to electronics and engineering design.

Led by Dr Arthur Lowery, Associate Professor at the University of Melbourne, the development team said the CAD package will not only 'revolutionise' photonics and opto-electronics design, with its almost limitless capabilities; it will also bridge the gap between costly laboratory experiments and associated instrumentations, both in the research environment and academic sphere. Incorporating some of the most detailed semiconductor laser models available, the program is capable of assessing the performance of new laser designs and their performance within an optical system.

The program has built in user-defined libraries which carry a large number of electrical, optical and electro-optic components available for manipulation. Some of the optical components available include couplers, delay lines, isolators and attenuators. Characteristics of these models can be customised to meet the needs and requirements of the user.

Laser models such as Fabry-Perot, Distributed-Feedback (DFB) and gain-coupled DFB are also provided in the package. Dr Lowery said other laser designs can be built up using these basic models. He said the laser models used in the program have been used and proven in the research environment, and have actually been used to develop new laser devices and novel system configurations.

Pointing out the cost-effectiveness of the CAD program, Dr Lowery said it can be used as an 'optical bench' for testing new device and system designs without the enormous cost associated with photonic laboratory experiments.

For example, Dr Lowery said a laboratory experiment to study the crosstalk induced by semiconductor laser amplifiers in optical systems using multiple wavelengths (one per channel) would need at least ten DFB lasers, a laser amplifier, ten pulse generators, a sampling oscilloscope and a monochromator. He said use of this equipment alone would cost over half a million dollars.

But in the program, duplication of the laser models and pulse generators cost nothing, he said. This means teaching courses in photonics and pursuing complex laboratory experiments will no longer be 'too costly'.

Dr Lowery, who brought the work on the CAD package from the UK in 1990, said its development was prompted by requests by a major international telecommunications company to provide a better tool for predicting the performance of new digital systems design — one which would incorporate the latest developments in semiconductor laser technology. Since then the project has been supported by the Australian Photonics Cooperative Research Centre.

The future

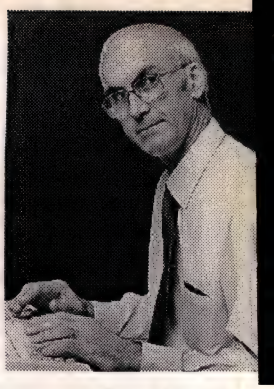
Dr Mark Sceats said although at present CRC's activities in photonics networks and systems are concentrated in the areas of telecommunications, they are also pursuing other emerging areas of photonics application such as industrial instrumentation and measurements.

The Centre foresees growth areas specially associated with the distribution of cable television by optical fibre to the small business and home. These will be accompanied by many comms services, ultimately leading to real-time voice/video/data personal communications.

The future for Australian involvement in this area looks bright, if the initiative taken by the APCRC can be maintained. ❖

FORUM

Conducted by Jim Rowe



Blue murder on the ham bands, and poorly regulated plug packs

Tom Moffat's piece in the November issue on belligerance, 'contest mania' and other undesirable behaviour on the amateur radio bands has attracted some more comment, including one letter which I suspect could generate quite a bit of further comment on its own. There's also a letter re-opening a topic that has attracted attention in the past: poor regulation in 'plug pack' power supplies.

We did get a fairly lively response to Tom Moffat's critical comments about amateur radio in his November column, and as you may recall we published some of these in the February Forum. However considering how critical he was, it's perhaps a bit surprising that we didn't get *more* response — especially from radio amateurs themselves.

Most of the response to date has come from shortwave listeners and other people who have noted the behaviour Tom complained about, and basically wrote in to back him up. With a few exceptions, letters or other responses from amateurs themselves have been conspicuous in their absence. Perhaps most amateurs are just too embarrassed to comment, or unwilling to admit to the rest of us that there's a problem with 'bad apples' in their midst.

Ducking for cover?

Another possibility, I suppose, is that they're adopting the same tactic that our politicians employ when their party is accused of mismanagement or shonky practices: say nothing, pretend you aren't aware of any problems, duck for cover and hope it'll all blow over...

Anyway, as it happens we've had a few more letters on the subject, and two of them have been from licensed amateurs — one of whom makes some comments which could easily trigger off some responses of their own. More about this one shortly, though, because I'll start the ball rolling again by showing you another letter from a reader who may not be an amateur, but is certainly a keen and well organised shortwave listener. The reader concerned is Mr John Smith, of Middleton in South Australia, and here's what he has to say:

It may be a bit late, but I have been trying to find a particular logging in my log books, [to make] *yet another response to Tom Moffat in his November '93 'Madhouse'.*

I am NOT an amateur radio person, but I do a fair amount of utility DXing. This activity has been going on for something like 12 years and I can only say that yes, over the last 8 - 10 years there have been a few Full Callers that have been abusive and using 'bad' language on 'their' bands. Mr Peter Parker VK6BWI may not have heard any, but that doesn't mean it's not there! I personally HAVE heard it, although it wasn't logged — it's not worth it.

On one occasion in Adelaide there was an Exposition of some renown in the Show Grounds. At this Expo were some radio enthusiasts, ranging from the so-called 'hated' CBers to pure listeners. I had my complete [utility listening] *set-up displayed as a working station.*

Two 'Old Timers' were sniggering at a Novice working packet. The two OT's then decided to show the Novice 'how it was done'. On hearing this I 'fired up' on the OT's frequency. The sending was to say the least abominable! When shown the results from my Telereader, I was abused as an interloper.

Not only was there double spacing between letters within complete words, but also wrong 'Q' signs. One OT even said that he didn't even know that RTTY code uses 'Z' signs. So much for not letting the Novices 'on line'. If these two OT's were to do the 'code' again and I was the inspector, I would fail them.

By the way, the Novice had error-free two-way signals. (I wonder if the OT's know what ARQ is?)

I have just located the logging which prompted this letter. The logging was made on the 13,000kHz band, while I was trying for a few Volmets. A VK8 was contacting (among others) a 'G' and 'WA' stations. In thinking that my receiver was playing up, I asked another DXpeditioner with a 'better' RX and antenna to tune in as well. He confirmed that all six 'full call' amateurs were 1MHz out of band. The date was 11/6/89 at 0650U; the mode was CW, on 13,112kHz. They are in my log, but I will not name them here due to the time lapse. They know who they are!

This MUST have been a 'set-up' network by themselves. Amateurs? No wonder I and other potential Novices will never 'go for it'.

Tom's article may have 'stung' a few people, but he just has to be right, even through my broadband listening (viewing on Telereader) alone. The 'Sacred Cow' will become a 'Sacrificial Cow'. Sorry to be so abrupt but, as Tom said, it is the way things are going here in the West.

By the way, Tom seems to have Spanish. Isn't it a shame more language courses are not taught in Western schools? As an aside, I noticed a note and errata for the 'Antenna Tuner & RF Preamp' in the November Issue. May I say that I got a kit from DSE, assembled it, and it works perfectly to original wire diameter specs. Wiring the toroids was a pain, but on several DXpeditions it has worked perfectly and as expected, better than a passive ATU.

Thanks for your comments, Mr Smith. It's a pity that some of the older amateurs seem to be so resentful of newcomers, and inclined to turn the hobby into some kind of childish 'Morse versus all of those newfangled modes' contest. Particularly if their skill at Morse is getting a bit rusty, as you relate!

Your other report, about the amateurs who were working well outside the 20m band, is even more of a worry. Accidents can happen, of course, but I agree that



this incident sounds very much as if they had moved out of band quite deliberately. That's extremely irresponsible and antisocial behaviour — the sort of thing that definitely brings ham radio in disrepute. It's also the kind of behaviour that can be used by the authorities as evidence that hams don't deserve much consideration when valuable spectrum space is being re-allocated...

It's ironic the way people can get away with this kind of behaviour, isn't it? I suppose it's a consequence of the way the authorities seem to have 'devolved' so much of the responsibility for spectrum management, down to the users themselves. In theory this means that all users have the responsibility to maintain 'law and order' on the bands, but in practice I suspect it means that many misdemeanors are simply given the 'wise monkey' treatment by everyone. (You know: 'hear no evil, see no evil, speak no evil'...)

I guess no one likes to be a 'dobber', but with the pressure building up all the time on use of the spectrum, it really is important for radio amateurs as a whole to ensure that no-one tarnishes their reputation for responsible operation. And that surely means reporting irresponsible people for antisocial and unacceptable behaviour, however unpleasant it may be to do so.

What makes the incident Mr Smith reported even more ironic, it seems to me, is that radio amateurs tend to be extremely vigilant in monitoring their own bands for 'intruders' — people using amateur frequencies when they shouldn't be. Perhaps it might be a good idea if they were also monitoring outside the bands (expecially in areas which are available to amateurs overseas, but not here), for transgressions by their own members. That would show they were *really* being responsible.

It's an old amateur radio maxim that hams should 'use them or lose them' — i.e., if they aren't seen to make use of their bands, the authorities might take them away. Perhaps the wording should be expanded a little, and written bolder: **Use them RESPONSIBLY, or there's an even bigger risk of losing them.**

Other nasties

Of the two other letters which arrived a few weeks ago, both from radio amateurs, one short note came from Mr Neil Brewster VK7GRN, of Trevallyn in Tasmania. Here's what Mr Brewster had to contribute to the discussion:

I had the displeasure of the last contest weekend, when a VK2 station was using an auto voice recording to repeat his call to all (with no problems). However the local VK2's were not happy, and were whistling over him. If that weren't enough, because he had a European accent they started to call him a 'dago'! Being so gutless as not to give their own call.

I am getting sick of the political discussion that's about, as well. On 7NT this morning was a person complaining about abusive language, etc., and interference on CB bands — saying that the Spectrum Management Authority was toothless. It's a fact that the Department is [too] *under-funded to do anything about any breaches of the Act.*

Thanks for those comments, Mr Brewster. Also for your good wishes to Tom Moffat and compliments on his column.

You say that the NSW amateur was using an 'auto voice recording' to repeat his call during the contest, 'without any problems'. But on the other hand, it was presumably this use of a recording which had upset the other hams and prompted their own anti-social behaviour. So in a sense, it did cause problems — even though there's no excuse for the behaviour of those who were deliberately interfering and being abusive.

I guess I have to confess that I've never been a 'contests' enthusiast. The whole idea of simply trying to make the largest number of radio 'contacts' in a certain time seems pretty pointless to me, and I've never been able to see what it has to do with radio experimenting. It also seems to have very little to do with good manners — judging from what you hear when you tune into a contest and people barking out calls and log numbers, abusing each other and scrabbling all over each other's signals in an effort to grab another contact in the shortest possible time, and so on.

It's really not a good advertisement for amateur radio, either.

As for the idea of using a recording device to allow you to bark out your call even faster, I guess I find this even less desirable. But perhaps I'm just revealing my prejudices, and a preference for the experimental side of the hobby rather than the 'operational' side. What do others think?

Broader criticism

Now let's turn to the remaining letter on the topic of amateur radio. This is the other one from a licensed amateur, and it's only partly a response to Tom Moffat's comments. The other motivations seem to have been the writer's own concerns about the future of amateur radio in general, and his disgust with recent events in the NSW Division of the WIA, where various factions seem to have been engaged in a very bitter power struggle.

While various people have made me aware of this ongoing problem, which looks as if it could easily result in the NSW Division tearing itself apart, I have deliberately refrained from publishing any comments about it in the magazine before this, because any publicity seemed likely to cause more harm than good — particularly for amateur radio as a whole. Now, however, I've decided to acknowledge the existence of the problem, at least to the extent of publishing this letter.

Why? Well, I suppose it's from a forlorn hope that the comments made, which are quite strong, might shock a bit of commonsense into some of the people who seem so hell-bent on tearing the WIA and amateur radio apart. Or at least they might galvanise enough other amateurs into action, to exercise their democratic power and bring things back into control before it's too late.

Anyway, here's the letter. It comes from a long-time amateur who has supplied me with his name, callsign and address, but has asked me not to publish them for fear of reprisals. He has been a member and supporter of the NSW Division for over 30 years, and prefers to use a *nom de plume*. See what you think:

It is interesting to read the responses in EA and elsewhere to any suggestions that Amateur Radio has a problem. Invariably the replies start with 'I remember back when...' written with a quavery hand by someone who is living in the past. For living in the past is what Amateur Radio is doing. Very little has progressed within the ranks, the technology, or the organisation since the 1940's.

Sure, Morse code has died out, conversation has died out, helping others has died out, home building has died out, and a few old hams have gone too! And that is what is happening to Amateur Radio, it is dying out.

Amateur Radio is an anachronism in today's world, where technology is overtaking the hams much faster than they are prepared to accept. Packet radio is a recent minor distraction, but look at what's happening there — it is currently flavour of the month but there is no development, no planning, no leadership, no co-ordination — no future.

The Wireless Institute is superfluous in today's climate. What has it achieved that wouldn't have happened anyway? What can it achieve for amateurs? What does it really provide? Why are there repetitive surveys of members' wants as the WIA struggles to justify its existence?

The WIA is always touted as the representative of united amateurs, but history shows that the lobbying power of the WIA with the SMA and politicians is insignificant. Members stay members out of loyalty, not from any good that comes from it. The vast majority of members would be happy with just their 'Amateur Radio' magazine (which is a worthwhile publication). But then there are rumours that certain people have designs on taking over the magazine as a private venture, and that would be the kiss of death for another WIA bastion!

The current unsavoury activities in the NSW WIA are no different to what has happened and will continue to happen in all states. In NSW factional elements are conducting a very expensive hate campaign against each other, to their eternal shame and the detriment of all amateurs. The most disturbing thing about these disgraceful events is that none of the combatants appear to be behaving any better than those they denigrate. The future looks particularly bleak for the NSW WIA organisation, no matter who seizes power.

Part of the problem in NSW arose when the WIA council of the day negotiated with a very astute commercial company and that has led to a situation which has disadvantaged the NSW amateur fraternity for evermore. Frankly, the councillors as a group were not qualified to make business decisions and I am afraid all the enthusiasm and dedication in the world does not make up for naivety and business inexperience, or worse, as these willing amateurs (in the full sense) struggle to be company directors running a million-dollar business.

Now are other states better served by their councils? Horror stories abound everywhere, so I fear not. Does any WIA council have a five-year business plan? Has any WIA council achieved anything new this year, over and above maintaining the status quo or going backwards?

What future?

So what is the future of Amateur Radio? To be brutally frank — it has NO future. World wide, the powers that be, authorities, politicians and big business are collaborating to totally change the concept of communications, to provide a Personal Communications environment in which anyone can communicate with anyone else via modern digital wireless technology. This progress is happening now, but amateurs are standing like King Canute, denying it will affect them. Inevitably, they are going to be steamrolled and will lose all claim to 'their' band space. But it is not all bad news, because they will have more facilities than they ever dreamed of, as Personal Communicators.

Packet, DX, QSLing, medical comparisons, all the favourites of today's hams will be available from private service providers, if they can see a profit in it. And the person who today becomes a ham will instead buy a service and enjoy his hobby as much or more than now, all laid out for him. He will enjoy the same privileges as any other person, provided he pays the call fees, just as people using mobile phones do now. Regulation will be firm and decisive via the service supplier, and progress will be sustained by multi-nationals, not limited by isolated backroom fiddlers.

The WIA will have no place in this commercial scene. The companies will dictate what happens and will respond to market forces, not some insignificant lobby of old fogies. The only unknown is how long this evolution will take — will it be within five years or 10 years?

If anyone wants to disagree, don't give

ne abuse, don't give me rhetoric or blus-er — give me facts, give me plans, give ne a future.

Yours sincerely,

'An old fogie and WIA member who loesn't have his head in the sand'.

Well, there it is. Pretty strong stuff, but bviously straight from the heart. And lthough the amateur concerned may de-cribe himself as an 'old fogie', he eems to me to be looking ahead with a emarkably high degree of honesty and larity. What he sees may not be very alatable to WIA members or other radio mateurs, but it's a scenario which may well turn out to be true, nonetheless.

I imagine his letter may upset even more people than Tom's column, but sometimes you have to ruffle a few feathers to get people thinking. And that's really what our correspondent is trying to do, I'm sure: get people to think, about amateur radio and its future — if indeed it has one.

So if you disagree with what he's said, the answer is not to fume and fulminate, but do as he says and provide a clear and logical alternative scenario. I'm sure we'll all be very interested to hear what you have to say.

Mind you, I don't really expect to get too many constructive responses. I can almost hear the wagons drawing tighter together, and the muskets being loaded to defend the amateur radio 'lager'.

Criticism of amateur radio in *Electronics Australia*? Right, let's all boycott it, to teach that Jim Rowe and Tom Moffat a lesson. They're both members too, aren't they? Right, let's chuck them both out on their ears. Damn cheek, publishing stuff like that 'old fogie' letter! Now, how can we find out who wrote *that* letter...

Plug pack regulation

Finally, let's change the subject, to a rather more mundane kind of problem: poor voltage regulation in 'plug pack' power supplies. Here's a letter I received a couple of months ago, drawing attention to this problem again. It comes from Mr Martin Tesar, of Wantirna in Victoria, and it's fairly self-explanatory:

To power some of my electronics gear, I recently purchased a variety of power packs. I was amazed to find the output DC voltage substantially higher in some cases than stated.

A power pack with a 9V 100mA stated output was in fact putting out 14.5V with a light load of 20mA. This one I immediately returned, only to be told that "They're all like that — what are you complaining about?"

When does 9V mean 14.5V? Does this mean the plug pack will drop 5.5V to supply 9V, only at full load? This higher voltage could shorten the life of some parts in the device you are powering, if they are drawing only a light current.

The SEC might be able to explain their compliance standards when issuing approval numbers for these units, with regard to output voltage tolerances.

Most shops stock only one model of each type, which limits obtaining a quality item. So tread carefully when powering your gear that doesn't take kindly to voltage boosts.

Keep up the great work at EA.

Thanks for those observations, Mr Tesar. By the way, Mr Tesar also sent in a table showing the measured no-load output voltage of four different plug-pack supply models, with a measured mains input voltage of 247V. These varied from the 14.5V or '60% high' mentioned in his letter, for a commonly available 9V/100mA model made in China, to figures about 40% high for a 300mA multi-voltage model also made in China, 27% high for a 500mA multi-voltage model made in Hong Kong, and finally a much better 4% high figure from a 250mA three-voltage unit made in Taiwan. He also gave the brands and model numbers, but I don't believe they're particularly relevant; it's a fairly widespread problem.

He's quite correct in suggesting that these supplies tend to be rather poorly regulated, of course. When they were made in Australia (and nowadays few of them are), the makers would admit (if pressed) that it was hard to give them particularly good regulation — so their approach was to design them for a relatively high no-load voltage, and work on the basis that the output voltage would fall to the nominal value when rated load was applied...

Why is it so hard to give them good regulation? As far as I recall, it's because the transformer has to be very small and light. This tends to result in a fairly lossy design, especially when they use welding to hold the laminations together.

The smaller the transformer, as I understand it, the harder it is to give it reasonable regulation. That's no doubt why the plug-packs with the lowest power rating tend to have the poorest regulation, and the huskier 300mA and 500mA types tend to be a bit better.

Of course it's one thing to explain *why* plug-pack supplies tend to have relatively poor regulation, and another to work out what to do about it. As Mr Tesar points out, equipment which draws only a few tens of milliamps (which is not at all unusual, nowadays) could easily be overloaded by continued application of a supply voltage 40% or even 60% higher than their rated figure.

Probably the safest solution is to use one of the newer plug-packs which include an internal voltage regulator chip. These get around the problem quite nicely, although they're still rather more expensive than the conventional unregulated type — and also not as widely stocked, as yet.

Add your own regulator

Another approach would be to fit a simple regulator circuit into the equipment itself. This could probably be nothing more than a three-terminal regulator chip like the LM317, plus a couple of resistors to let you set the output to the voltage level expected by the rest of the equipment, and perhaps a bypass cap or two. If the equipment has a low current drain (say less than 50mA or so), you probably wouldn't need to fit the regulator with a heatsink.

Finally, there's always the option of using one of the standard multi-voltage plug packs, and selecting the most appropriate switch setting with each piece of equipment, by using a DMM to measure the actual voltage being delivered under load. This might be a bit fiddly, but is probably satisfactory where you are only using the plug pack to power either a single piece of equipment or at most a couple of different items.

Considering the widespread nature of this problem, I suppose it's a bit surprising that the manufacturers have been so slow in coming up with the regulated types of plug pack. Still, perhaps it's a case of better late than never!

See you next month, I hope. ❖

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When I Think Back...

by Neville Williams

More about Wally Coxon and the first broadcast station in the West — 2

Continuing last month's instalment, we share here more of Walter Coxon's personal account of his early career as founding engineer/manager of Western Australia's 6WF, as per articles published in *Broadcaster* magazine, beginning in February 1939. Later, he had a hand in setting up three other broadcasting stations — 6ML, 6BY and 6AM — before ultimately becoming involved with Alfred Traeger in providing wireless back-up for the Royal Flying Doctor Service.

In common with other early broadcasters, the engineering staff at 6WF were concerned about unreliable night-time reception — with broadcast signals subject, at times, to fading and/or distortion every few minutes beyond 50 - 100 miles (80 - 180km) from the transmitter. Depending on the season, prevailing conditions and transmission wavelength, such effects could limit the dependable night-time range of medium wave stations, in particular, to less than their daytime coverage.

Keen to collect and correlate data in their own environment, Wally says that 6WF staff organised two transportable listening centres which could be set up, typically 300 yards apart, in any available level field. By way of communication, both teams were equipped with a hurricane lamp which could be turned up or down in brightness as the signal strength varied.

Although primitive, the method was sufficiently effective to confirm that there was a significant time difference in the fading cycles, as observed at the two sites: when the signal was poor at one, it would often be good at the other — an observation that gave rise to the concept of *diversity* reception.

Through 6WF, Wally C. also coodinated research into thunderstorm static. The method in this case was to distribute hundreds of typewritten word lists — statewide — to those listening to its long-wave and short-wave transmitters.

At opportune times, the words would be read into the studio microphone and listeners were asked to cross out any word that was obliterated by a static crash.

With a couple of hundred lists returned for analysis, it was enlightening to compare them, having respect to the listener's address.

Some thunder crashes wiped out certain words state wide, indicating that they had originated in a violent storm a long way off. Others showed just as clearly the effect of localised disturbances, limited to certain areas.



Fig.1: From the sketch pen of Harry Hudson, an ageing Wally Coxon is shown being interviewed at his home in Darlington, WA.

Intriguingly, Wally Coxon says that the same two transmitters were used (presumably in the late 1920's) to broadcast what was probably Australia's first stereo radio program.

Normal procedure at 6WF was to feed a common mono signal to both transmitters but, for the 'stereo' experiment, physically separate microphones were fed to the respective transmitters. Listeners with access to separate longwave and shortwave receivers were encouraged to connect them respectively to the left and right headphones.

Despite the random effects on phase of the two dissimilar signal paths, Wally Coxon says that the 'spatial' nature of the two-channel sound, as heard, was clearly apparent.

Microphone techniques

6WF, he adds, also became a spontaneous training centre in the west for vocalists and instrumentalists aspiring to break into broadcasting. The development was unwittingly inspired by the visit to Perth of Raymond Ellis, an experienced broadcaster and, at the time, Chief Baritone of the British Opera Company.

Entering the studio for a recital, his custom was first to remove his coat, waistcoat, collar, and tie. "If you feel all bottled up, that's how you'll sound over the wireless", he would say.

But that was not all. During the performance, he would work within a few inches of the microphone, being meticulous about his enunciation and his control of breathing. Despite the worst fears of cautious operators, he would never bump the mic or 'puff' the diaphragm, and the sound was invariably outstanding. Such was his voice control that the operators actually had very little to do.

From his example flowed regular Saturday morning tutorial sessions in the studio, in which local artists and lecturers alike honed their skills at getting the best from studio equipment of the day.

To round out his story, Wally Coxon recalled some of the memorable OB's (outside broadcasts) carried out in the late 1920's.

When a group of Japanese warships visited Fremantle, station management thought it would be a novel idea to do an OB from the flagship, featuring a few words from the Admiral and music from the ship's band.

Initially, the WA District Naval Office wouldn't have a bar of the proposal — on the grounds that an Australian broadcast station would, technically, be broadcasting from foreign 'soil'. His objections were overcome only by resort to political and diplomatic channels.

This done, the arrangements were painstakingly communicated to the relevant Ship's officers, and in particular to the bandmaster.

What does 'on cue' mean?

There would be an introductory announcement, after which the band would present its first item — on cue, at (about) such and such a time, lasting for (about) so many minutes. Segments would follow from the onboard announcer and the studio, after which the band (on cue) would present its second item at (about) such and such a time. And so on, for the duration of the broadcast...

But, on the day, the announcers were only part way through their planned introduction when the band struck up its first item. The introduction had to be cut short, followed by a hasty reference to the band, and what remained of the first selection; then an awkward silence!

Taken completely by surprise, the announcers and operators were still busily picking up the tangled threads of the broadcast when the band struck up again.

What was going on? Simple: unsure about the references to 'on cue', the bandmaster had meticulously listed the provisional times and decided that the safest way was to work precisely to them. So, equippped with a podium, a baton and a table clock, he was doing his own thing — without reference to the rest of the proceedings!



Fig.2: Having made a major contribution to broadcasting in WA, Wally Coxon found time in later life to draw circuits, prepare service data and supervise the construction of transceivers for the Royal Flying Doctor Service (RFDS).

Prevented by the language barrier from ensuring a different result, the whole broadcast had to be improvised to conform to the bandmaster's list and table clock.

Coverage of a different kind had to be provided for the visit to WA of the Duke and Duchess of York — later King George VI and his Queen — aboard the *HMS Renown*.

Wally said that Dr J.B. Battye was available as the principle commentator, but as things worked out, he (Wally) found himself, at a critical moment, perched on the roof of a nearby wharf shed overlooking the scene. From his isolated vantage point, he had no option but to describe what the Duchess (the present Queen Mother) was wearing. In this department, he said, he had about the same level of expertise as the average Australian male!

More familiar ground

The epic flights of Smithy's *Southern Cross* provided occasions for other memorable broadcasts. 6WF was one of the stations which carried transmissions from the plane during its historic flight across the Pacific.

When the *Southern Cross* landed at Perth after a trans-Australian flight, 6WF covered the event from a car equipped with a small transmitter feeding a signal back to the studio. To the best of Wally Coxon's knowledge, this was the first occasion in Australian wireless history when a major program feature was broadcast 'live' from a road vehicle.

The same vehicle was used subsequently to provide live coverage of a road race from Beverley to Perth and, in 1927, to provide roving coverage of scenes at the Perth Royal Show.

Adding to listener interest, the car carried a receiver tuned to 1250 metres such that commentators in the car and in the studio could conduct an on-air two way conversation.

Early race broadcasts also provided their moments, if only because announcers like Frank Anderson had to learn how to improvise a spontaneous running commentary, given a basic interest in racing, a pair of binoculars and glances at a race book to refresh his recollection of horses, jockeys and colours.

On one memorable occasion, Frank failed to notice that the wind had flipped a page during the course of a race. To make matters worse, he had also forgotten that, at the time, two horses carried the same colours. As a result, Frank inherited the distinction of calling, as the winner, a horse that wasn't even in the race!

Some announcers, according to Wally, became a little too adept at 'talking up' situations. In wrestling bouts, for instance, a display of grimaces and tangled limbs could translate into "a desperate test of endurance" — when the contestants were just as likely having an impromptu rest!

WHEN I THINK BACK

Similarly a motor race with the contestants spread half-way round the track could become a "tightly contested finish".

As if to make a manager's life a touch more interesting, the PMG Broadcast Station licence carried a requirement that 'no matter which is the subject of copyright may be broadcast without the permission of the owner'. While included, perhaps, as a formality, it had the ultimate effect of alerting the music industry to the possibility of making 'a few extra quid' out of the new radio broadcasting industry.

It had long been assumed that purchase of sheet music or a disc freed the purchaser from copyright obligations for normal use. Official mention in the licence raised doubts about this simple convention, and ultimately put pressure on stations to keep a formal log of all music reproduced or performed on air.

In turn, the log caused arguments about who really did own the rights (if any) to what, with some copyright agents simply submitting ambit claims repeating everything in the list. In one classic case, one copyright agent claimed for the National Anthem and a song called 'Poppies', written and performed by 6WF staff and specifically endorsed 'unpublished'!

It marked the commencent of a saga which was not resolved until much later.

Personal reflections

In 10 of the 11 weekly articles published in *The Broadcaster* in 1939, Wally Coxon dwells on the setting up of 6WF. The final article, however, records his personal reactions to broadcasting in Australia over the period 1923 - 1939.

He emphasises that the choice of long-wave technology for 2FC (Sydney), 3LO (Melbourne) and 6WF (Perth) was made by local 'experts' who would appear to have been influenced by the European scene and, in particular, by the respected P.P. Eckersley, Chief Engineer of the BBC.

In line with their advice, the respective sponsors submitted their choice of wavelength, which the PMG's Dept formally accepted and endorsed. That, I must confess, came as news to me.

In his own state, he explains that the reasons why 6WF chose 1250 metres (240kHz) were:

1. The fade-free night coverage would more likely approximate the daytime figure and exceed the reliable day/night coverage of an equivalent medium-wave station.
2. By promoting a predominantly long-wave system, the night-time airwaves in and around Australia would be less cluttered by fade-prone signals randomly reflected from the upper atmosphere.
3. Within their own service area, the signals from a long-wave station could be enhanced by increasing transmitter power — without unduly extending 'skip' effects.
4. The front-end performance of receivers tuned to a long-wave signal was better than for medium waves, thereby reducing the need for complex circuits — in particular resort to the superheterodyne configuration.

Unfortunately, he said, while choosing a sensible wavelength, 6WF had erred in cramming the aerial system on top of the company premises in Perth. The transmitter should really have been located outside the City proper, where the aerial could have been 500 - 600ft (153 - 183m) long.

Writing in 1939, Wally Coxon clearly deplores the political and commercial pressures that seduced the Australian radio scene away from the British/European example to the American pattern, with all broadcast stations crammed into the medium-wave band.

Noisier signals

As a result, he claims, the reliable day/night coverage of the average Australian station was limited to about 30 miles (50km), and listeners were responding to the plurality of signals with American style (superhet) receivers which were too sensitive for their own good. While certainly able to log distant stations, they also reproduced the attendent noise and inter-carrier interference, meanwhile sacrificing basic sound quality for the local stations which really mattered.

If Wally Coxon was conscious of 'the Golden Age' of radio in the 1930's, he makes no mention of it as such. Nor does he allow for the beneficial effect of resonant vertical transmitting antennas or the prospect of an interference-free FM service. His fervent but forlorn hope in 1939 was seemingly that the Government would wake up to itself and re-establish his beloved long wave band.

For 6WF, he says, the 'new era' was ushered in on 1st September 1929, when the station was transferred by Government/PMG edict to 435 metres (690kHz). At about the same time,

In lighter vein...

In outback lingo, a 'dogger' is someone whose job is to exterminate dingoes. From RFDS literature comes the tale of a dogger employed by the Agricultural Protection Board.

Of European origin, he had access to a transceiver with a callsign which included the letter 'W' — identified phonetically as 'Whisky'.

He objected, on the grounds that he didn't like the stuff. Why couldn't it be 'W for Wodka'?

And subsequently, for many years in that part of WA, it was!

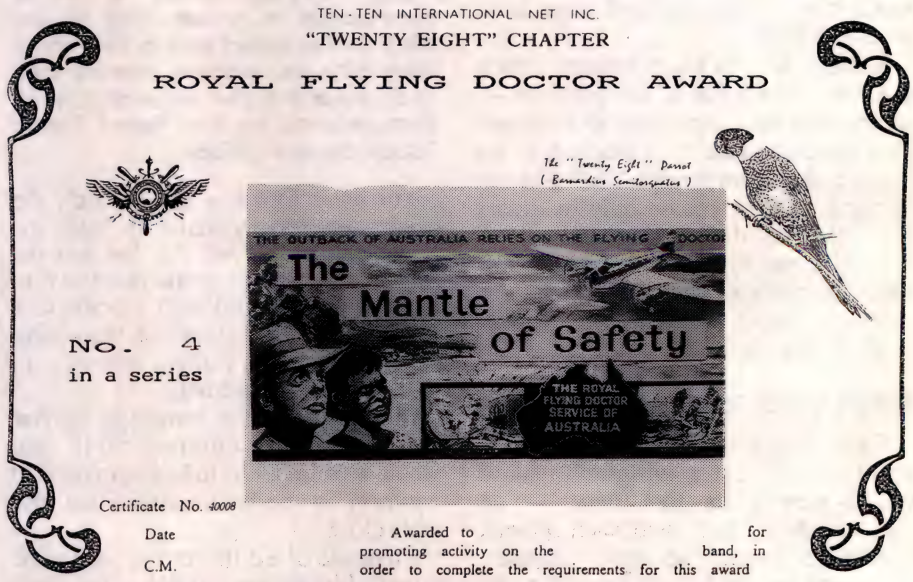


Fig.3: One of a series of awards seeking to commemorate and promote a long standing association between licensed amateurs and the RFDS. For details contact Dave Hanscomb VK6ATE, PO Box 39, Quinns Rocks, WA 6030.



Fig.4: This DH83 Fox Moth, VH USJ, was chartered and later purchased in the late 1930's by the RFDS Council (WA Div), with which Wally Coxon was actively associated.

programming responsibility was transferred to Union Theatres Ltd (also J. Albert & Sons and Fullers Theatres), functioning under the title of The Australian Broadcasting Company.

(In 1932, A-class stations Australia-wide were acquired and consolidated under the Federal Government controlled ABC — Australian Broadcasting Commission — with the PMG's Dept responsible for their technical facilities.)

In point of fact, back in 1929, 6WF had not been doing well financially and Westralian Farmers' management had been considering the possibility of attracting more listeners by operating their 100-metre channel as a separate station. As things turned out, they didn't have the option; but would have faced instead an obligation to re-equip and re-licence 6WF as a stand-alone medium wave station.

When the Australian Broadcasting Company and the PMG Dept entered the picture, the time had come for a parting of the ways, affecting both Westralian Farmers and Wally Coxon personally. Without speculating as to who said or did what, it is possible that Wally's observations in 1939 stemmed from nostalgia for the 'good old days' when broadcasting was less subject to bureaucratic control.

New stations

However, if Wally Coxon found himself 'at a loose end' after leaving 6WF, it wasn't for long. As mentioned in the original article, he was very soon occupied in setting up 6ML for Musgraves Ltd. Opening on March 19, 1930, it was subsequently taken over by W.A. Broadcasters, but closed down during the early war years — a victim of wartime manpower problems.

He was also involved in setting up 6BY Bunbury, but it too closed down after a couple of years — a belated casualty of the Great Depression.

Then, in late 1933, Coxon was commissioned to design and build a transmitter for 6AM, to be set up in Northam, some 80-odd kilometres north-west of Perth. Backed by two brothers Frank and Archer Whitford, it was to prove no less successful than its founders' other widespread ventures — including Whitford theatre slides, the Sydney Harbour Bridge Pylon Exhibition and what was at the time one of the largest dairy farms in NSW, in the Gloucester region.

Station 6AM was officially opened some six months later (June 1, 1934) with a small emergency studio in Northam, but with the main studios in Perth, connected by landline. To his obvious satisfaction Coxon, as Supervising Engineer, was able to boast that the design and manufacture of the plant had been effected in Western Australia — all except the meters and valves.

Broadcasting on 306 metres (980kHz) with a 1kW licence, 6AM was at the time the most powerful commercial station in WA, offering an effective service throughout the critical area NW of Perth. In September 1934, Wally Coxon was appointed to the joint position of Supervising Engineer and Manager.

As if to make Coxon feel even more 'at home', Harold R. Wells had also joined the staff of 6AM in June 1934 as its Chief Announcer. Wells had begun his career with the inauguration of 6WF in June 1924, as Western Australia's first professional radio announcer.

He had cut adrift from 6WF in 1929, ostensibly for health reasons. Significantly or otherwide, it was about the same time that Wally Coxon had 'walked' or been 'shoved', and replaced by Basil Kirke from Sydney, the ABC's own nominee.

THE 'REAL' SHORT WAVES

6AG's successes have fired the imagination of Westralian amateurs, and all the (licensed) transmitters are calculating inductance values and so forth, preparatory to sliding down to 40 metres.

(From The Western Wireless for October 28, 1925)

Coxon and the RFDS

That Wally Coxon was still a key figure in WA broadcasting in 1939 is indicated by the editorial introduction to the series of articles which he prepared for *The Broadcaster*. 'Nobody is better qualified', they said, 'to write a history of broadcasting in WA from pre-1924 to the present'.

But, despite his involvement in public broadcasting, he had another committment and for much of the relevant documentation, I am indebted to Dave Hanscomb (VK6ATE) of Quinn's Rocks, WA.

Quoting from *Radio History of the Royal Flying Doctor Service of Australia 1928 - 1981*, written by John Behr, Dave says that the Federal Council's Radio Committee met in Melbourne on November 20, 1936. Included in the initial six members was Mr W.E. Coxon, Technical Adviser to the Victorian and WA Section and Mr Traeger's representative in WA.

It would appear, in fact, that Wally Coxon's involvement with the RFDS dated back at least three years before this, to the formation of the Western Australian Division in Perth in October 1933. Patterned on the Cloncurry model, the Division had chartered its own DH83 De Havilland 'Fox Moth' from MacRobertson Miller Airlines, with potential cabin accommodation for a doctor, nurse and stretcher patient.

About the same time, 'Mr W.E.Coxon (VK6AG), of broadcast stations 6WF and 6AM' was named as Communications Consultant to the WA Group and as an associate councillor.

A much later reference dated March 4, 1942 mentions that Mr W.E. Coxon 'our Technical Adviser' had been conferring with the Military Authorities in Perth regarding the transfer of the bases at

Wyndham and Port Hedland, and had already been advised as to the RAAF personnel who would be allocated to those bases.

Indicating an on-going involvement, John Caswell (OIC Radio, RFDS) says that archives at the Cairns Base contain an original Workshop Service Manual dated 1945 - 6. Compiled by W.E. Coxon, it was intended for use by operators at RFDS bases and authorised regional servicemen — remaining at all times the property of the RDFS Federal Council.

The unusually substantial covers on the Archive copy are of Masonite board measuring 240 x 280mm, edge-bound with black leather. Despite having been used as a workshop manual, the covers and worksheets are still in good condition. One of the original pages is rubber-stamped: Tillys Limited, Plan Printers, 728 Hay St, Perth.

A contents index lists comments, circuits and layout diagrams relative to a dozen-odd models, as prepared by Alf Traeger and Walter Coxon.

An example involving notes by Traeger and a circuit drawn by Coxon recommends modifications to reduce the risk of transceivers being inadvertently left 'on' in transmit mode, thereby blocking a community channel. The problem arose from children failing to replace the microphone on its switch-hook after use, while also leaving the mode switch on 'Send'.

As I pondered the above and the legend 'Drawn by W.E. Coxon', it seemed almost like an anti-climax for someone with so much experience to be simply drawing circuits. But that was before I came across a photostat sent to me by Des Bird (VK3DB) of Surry Hills, Vic, lifted from a book *Flynn's Flying Doctors* by Harry Hudson and P.R. Stephenson. Hudson records, and I quote:

"I spent a day with Wally Coxon, Radio Advisor, at his home at Darlington, in the hills close to Perth. A radio technician of oustanding ability, he assisted Alf Traeger during the installation of the bases at Wyndham and Alice Springs. At the time of my visit, he was completing the equipment for the new Base at Carnarvon."

"At the end of the war Traeger, overwhelmed by orders for transceivers which he was unable to fulfill, gave Coxon permission to build sets in Western Australia. With the help of spare-time workers, sets were assembled from parts bought in or made by local mechanics."

"Later, he built his own set 'The Coxon Communicator', used at many outposts in the State. It is inexpensive and operates efficiently over the Base frequency."

How very inappropriate was my earlier remark about an anti-climax!

If Wally Coxon wanted to apply to good purpose a lifetime of communication skills, humble or otherwise, what more worthy cause could he have chosen to support than the vision of Rev John Flynn: 'To spread a mantle of safety over the people of the vast inland of Australia, combining the use of aviation, medicine and radio'?

Dave Hanscomb, mentioned earlier, is confident that a detailed search through relevant literature would cast still more light on the career of Wally Coxon. But for the present, we have probably said enough.

The ultimate comment in Dave's letter is "I didn't actually meet Wally, as he became SK (Silent Key) in mid 1968. (Amateur Radio list, changes for callsigns for October, 1968. See also *Amateur Radio* for April 1969. VK6AG W.E. Coxon — deceased". ❖

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READER INFO NO. 8

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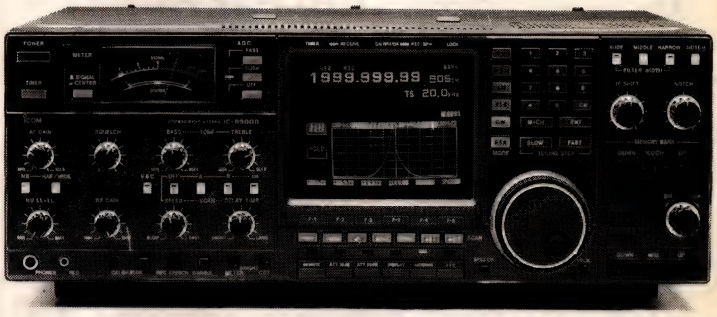
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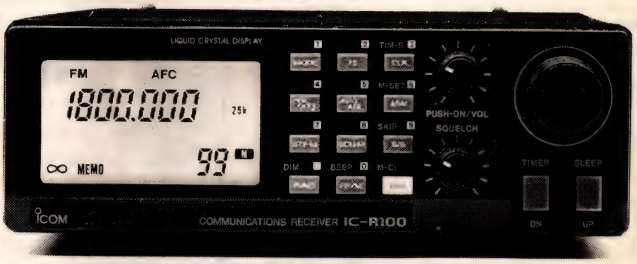
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READER INFO NO. 9

THE SERVICEMAN

Oh no — not an intermittent fault in (gulp) the car radio!

One of my stories this month concerns a magnificent old Kriesler colour TV, whose owner seems to want me to keep it going until this type of set comes back into style. Happily I was able to fix i on this occasion, though more by good luck than sound diagnosis. There's also tales from twc colleagues — one who struck a most unexpected fault in a VCR, and the other with what must bc the very worst kind of equipment to get an intermittent in: a car radio...

On quite a few occasions in the past I've told a story about an unfashionably old TV that I had just serviced. In most cases the customers were of long standing and I knew their sets intimately, after many years of looking after them.

Also, most of these old sets finished up showing very good pictures, often earning the accolade 'As good as any modern set!' I don't know to what extent my attentions over the years have contributed to their present notable condition, but I like to think that I did have *something* to do with it!

One of these fine old TVs came under my attention again just recently. It was one of those magnificent Kriesslers, in a handsome console cabinet finished in a genuine teak veneer. The owner is determined that it will last forever, or at least until these heavy furniture style cabinets come back into fashion — so that his old Kriesler can be replaced with a new set in a similar style. In the meantime, I do what I can to keep it serviceable.

The set was one of the first range of colour sets released by Kriesler, and was fitted with the 59-01 chassis. This was more or less identical to the Philips K9 chassis and although the main PCB's bore little resemblance to each other, they were each based on identical circuits and built up from almost identical components.

Over the years this has been very convenient, since the one set of major spares suited both brands. Most of the ICs and transistors were interchangeable, as were many of the capacitors, resistors and inductors. However the fault that I'm about to discuss occurred on the one board that was significantly different to the corresponding Philips chassis and as a result, this made diagnosis more difficult than it would have been in the latter set.

The owner called me one evening to say that the picture had "...almost disappeared". He still had colour and could see a bit of the picture, but it was "all wobbly and dark". Significantly, the sound was still normal. His description didn't tell me very much, so I made a note to call on him next day and left it at that.

When I got around to seeing the set in operation, I realised that his description of the fault had been quite accurate. The only thing that I could add to the story was that the picture seemed to be lacking contrast. The dark parts of the picture seemed reasonable, but the highlights were distinctly dim.

I tried changing channels, both on the TV and the attached VCR, but there was no real difference in any of the pictures. However, I did find that fine tuning the TV made a considerable change to the picture. The wobble in the vertical lines became more pronounced, finally breaking up into complete loss of horizontal hold. The picture was also badly affected by herringbone patterning, which changed with the setting of the fine tuning.

At first, I had been inclined to think that the problem was some kind of sync fault that made the horizontal hold unstable. But fine tuning does not usually affect bad sync, so I abandoned that avenue of thought and looked for some other explanation.

I sat for some time looking at the picture and reviewing all I knew about picture stability. I reasoned that we had colour and sound, and some part of the picture, therefore it seemed that the front end of the set must be working reasonably well. Indeed, the sound was perfect and since that service is picked off at the video detector, I decided that the signal must be satisfactory up to that point.

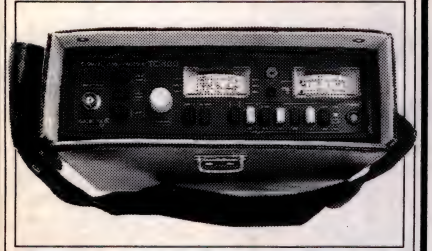
There is one unusual feature of the Kriesler 59-01 and Philips K9 chassis — the AGC (automatic gain control) circuitry is located in the vertical frame control module, not on the IF strip as in most other designs. I have only rarely found an AGC problem in these sets, but vertical troubles can affect the AGC without there being any fault in the latter circuit!

I did wonder if this might be another case of vertical trouble messing up the AGC, but decided against this line of thought since the only observable sync problem lay with the horizontal deflection. As far as I could see, the vertical stage was faultless.

I had never seen a set of symptoms quite like these, and I sat there for some time trying to make sense of them. If the set had been in my workshop it would not have been such a problem, since I'd have

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READER INFO NO. 10

signal sources from my pattern generator that would have made isolation of the trouble easier. In the customer's home, I only had a multimeter and an old and rather worn-out brain to help me.

I was still inclined towards an AGC solution and decided to apply an old trick to see if it would help me. Back in the valve TV days, AGC was often a problem and I would use the ohmeter function of my multimeter to apply an external voltage to the AGC circuit. The meter voltage would add or subtract from whatever AGC voltage was present, and the result would give me some idea of what was wrong.

In this case, grounding one probe and touching the other to the tuner AGC input produced a marked deterioration in the picture. In fact, it almost disappeared. So I reversed the probes and tried again. This time the treatment gave a big improvement in the picture.

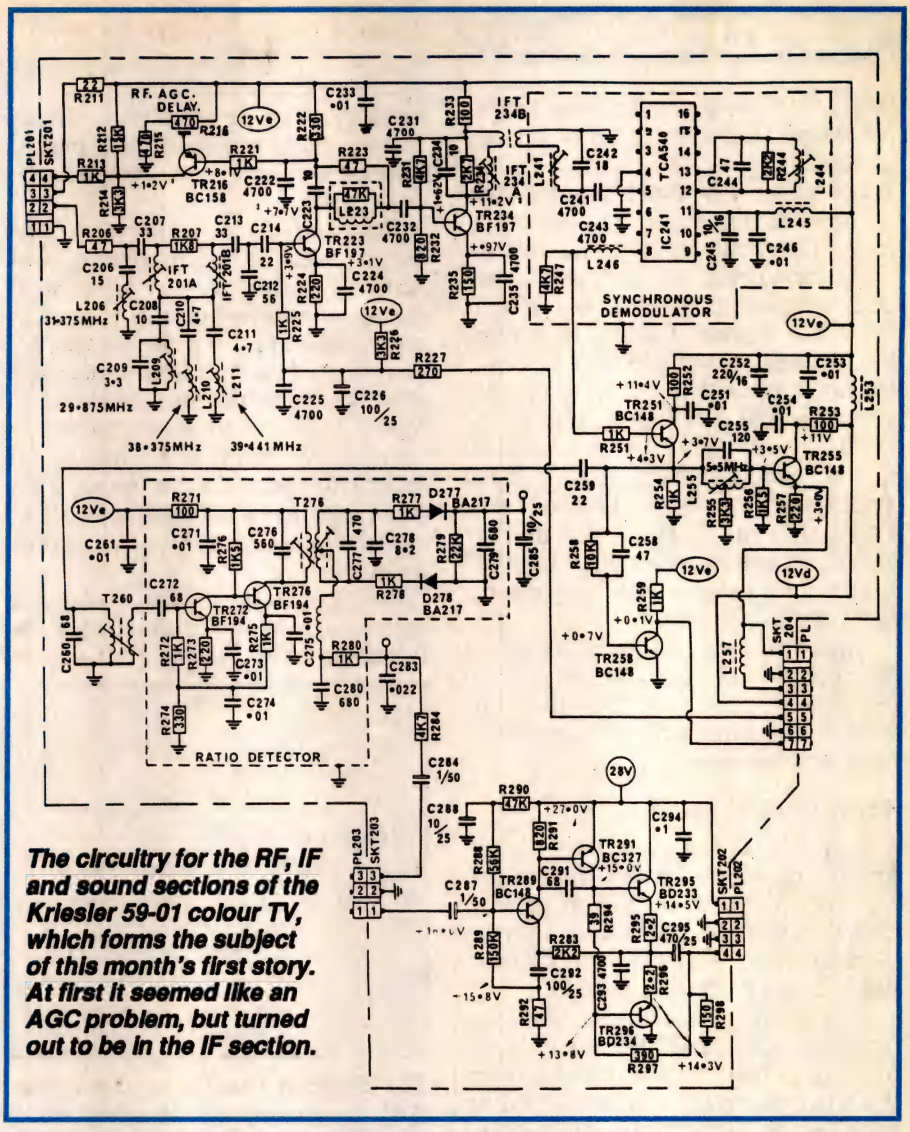
I switched the meter over to volts and measured the voltage at the AGC terminal. It was rock steady on 2.0 volts, no matter which channel I selected or where I set the fine tuning. So it seemed to me that the fault was confirmed as in the AGC system, somewhere.

As mentioned earlier, the AGC circuits in these sets is in part of the vertical circuitry. In the Philips set it's contained inside a small module designated U335. These are easily replaced and since I've wrecked dozens of these models, I've got a good supply of replacement modules on hand. If this had been a Philips set, I could have resolved the problem instantly by swapping U335 for a known good one.

The Kriesler 'module' is labelled CU601 and uses more or less the same circuit as in the Philips set. But it's built on a small plug-in PCB and is in no way compatible with the Philips module. As luck would have it, I had no CU601 boards on hand, so a simple swap was not an option. However, while searching through my Kriesler spares, I did come across a complete IF/audio board.

It's in this area that the Kriesler differs from the Philips chassis. In the Philips circuit the IF stages are on the small signals board, in two of the aforementioned modules, specifically U210 and U230. In the Kriesler set, the IF stages are incorporated with the audio stages on a separate PCB mounted inside the front panel, along with the tuner and convergence board.

Another way in which the Kriesler circuit differs from the Philips in this area is that it uses a TCA540 IC as a synchronous demodulator, whereas the



The circuitry for the RF, IF and sound sections of the Kriesler 59-01 colour TV, which forms the subject of this month's first story. At first it seemed like an AGC problem, but turned out to be in the IF section.

Philips circuit uses discrete components to do the same job.

So that was the situation. What I *wanted* was a CU601, and what I had instead was a complete IF/audio board. I wasn't thinking that I could use one for the other, but I did wonder about that TCA540. It's quite rare to have to replace small signal transistors, (unless there's been a major blowup). It's far more common to replace ICs, for no more reason than that the chip has died.

On my next visit to the customer's home, I made sure that I had replacements for the two ICs on CU601. I don't know at what point my thinking changed from 'AGC' to 'IF', but I also took along the IF board — with the thought that I might swap it for the one in the set just to see what happened.

The IF board swap was the easiest job to do, since it was accessible from the front of the set, after loosening just one screw. In fact it required only the exchange of four plug and socket assemblies to set it up for a test run. The CU601 job would have been much more difficult as it was inside the set, on the inside of one of the main circuit boards.

So I decided to do the easy one first — and it's just as well I did! With the spare board plugged in, we had a perfect picture. Full contrast, no lines, no herringbone patterns, just good brightness and nice colour. There was only one problem: we now had no sound!

I don't doubt that solving the sound problem would have been fairly easy, and I might still do so one of these days. In the meantime, I completed the job on hand by changing the TCA540 IC in the synchronous demodulator. Although I had spare ICs in the van, it was easier to exchange the whole demodulator sub-assembly. These are mounted in small aluminium cans, similar to the Philips modules. However, they are soldered into circuit, not plugged in. But since there are only four terminals involved, the job was done in no time at all.

(I have since replaced the defective IC and restored that part of the IF

board. I still have to fix the sound section, but at least I know I have a good IF board on hand.)

The lesson to be learnt from this story is one about reading the symptoms correctly. I had convinced myself that the AGC circuit was at fault, and I was quite prepared to do battle with CU601 inside the cabinet. I might have come to a different conclusion if I'd been in the workshop with my CRO and pattern generator and other tools. Everything about this job pointed to the AGC and it was only by chance that I found the real fault when I did. However, I now know that an IF fault can deliver symptoms almost identical to an AGC fault and I'll have to read the symptoms more carefully next time.

I was also surprised that I had solved the problem so easily. To be able to complete a complex job like this without taking the back off the cabinet is quite an achievement.

Tricky VCR fault

Now we come to the first of this month's contributor stories and it's one I'm very happy to be able to present, even though it's taken me more than the usual amount of work to prepare for these pages. I open it with a question:

How would you manage, writing a technical story in Polish? Or Russian, Spanish, German, or any other language that's not your own? I know that I'd be hopeless, so this contributor deserves more than the usual credit for his efforts.

The story comes from A.K., of Blackmans Bay in Tasmania. I understand that he came to Australia from Poland only seven years ago, knowing virtually no English. Since then he's converted his technical knowledge from Polish to English, and learned to speak and write what is regarded by many as one of the world's hardest languages.

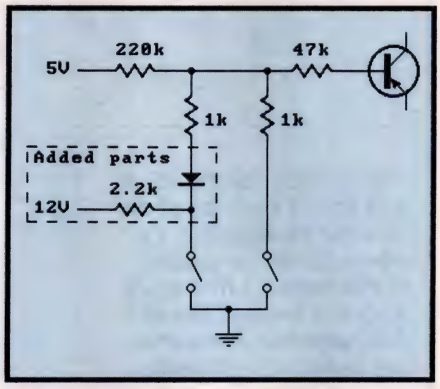
We have heard from A.K. before in these pages, but on that occasion he told me the story over the phone. This time he wrote it out for me and his efforts to express himself deserve the highest credit. Unfortunately, his English is not yet good enough for direct transcription, so I must do my best to tell his story, in my interpretation of his words.

I hope that A.K.'s story will encourage other newcomers to Australia to tell us of their experiences. So long as I can understand what you are saying, I can re-write it into acceptable English. Anyway, this is what A.K. had to say:

One of my customers brought in a Panasonic video recorder for repair. It was an NV370A and the complaint was that the picture had disappeared quite suddenly. The customer had decided that the cause was dirty heads and had used the inevitable 'cleaning tape' — but to no avail.

I agreed that it looked like dirty heads, but no amount of manual cleaning would restore a normal picture. Significantly, the sound remained normal — only the picture showed signs of the problem. So I disconnected the head leads on the upper drum and tested the head quality with a 'Head Tester'. Both heads recorded a very low efficiency, so I gave the customer an estimate for new heads, a new pinch roller and a full set of belts. He accepted the estimate and I placed an order for the parts.

When they arrived, I first replaced all the mechanical bits, then cleaned and lubricated the mechanism. Only then did



The diagram sent in by contributor A.M. to accompany his story about the intermittent fault in his car radio. The fault turned out to be a most unusual one.

I replace the head drum, in order to avoid any accidental damage. But you've probably guessed — the picture on playback was still very snowy, almost as though one of the heads was dirty.

I couldn't believe that one head on a brand new drum could be faulty, so I checked the FM envelope with my CRO. Unfortunately, the CRO told me that one head had almost no output — less than 5% of that of the good one. I wondered if the new head could be faulty, but a check with the head tester said 'No'. So what could it be?

Then I remembered that when I had removed the old, faulty drum, I had seen some kind of unusual fouling on the upper face of the lower drum. It looked like dried resin flux, and I cleaned it away before fitting the new drum. Also, when the drum was rotating, I could hear a faint noise, rather like a noisy bearing.

I removed the new head drum and used the head tester again to confirm that the heads were OK. But with the upper drum off, the noise was still there. It could have been a faulty bearing, but the sound was not convincing. Since I knew that the new drum was OK, I checked the continuity of the rotary transformer upper windings and found that one of them was open circuit. (Why me?)

I was really in a pickle! I had given the owner a firm estimate and now had to ring him and add to that the cost of a new drum motor assembly. The total cost would be more than the VCR was worth, and I guessed that the owner would probably scrap it rather than spend the money. If he did this, I would have lost my time and the cost of the parts I had invested in the job!

For my part, I had nothing to lose. So I removed the whole drum assembly and began to pull it apart. Clearances in a precision motor like this are set with shims of different thicknesses, so it is important when disassembling that the various shims are kept in their proper order.

Once I had removed the rotary part of the motor, I could examine the bearings; but nothing seemed to be wrong. I then turned my attention to the windings of the rotary transformer, and here I found the cause of all the trouble. One of the windings in the upper half of the transformer had come loose, and one end had broken away from its termination.

The resin-like material I had seen earlier turned out to be some of the cement that had been used to secure the winding into its slot, in the upper half of the transformer. The loose wire, dragging on the lower half of the transformer, was the cause of the scraping noise I had heard earlier.

On further examination, I found that all four windings were loose, although only one end of one winding had broken. I resoldered this, then secured all the windings in their slots with Super Glue, being careful not to allow any glue to get onto the surfaces outside the slots.

After this, I carefully reassembled the motor and refitted it into the video. I was rewarded with a perfect picture (whew!), and the owner never knew how close he was to having a junk machine handed back to him.

Going back to the beginning of this story, the customer complained of a sudden loss of picture. This must have been the point at which the transformer winding came adrift, since worn heads don't collapse suddenly like this. However, the real problem was that this left one channel down in efficiency — and the worn heads on the old drum

would certainly have masked the symptoms of that trouble.

I guess the moral of this story is that when you've nothing to lose, it's worth having a go!

Thanks, A.K. I wonder how many other drum motors have been scrapped for the same reason as you found. I expect that very few of us would take a motor apart once it had been replaced, so there could have been quite a lot that could have been salvaged, but weren't.

In fact, after reading this story from A.K., I looked in my 'duds' box for a motor I replaced a few months ago. It was suffering from just such a noise as A.K. described. Unfortunately, that one really turned out to be a bad bearing — the windings were firm and fast in their grooves. But it *could* have been otherwise — I just didn't think to look. I certainly will next time!

Anyway, thanks for your story, A.K. We are looking forward to your next effort.

Intermittent car set

Now we come to a story from A.M., of Turramurra in NSW. A.M. tells us of a most frustrating intermittent in the worst of all possible places — one's own car radio.

I used to do a lot of car radio work myself, but as I got older the contortions needed to get the instruments in and out of the cars forced me out of the business. Since then I've passed all this kind of work over to younger people and I assume that A.M. is among that age group. I hope so, since the story he tells here is quite unfit for anyone over 30. It goes like this...

The radio in the family car started turning itself on and off randomly. The first time it happened, it went on and off about 20 times in a 10-minute journey. But on the return trip it behaved quite normally. Over the next week or so, it would be OK for a day or two at a time and then play up now and again, or almost continuously. In short, it was a classic intermittent.

The radio is a PLL unit and all functions are logic controlled. There is a satellite control unit near the steering wheel and the on/off function is initiated by a momentary contact switch behind the main and satellite volume controls.

Apart from the antenna, all interconnections are by means of three plugs: a five, a nine and a ten pin unit, made up into a single unit on the radio itself.

Having established which pin came from the on/off switch on the satellite, (not the same pin as the plug on the back of the satellite unit, of course!) I proceeded to dismantle the beast.

The cassette player occupies one half of the case and the power supply filter, power amplifier and radio are on two PCBs, interconnected with ribbon cables and folded over in the other half. Both units are connected with the logic and display circuits behind the front panel by ribbon and ordinary cable and plugs.

The tracks on the various boards were not easy to trace, but the circuit is simple enough as can be seen from the diagram. I could detect no leakage from the switching control line either with my DVM or my trusty old 50uA analog meter, which I often use for a second opinion. I did find a small blob of solder on a corner of the track, which could conceivably have taken the track to ground; but in the absence of anything more definite, I reassembled the radio and replaced it in the car. It worked normally for three days, and then it was off again. So out it came once more...

It was now clear that sterner measures were called for. So, after a bit of fiddling, I had the power and radio boards unfolded on the bench, with the logic control panel plugged in like the stem of a 'T' and all hooked up to a 12V supply, with the DVM connected to the switch line. It ran all day like that, without ever missing a beat.

The next day it ran OK for a while, then started switching on and off. The switch line voltage was all over the place, between about 1V and 5V. I checked the 220k resistor and thought I saw a flicker in the value, so out it came. All the components on this board are surface mount types, but fortunately there was enough room to fit a standard 1/4 watt resistor.

The set worked fine for three days, so I reassembled it and put it back in the car. This time it worked for over a week — but then the on/off syndrome reappeared.

Back on the bench again, I figured the only thing left was the buffer transistor. Replacing a surface mount transistor with a TO-92 is fiddly in the extreme, and when it was done it made not the slightest difference. But at least this time, the set played up immediately. There had to be an intermittent leakage from the switch line — but where could it be?

I disconnected the 47k and 220k resistors from the switch line and put 12V between the line and ground through the 25V range of an analog meter. And there it was! The meter was doing a slow and erratic dance, which indicated a resistance varying between about 100 and 200k. By a process of elimination, it proved to be in the ten-pin plug — which looked fine externally and could not be disassembled.

A thorough cleaning made no difference and neither did an attempt to burn it out with 70V DC, the highest voltage I was game to try. Replacement of the plug would have been a very messy job, as all the plugs are soldered into the case. So long as the switch line could be held high until it needed to be pulled to ground for switching, I figured the circuit should work OK. I decided to force the line high by pushing 12V into it through a 2.2k resistor, while isolating the logic supply and circuit with a diode. This has cured the problem, but it did lead me a merry chase.

You don't really expect a modern moulded connector to have a subtle leakage to ground hidden inside it. It just goes to show that in this servicing game, you have to watch out for the totally unexpected.

I agree with you, A.M. The sort of fault you describe is not unheard of, but is so rare as to be totally confusing. If yours had been a commercial job, it would probably been a write-off — since no one could afford the labour cost of the hours you put into it.

However, your telling of the story here may alert others to a similar possiblity and so save them hours of frustration. That is, providing they can remember your story while twisted into unnatural attitudes under a car dashboard. I wish you all well!

That's all for this month. There will be another column next month with more stories from my bench and yours. ❖

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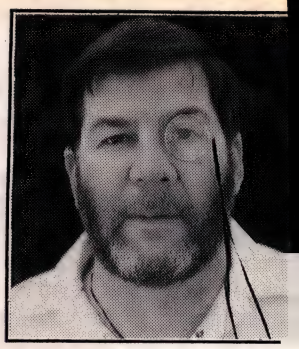
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Moffat's Madhouse...

by TOM MOFFAT



Living in a backwater: the drawbacks

"Hello, Hobart. Any questions about Optus?" Well, yes, actually, my question is, why won't it work? Amid much ballyhoo and full-page ads in the local paper, Optus stormed into Tasmania in December last year. That is, *part* of Tasmania. Not MY part of Tasmania.

'Dial 1 for Optus savings'. It all sounded too good to be true. 'Is Optus easy to use? Yes, it's very simple'. So said the ad. All you had to do was dial '1' before any STD number and you got cheaper phone calls.

At one stage they were even offering them at half price. But as it turned out, it was too good to be true. When I tried to say YES to Optus, all I got was a recording saying "This number is not in service..."

Well, the adverts did say, deep down in the fine print, 'available most areas'. Except my area. Yet again, our little hamlet on the side of Mt Wellington, although only seven kilometres from the Hobart GPO, was a no-go area for modern technology.

"If you would like further information about Optus, call us on 008 500 055". Presumably that was a Telecom-supplied number, since there was no '1' in front of it. I rang the number and said, "Hey Optus, how come I can't get your cheap phone calls?"

The nice lady on the other end put me on hold for a minute, while she consulted a big list. Then she returned and said our exchange wasn't ready yet. I asked when the exchange might be ready, and she said it was scheduled for September 1994. Golly, such a long wait!

A source within Telecom told me that the problem was that our exchange was unable to cope with Optus because it didn't have the itemized billing capability. So there was no way to say, 'Send that one to Optus'. I thought of ringing Telecom and asking them to quickly upgrade their exchange so we could start using Optus, but I thought maybe they wouldn't take too kindly to that suggestion. Still, it would be interesting to see their reaction if someone tried.

Will Optus be worthwhile, once it arrives? The reading I've done suggests both Telecom and Optus have many varying rates, and plans that change depending upon the time of day and the day of the week. The feeling I get is that overall Optus will be best for the business user, someone who keeps more-or-less regular daytime hours. Apparently the cheap rate cuts in at 6:00pm every day, and includes the whole weekend.

Telecom, on the other hand, has a sort-of cheap rate starting at 6:00 but a mega-cheap rate after 10:00 and on Sundays. So people who are prepared to stay up late to make their phone calls at times when businesses are closed will probably be ahead with Telecom. Trouble is, by the time you read this, the whole scheme may have changed. That's how volatile it is.

One thing is certain, though. As long as Optus and Telecom both exist and both continue competing with each other, the real winners will be those of us hanging on the ends of the phones.

In the meantime, here in Hobart, we're stuck with a telephone exchange that has a lot to answer for.

A couple of years ago it was announced that our exchange was to be upgraded, and we would be aware that this had happened when the dial tone changed from the old one that sounded like an extended rude noise, to the new electronic-sounding dial tone. This upgrading would allow us to access many 'modern features'.

One thing that looked likely was the ability to use DTMF, or 'Touch-Tone' dialing. You know the stuff, the phone makes little 'beep-boop-boop' noises instead of laboriously going click-click-click (pause) click-click-click-click-click (pause) until the whole number has been tapped out.

The modem in my computer would much prefer to unleash a burst of tones, as would my fax machine to connect with numbers around the world. And I've got one of those snazzy little Panasonic portable phones which could certainly dial quicker and easier with Touch-Tones. But with our good old 'modernised' exchange, Touch-Tone was not to be.

This is somewhat of an inconvenience when you ring up one of those robot answering services, where a speech synthesiser asks you to "Enter 1 to check your bank balance or enter 2 to transfer funds". These things *expect* DTMF tones, and ignore the fact that a few of us backwoods types may still be on an old dial-pulse exchange and have phones that go clickety-click.

The little Panasonic phone overcomes this with a button you can press, to switch the thing over to tone dialling after it has already connected to a service via dial pulses. But if you forget and use a regular phone, you've just blown a phone call.

Something else that would be lovely to have, were it allowed up here on the mountain, is the ability to divert incoming calls to some other number. That way I could nick off to the beach house on nice summer days and get my phone calls to switch through automatically, and nobody would be the wiser that I was having a bit of a bludge. This kind of service is available to most businesses and homes in the main metropolitan area — but not us, I'm afraid.

If and when they do put things right at this end, there's a chance the diverting gadget *still* won't work, because the beach house is on another non-Optusified telephone exchange. This one is at Garden Island Creek, an area better known for the excellence of its marijuana crops than its high-powered business environment. So I'd reckon upgrading it is fairly low on the priority list.

The upshot of all of this is that my own score at accessing Optus is zero, out of my two phone services.

There is one telephone service that

works very well indeed. That is the system's ability to tell if you're 'too far away'. This facility first revealed itself one night as I was watching television. Along came a commercial for Pizza Hut, advertising this most enormous pizza called a 'Bigfoot'. The thing was rectangular instead of round, and appeared to be at least twice the size of a normal giant pizza, at around half the price.

My stomach visualised this Bigfoot, smothered in lots of tomato and cheese and hot salami, and it immediately went into full growling mode. One of those Bigfeet would allow me, and the kids, and even the dog, to pig out in a most disgusting manner. So I picked up the phone and rang the number, only to be greeted with a message something like "I'm sorry, that number is not available in your area".

Hey, no Pizza Hut deliveries. We're only 7km from the Hobart GPO, but no Pizza Hut deliveries. Think of the money they're going to miss out on. Think of the fat I'm going to miss out on!

I guess it would have been a simple matter to drive to my daughter's flat, less than four minutes away but with a different telephone prefix, and there we could have had our Bigfoot. But by then, it just seemed like too much trouble.

A few days later, it was my son's birthday and we fronted up to Pizza Hut in person. And there it was, advertised on a bright leaflet — Bigfoot! Oh, yes, yes, forget about saying 'Yes' to Optus, we're going to say YES to Bigfoot at last.

But Pizza Hut said no. You can't get a Bigfoot there. It can *only* be ordered by telephone. So I have never yet had a Bigfoot.

Speaking of big feet, here's a sad story about shoes. One day the local paper carried a big glossy advertising brochure for a chain of stores that sold sports shoes. On the front was a picture of a fellow who was screaming in pain because he had just wrecked his knee while jogging. The brochure suggested that the guy wrecked his knee because he had bought his shoes from a sales assistant who had not received proper training in fitting shoes. But in this particular chain, all sales assistants had undergone a 'special training course'.

Well, that ad got me in. I go out running every morning, not on roads but on the bushwalking tracks on Mt Wellington. These tracks go up and down and tilt left and right, and they sometimes cause my knees to make noises like someone crinkling up cellophane. One false step and that could be ME on the front of that brochure...

The walking tracks are made mostly of very abrasive dolerite rock, or boulders, and the running shoes I'd bought from another big chain had just about fallen to pieces in four months. So I was due for some new ones, along with advice on protecting my knees and ankles. And on the back of the brochure was a pair of lightweight trekking boots for a very attractive price.

Off I went to the shop in the ad, Bankcard in hand, ready for action. Only to learn that the brochure "only applied to the Mainland, not Tasmania". No trekking boots, sorry — why didn't I go down the road to Paddy Pallin's? They'd have them. Well maybe we could talk about my knee problems and come up with something else? No, you'd really be better off going down the road...

The poor girl running the shop seemed highly embarrassed, and I got the impression she was hugely surprised when that brochure appeared in the local paper, placed there by a 'mainland' advertising agency. Oh, well.

But just because we live in a backwater and are not allowed certain things, that doesn't mean we aren't allowed the benefits of those things. In the case of Optus, the mere threat of their presence caused Telecom to cut telephone rates dramatically. Every now and then on television, they advertise specials where for the next few hours you can ring anywhere in Australia for 75 cents. And in December, just as Optus turned on the switch in Tasmania, Telecom offered half-price overseas calls between midnight and 7am. I celebrated by rolling out of bed at a disgusting hour to send a flurry of faxes to Germany and the UK.

Another case in point is airlines. You may remember Compass, the airline that surfaced not once, but twice. As far as I know Compass never made one appearance in Tasmania, but the possibility that it *might* come here caused the existing airlines to try to cement their relationships with the travelling public.

Within a week of Compass's first appearance, the major airlines laid on special fares of (if I remember right) $97 return to Melbourne. I jumped in and bought two tickets for a quick and totally unplanned holiday. Compass eventually went under, but when they resurfaced a second time East-West responded with a special trip to Sydney: return airfares and five days in a plush hotel in Manly, for $250. This time I took my son for another instant holiday. The hotel alone should have cost more than the whole trip. We never did get Compass airlines here, but we did get a couple of cheap holidays we'd never have had otherwise.

You'd think this place is the pits, wouldn't you? No Optus, no Compass, no cheap trekking boots. But there are certain advantages.

You people in Melbourne and Sydney can get all the goodies and more, but you do miss out on some things. Getting back to Mt Wellington, I usually slog my way up to the 1100-metre level, about 100 shy of the summit but out of the wind. And from there I can look out over the city and suburbs. The air is so clear I can pick out individual trees at Kingston Beach, 12km away. Try that in the big smoke! ❖

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DICK SMITH ELECTRONICS

Check Out OUR LATEST KITS!

Including Mystery Bonus!

180W Per Channel Stereo Amp

The latest and greatest in build-it-yourself hi-fi power amps, this clever design packs a real wallop for the price! Nevertheless, the massive heatsinks at each end plus its well-tried design philosophy will ensure an ultra-reliable result. The kit comes complete with everything you need - all required components: PCBs, case, heatsinks, transformers and all hardware.

Specifications:

Power Output (per channel, with both channels driven):

	4 ohms	8 ohms
Continuous:	255W RMS	185W RMS
IHF (short term):	380W RMS	240W RMS

Distortion - (THD)
0.005% at 100W RMS into 8 ohms
0.009% at 100W RMS into 4 ohms

Frequency Response:	-3dB points: 10Hz to 100kHz
Signal To Noise Ratio (unweighted):	>100dB with respect to 100W RMS
Input Sensitivity/Impedance:	0.8V/33k for 100W into 8 ohms
Overload Indicator:	Activated if output THD exceeds approx 0.05% (regardless of load impedance)



NEW

EA Feb/Mar '94 Cat K-5570 **$549**

YES! Our kit is supplied with:

- Mystery bonus valued at over **$40**.
- Metal work pre-punched & powder coated matt black.
- Front panel pre-punched, anodised matt black & silk-screened.
- Supplied with original heatsinks as seen in Electronics Australia.
- Heatsinks drilled and tapped to suit front and case panels.
- Quality Australian made toroid transformers.
- DSE prototype built & tested.
- Best value in town.

Mystery Bonus Valued At $9.95

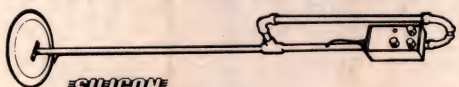
INCLUDING MYSTERY BONUS

NEW

Metal Detector

Try your luck at finding valuables with this highly-sensitive metal detector! It's extremely easy to operate with three simple controls - volume, ground and sensitivity. It's suitable for use in both wet and dry earth/sand, and you can even adjust it to search different depths underground. It alerts you when metal is detected with an audible signal that you can monitor over a loudspeaker or on headphones. Comes with all components, PCB, case & front panel label. Hardware bits such as conduit, bends, clamps, head assembly etc are optional and can be obtained from your local hardware store.

Cat K-3006



$69.95

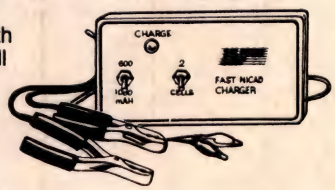
SILICON CHIP May '94

Fast NiCad Charger

NEW

Now you can charge up your NiCads in as little as 50 minutes! Using just a single Philips IC, this low-cost kit will charge either two or four "AA", "C" or "D" cells in a very short time (50 minutes for AA (600mAH) cells and 100 minutes for C and D cells (1.2AH)). You can even power it from your car battery or a 12VDC power source. It provides built-in switching controllers to allow you to create much more efficient chargers than the standard linear methods, plus it uses both current and voltage sensing to ensure correct charging as well as an RC clock/timer to prevent overcharging. Comes complete with PCB, case, front panel label and all components.

Cat K-3125



$49.95

EA May '94

Lighten Up Your Photos!

Light And Sound Trigger

Now you can get all the special effects from your camera you've dreamed about! This simple circuit lets you enhance your photographic skills in a variety of ways. It fires your flash, allowing you to capture even the quickest events and also provides a supplementary flash to give background or fill-in lighting for your photograph. It can be attached to any camera with an input socket that takes an extension flash cable. Kit comes complete with all components, hardware, PCB, cases and front panel labels including mini solar panel.

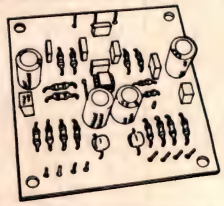


EA Cat K-3034 Apr '94 **$42.95**

Universal Pre-Amplifier

This low-noise pre-amplifier is easy to build and is ideal for use with magnetic cartridges, cassette decks or microphone inputs. If you have distorted sound on your stereo, microphone etc, upgrade your present amplifier's pre-amp by installing this and its sound should be significantly clearer. It uses a single dual op-amp IC (LM-833) with supply rails of 15-0-15 volts and is supplied in short form with components and PCB only.

Cat K-5402



$16.95

SILICON CHIP Apr '94

PLEASE CONTACT YOUR NEAREST STORE FOR AVAILABILITY AS SOME KITS MAY STILL BE IN PRODUCTION.

THE QUALITY TOOLS
THAT WON'T BREAK YOUR BUDGET!

Ceramic Adjusters/Alignment Tool

You'll find these high quality adjusters perfect for computers, communication instruments, VCR, CD and other electronic devices. They're made from a combination of high-tech materials with zirconia ceramic blades and anti-static handles. Plus, they're non-conductive, non-magnetic, non-static and long-lasting.

At just $14.95 each, you can afford to buy the complete set!

Cat T-5200
0.9mm Flat

Cat T-5202
1.3mm Flat

Cat T-5204
1.8mm Flat

Cat T-5206
2mm Flat

Cat T-5208
#0 Phillips

$14.95 ea.



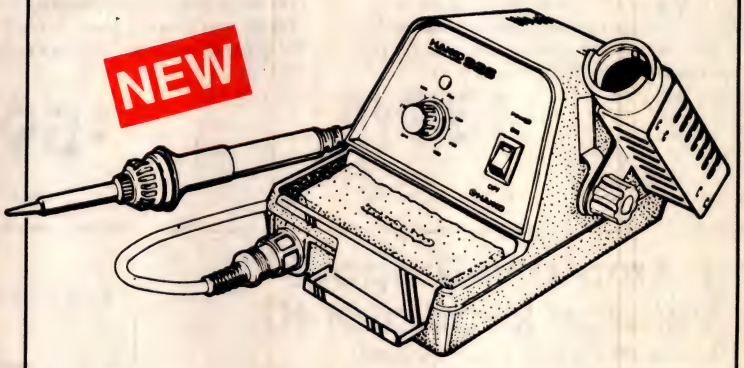
Hako '926' Soldering Station

Well known throughout the professional service industry, this high-quality general-purpose soldering iron delivers superb performance! With an accurate manual temperature, it's rated at 60W 24V AC and has an operating temperature of 200-480°C/392-896°F. The iron comes complete with holder, cleaning sponge, tip and sponge tray.
Cat T-3800

$259

HAKKO

NEW



Extruded Aluminium Heat-Sink Boxes

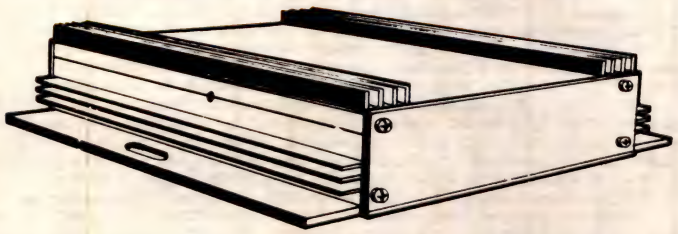
Internally-slotted to accept PCBs, they're an ideal choice for any project that needs heat dissipation. Their black, powder-coated finsh gives an ultra-professional look to any project.

17(l) x 32(h) x 140mm(d)
Cat H-3000 **$19.95**

***108(l) x 38(h) x 140mm(d)**
Cat H-3002 **$24.95**

NEW

** Features sliding top panel (immobile when assembled).*



Butane Soldering Iron

A portable, butane-powered soldering iron that fits easily in your shirt pocket. Ideal for service people, handymen and technicians, it provides up to 60 minutes continuous use at full power (equivalent of 60 watts) and adjustable temperature control from 10 to watts (400°C).
Cat T-1370

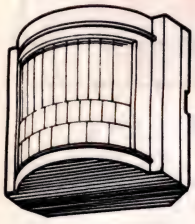
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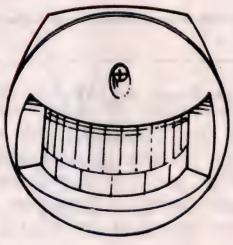


Mini PIR Detector

NEW

Though it's compact and unobtrusive, this detector provides an easily-adjusted range of up to twelve metres through 95°. An indicator LED illuminates when the alarm is triggered and pulse- stretched output minimises false alarms. It can be mounted on any flat surface or corner.
Cat L-5011

$39.95

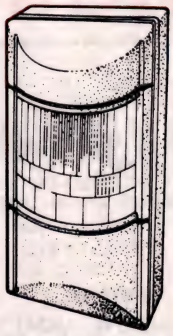


PIR Detector

NEW

A highly-sensitive infrared motion detector that can be wall, ceiling or corner mounted. It offers four interchangeable lenses so you can set it to focus on the area of your choice and has programmable pulse count for greater accuracy and fewer false alarms.
Cat L-5015

$59.95



IR-TEC 'Intelligent Pulse Count' PIR

NEW

Provides maximum security and false alarm protection by distinguishing true alarm signals from false alarms. It's designed for large area protection in rooms and hallways and can easily be mounted on walls and in corners. Includes a full range adjustment up to 12 metres, tamper protection, noise reduction circuit and a disable switch for its "walk-by" LED. Simply wire into virtually any alarm system with an operating voltage of 9-16 volts DC.
Cat L-5014

$89.95

1 Amp Low-Dropout Voltage Regulator IC

Suitable for low-battery type applications and mains transformer-fed DC supplies such as those in portable computers, boats and cars - anywhere there's a need for energy efficient circuits.

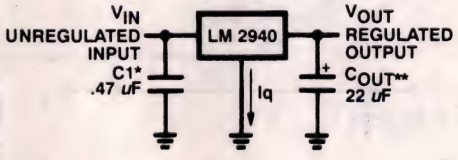
Cat Z-6602 LM2940-8+8V
Cat Z-6600 LM2940T-5+5V

$4.95

NEW

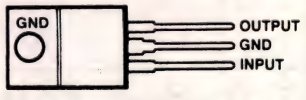
See April BENCHMARK for specifications.

Typical Application



Connection Diagram

(TO-220) Plastic Package



Front View

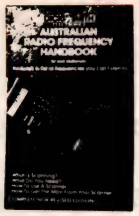
* Required if regulator is located far from power supply filter
**C out must be at least 22uF to maintain stability. May be increased without bound to maintain regulation during transients. Locate as close as possible to the regulator. This capacitor must be rated over the same operating temperature ranges as the regulator and the ESR is critical.

MAJOR DICK SMITH ELECTRONICS AUTHORISED STOCKISTS:
NSW ARMIDALE: New England Electronics 711 655 **BALLINA:** Ballina Electronics 867 022 **BATEMAN'S BAY:** Baycity Sight & Sound 725 030 **BATHURST:** Electronic Frontiers 323 933 **BOURKE:** Countrywide Services 722 150 **BOWRAL:** Bowral Electrical Suppliers 611 861 **BROKEN HILL:** Hobbies & Electronics 884 098 **COOTAMUNDRA:** Cootamundra Music & Light 422 561 **DENILIQUIN:** Deni Electronics 813 672 **DUBBO:** Chris's Hi Fi 828 711 **GOULBURN:** Tunlive 221 288 **GRAFTON:** Repairs & Spares 421 911 **GRIFFITH:** Miatronics 624 534 **GUNNEDAH:** Carter's Sportscene & Electronics 42 2230 **INVERELL:** Infolink Computer Systems 513 131 **KATOOMBA:** Niagara Photo & Sports 822 800 **KEMPSEY:** P & K Richards 631 134 **LEETON:** Leeton Audiotronic 532 800 **LIGHTNING RIDGE:** Lightning Ridge Solar Power 291 013 **LISMORE:** Decro Electronic Services 321 896 **LITHGOW:** Douroy Photographics 513 173 **MACKSVILLE:** Macksville Electronics 682 899 **MOREE:** Moree Electronics 522 091 **MUDGEE:** Headwear 723 895 **MURWILLUMBAH:** Strings & Things 723 684 **NARRABRI:** Namoi Computer Service 923 274 **NELSON BAY:** Nelson Bay Elect. & Hobbies 813 685 **NOWRA:** Nowra Electronics 210 722 **PARKES:** Strad Music Centre 623 366 **PORT MACQUARIE:** Port Electronics 836 875 **RICHMOND:** Silicon Crafts 784 101 **TAREE:** Manning Electronics 512 233 **TUNCURRY:** Tuncurry Electronics 545 006 **ULLADULLA:** Coastal Electronics 553 989 **WAGGA WAGGA:** Phillips Electronics 216 558 **WALGETT:** Walgett Electronic Centre 281 111 **WINDSOR:** Hawkesbury Electronics 776 722 **YASS:** Warmington Electrical 226 1411 **YOUNG:** Keith Donges 821 279 **VIC ARARAT:** Jerram Electronics 522 345 **BAIRNSDALE:** Green Gage Services 525 677 **BENALLA:** North East Electronics 622 710 **CASTLEMAINE:** Inspect Electrics 723 773 **COLAC:** Colac Electronics 312 847 **ECHUCA:** Gilmour Electronics 822 956 **HORSHAM:** Burgess Camera House 81 1680 LEONGATHA: Leongatha Photographics 623 227 **MILDURA:** Pullman Auto Pro 232 882 **MORWELL:** Roylaine Pty Ltd 339 458 **ROSEBUD:** Seatech Vic Pty Ltd 822 225 **SHEPPARTON:** Andrew Guyatt Electronics 219 497 **SWAN HILL:** Nyah District TV Service 329 303 **ST. ARNAUD:** Whartons Appliances 951 069 **WARRAGUL:** Roylaine 234 255 **WARRNAMBOOL:** Koroit St. Elect. Services 627 417 **WONTHAGGI:** South Gippsland Photo Service 721 411 **QLD AYR:** Delta Electrix 831 566 **BOWEN:** Plaza Electronics 863 477 **BUNDABERG:** Bob Elkin Electronics 521 785 **CALOUNDRA:** Electro-mart 918 533 **DALBY:** Hobby & Electronics 625 770 **GLADSTONE:** Electronic Enterprises 726 660 **GOONDIWINDI:** CTW Electronics 713 411 **INGHAM:** Masons Electronics 763 188 **INNISFAIL:** Innisfail Hi-Fi 612 014 **MACKAY:** Steven's Electronics 511 723 **MARYBOROUGH:** Keller Electronics 214 559 **MOSSMAN:** Mossman Electronics 982 200 **MT. ISA:** Outback Electronics 433 331 **PIALBA:** Keller Electronics 283 749 **STANTHORPE:** Granite Belt Communications 813 333 **TAS BURNIE:** Electronic City 314 760 **DEVONPORT:** Al Electronics 248 322 **SA MT. GAMBIER:** Hutchesson's Communication 250 400 **PORT LINCOLN:** Basshams TV & Comp. World 830 075 **WHYALLA:** Eyre Electronics 454 764 **WA ALBANY:** Micro Electronics 412 077 **BUNBURY:** Micro Electronics 216 222 **GERALDTON:** Angora Lighting 211 278 **MANDURAH:** Mandurah Hi Fi 581 2206 **MARGARET RIVER:** CPA Electronics 573 888 **PORT HEDLAND:** Ivan Tomek Electronics - Retail 732 531

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Dick Smith's Australian Frequency Handbook



Jack McDonald
An essential book for anyone into scanning. This latest edition has information on using your scanner, as well as understanding codes & marine bands. Plus, there's a glossary of scanner terms, frequency directory and more!
Cat B-9601 ***New low price:*** **$9.95**

World Radio TV Handbook 1994



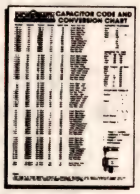
The ultimate directory of international radio and television. Gives complete listings including frequencies, addresses, call signs, station identification and transmission times. There's even a special feature on how to convert local time against UTC.
Cat B-2094 NEW **$34.95**

Excel 5.0 For Dummies



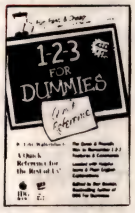
By G. Harvey, 2nd Edition
The best beginners guide to Excel 5 for Windows, today's fastest growing spreadsheet program. You'll become a whiz at building and formatting spreadsheets as this book makes light work of a relatively advanced software program. Plus, you'll have fun while you learn!
Cat B-6620 NEW **$34.95**

Capacitor Code Chart NEW



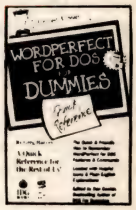
This handy reference chart will save you time converting codes. It provides an easy cross-reference between microfarads, nanofarads, picofarads, EIA/American code markings, European code markings and colour-band code used in identifying capacitor values for most capacitor types.
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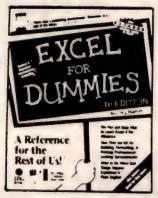
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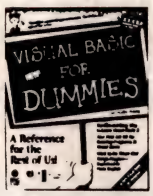
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B 1698

Construction Project:

AN IMPROVED DSO ADAPTOR FOR PC'S - 1

In the February 1993 issue, we published the design for a low cost digital sampling scope adaptor for PC's, which has been very popular. However various people have asked if we could describe a similar unit but with additional features, such as a calibrated vertical amplifier and timebase, and more flexible triggering facilities. So here it is: the Mark 2 DSO Adaptor.

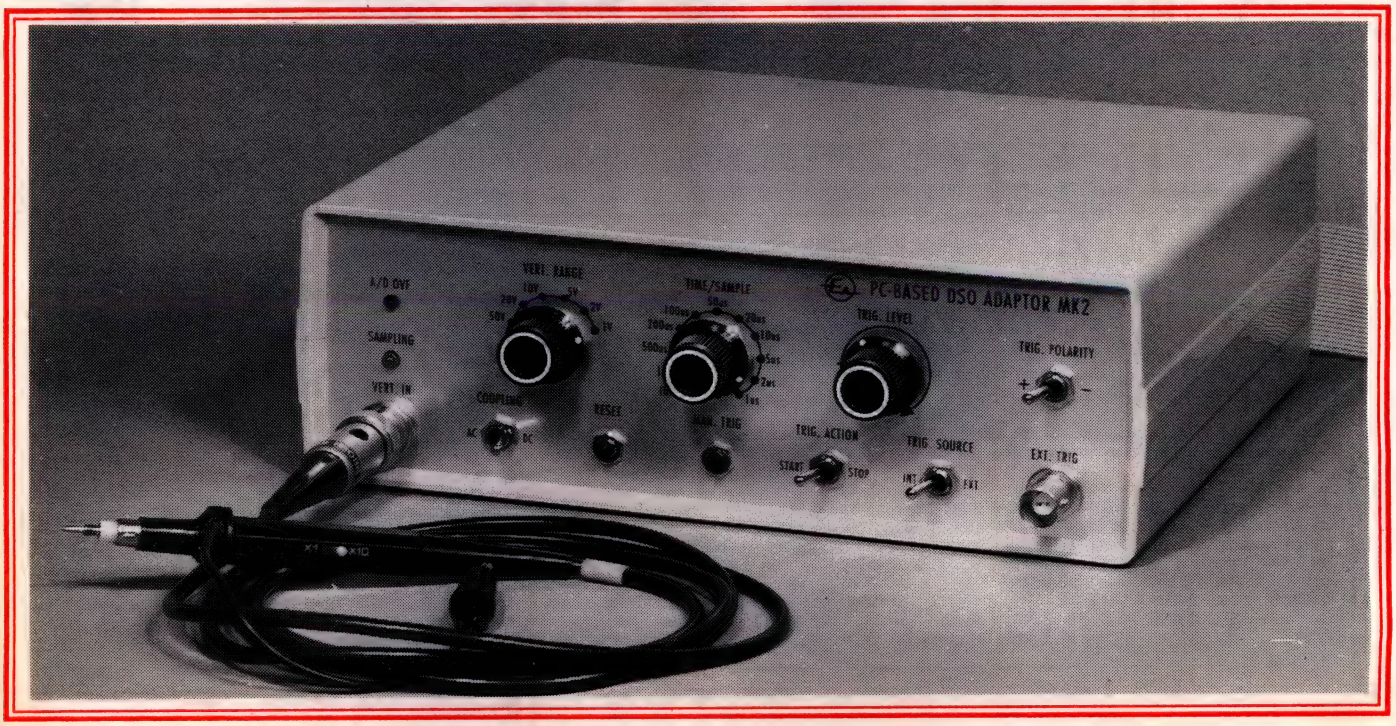
by JIM ROWE

It's really not surprising that David Jones' original DSO design was so popular, because it provided a very low cost way to provide yourself with an audio DSO — using your PC for the display, storage and printout of sampled waveforms. The hardware design was also quite elegant, using only a small number of low-cost ICs. Most commercial DSO's are quite complex and expensive instruments, with even the new handheld LCD-readout models generally carrying a price tag of around $2000. The alternative approach of adapting an existing PC to do the job for less than $100 obviously appealed to many hundreds of readers, judging from what we've heard regarding the numbers of kits sold...

All the same, the conscious 'lowest possible cost' approach taken by Mr Jones did result in a few limitations in terms of the adaptor's facilities. Neither the vertical amplifier nor the sampling timebase was calibrated, both being adjusted by means of simple pots, and the triggering facilities were also rather restricted. For those used to using modern 'scopes, these limitations did tend to grate somewhat — hence the requests to come up with something just a *little* more pretentious.

That's the background, then, to this new DSO Adaptor design. Although based on the David Jones original, and capable of being used with both his original and more recent software, it provides a number of enhanced measurement facilities, including:

- A calibrated vertical amplifier, with a maximum input sensitivity of 1V full scale, an effective frequency response of DC - 600kHz and a risetime of around 200ns.
- A calibrated sampling timebase, with 11 crystal-derived sampling clock periods from 1us to 1ms, in a 1/2/5 sequence.
- A more flexible triggering circuit, offering a choice of either internal or external triggering source, positive- or negative-slope triggering, software triggering from the PC and selection of triggering to either 'start' or 'stop' sampling (for capturing events either after, or before the trigger event).
- Circuitry which allows the sampling write/read mode switching to be con-



trolled directly by the PC software, instead of a manual switch. This makes operation faster and more convenient. (However a manual switch can be fitted if desired, to make the new unit compatible with the original software.)

- Similarly, there is now also circuitry to allow the PC software to supply the adaptor's A/D converter directly with sampling clock pulses — making possible full software- controlled sampling, for applications such as long-term data logging.

Another difference between the Mk2 adaptor and the earlier design is that it is now able to take advantage of a new and faster A/D converter chip, the ADC08061. This is capable of sampling at rates up to 1.5MS/s (megasamples per second), roughly twice the limit of the ADC0820 chip used in the original design.

It's thanks to this faster converter that the new unit is able to have a maximum sampling timebase range of 1us (i.e., 1MS/s). This gives the DSO adaptor an effective bandwidth of about 100kHz, on the basis of at least 10 samples per signal period.

I should point out, though, that because the ADC08061 is at least 50% more expensive than the slower chip, some readers may still prefer to use the ADC0820 — especially if they don't need a bandwidth of more than 65kHz or so. Luckily the two chips have the same pinouts, so the slower chip can still be used if you wish; all that is needed is to change the value of one resistor, as I'll explain later. But of course you won't be able to use the fastest (1us) timebase range, if you do this.

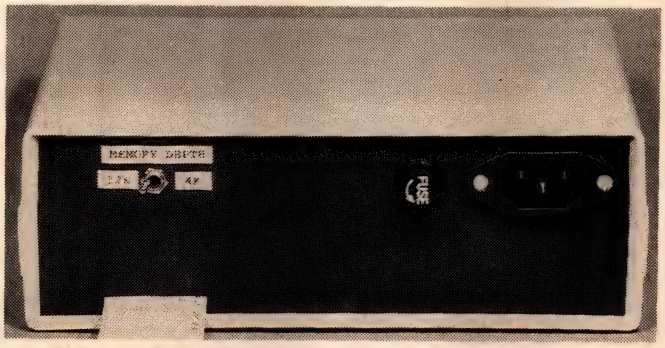
By the way, contributor David Jones had already made many significant improvements to his original DSOA software, and on hearing that I had produced this new version of the hardware, he very kindly volunteered to adapt his latest version of the software to suit it. So there's a very nice software package now available to suit the new design, directly from David himself. You'll find more details about this in a box, later in the article.

As with the original DSO adaptor, the basic idea is that when triggered, the circuit hardware automatically takes a series of digital samples of the input signal, and stores or 'writes' them sequentially in an on-board memory. This is all done in 'real time', at a rate determined by the sampling timebase clock you've selected.

After the set of samples have been stored, they are then read back out of the memory, again in sequence, and passed back to the PC via the normal Centronics-type parallel printer port. This second 'read' phase is performed under the control of software running in the PC, and the software can also display the sampled waveform on screen, zoom in to display details, save the waveform to disk, retrieve it again and so on.

Circuit description

Now let's have a look at the circuitry which does the hardware side of these functions, in the new adaptor. As before, the heart of the adaptor is formed by U12, the A/D converter chip, and U16 which is the memory — a fast static RAM. U12 is where our analog input signal is converted into a series of digital samples, and U16 is where they're then stored.



The rear view is not particularly exciting. At upper right are the mains input and fuse, with the PC interface cable exiting at lower left. The optional switch visible at upper left allows selecting either 4K or 32K of effective sample memory.

Like the ADC0820 A/D converter used in the original adaptor, the ADC08061 is a compromise between the super-fast 'full flash' type and the slower 'successive approximation' type. In this case it uses a multi-step technique, to deliver a full eight-bit sample in less than 700ns — using only 14 internal comparators, plus some fancy multiplexing. As a result, it can comfortably perform over one million conversions per second.

The SRAM chip used for U16 is the same is that used in the original design: a 62256-10, which is a 100ns access time 256K bit device, organised as 32K (32,768) eight-bit words.

A faster chip such as the 62256-8 (80ns) can be used instead, but not a slower one. As you can see, the data outputs of the A/D chip are connected to the data I/O lines of the SRAM.

Each conversion cycle is triggered by the arrival of a negative-going pulse at pin 6 of U12. Pin 9 of U12 goes to a logic high during the conversion, and then goes low at the end. This 'INT' pulse is fed via inverter U17e and gate U18a to the Write Enable-bar input of U16, to cause the memory chip to write the sample into the next available memory.

The same pulse is then fed via U10d to the clock input of counter chip U14, which together with U13 forms the SRAM's memory address register. As a result the memory address is incremented ready for the next write cycle.

Each 'sample clock' pulse fed to pin 6 of U12 initiates one of these conversion/write cycles, so by controlling the pulses we determine not only when sampling takes place, but also the rate at which samples are taken.

Control of the sampling is made by 'master write control' flipflop U9b, whose Q output (pin 9) enables gate U6c. The input pulses to U6c are shaped by C21, R21 and D6, fed in turn with a timebase signal selected by timebase switch S8 and buffered by gate U6b.

The purpose of the shaping circuit is to ensure that the pulses fed to U12 are narrow enough to allow reliable operation at sampling rates up to 1MS/s, but wider than the ADC08061's requirement for 100ns minimum pulse width. The values shown give a width of 150ns — which is increased to 680ns if the slower ADC0820 is used, by increasing R21 to 680 ohms.

Crystal timebase

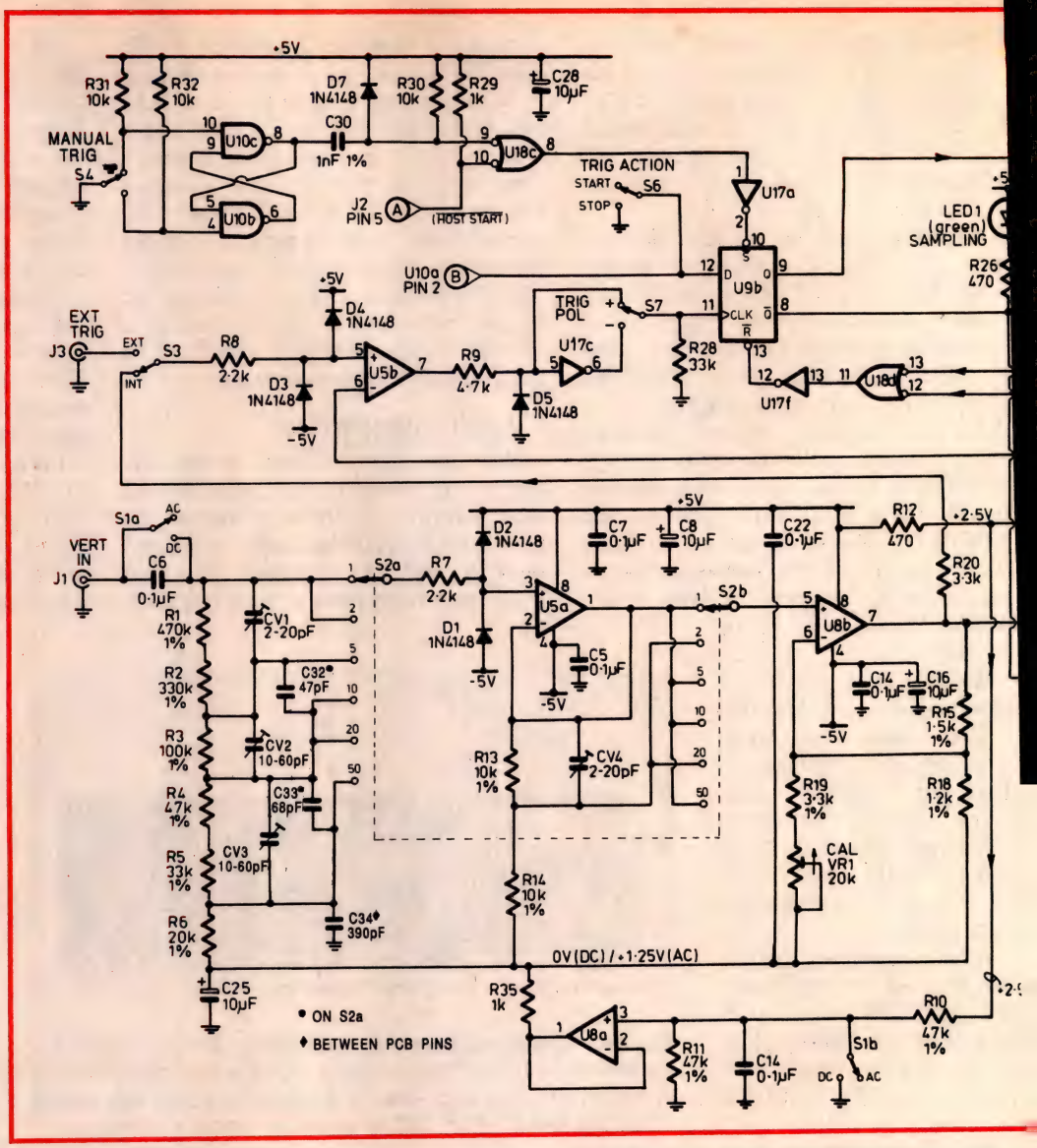
Most of the timebase signals selected by S8 are derived from a crystal divider circuit, to give accurately known sampling rates. The crystal oscillator uses a low cost 2MHz crystal X1, together with gate U6a. Trimmer capacitor CV5 is used to adjust the crystal to exact frequency, for timebase calibration.

The 2MHz signal from U6a is divided by the two cascaded sections of U7, a 74HC74 dual flipflop, to provide the 1us and 2us timebase signals. The 1us signal is then passed to the various sections of U3 and U4 (both 74HC390 dual decade counters) to produce the remaining signals in a 1/2/5 sequence, down to 1ms.

The remaining 'timebase' signal selected by S8, in the 'host' position, comes from the PC itself via pin 4 of connector J2. This allows the PC software to initiate each A/D conversion

DSO adaptor for PC's - 1

Here is the schematic for most of the new DSO adaptor — the crystal derived time- base and power supply are shown separately. Features added to this version include a calibrated vertical amplifier with ranges from 1V to 50V full scale, a calibrated sampling timebase with clock rates from 1us to 1ms, and more extensive triggering facilities — such as selection of positive or negative slope triggering, internal or external triggering, and the ability to either start or stop sampling with the trigger event. The PC can also provide sampling pulses directly, for long-term data logging.



cycle directly, for applications like data logging.

Like most A/D converter chips, U12 essentially operates by matching the analog input voltage, fed into pin 1, with a digitally switched fraction of an analog reference voltage, fed into it via pins 12 and 11. In this case the reference voltage is an accurately known 2.5V DC, developed via shunt reference source U11. Although U11 is shown in the schematic as a zener diode, it is in fact an IC in a TO-92 package, designed to develop a particularly accurate and stable voltage.

The LM4040CIZ-2.5 device specified develops 2.5V +/-0.5%, stable to within 100ppm/°C. (Alternative devices are the LM336Z-2.5 or the LM4041CIZ-ADJ, which in both cases also require additional divider resistors R36 and R37 — both 10k.)

Since the converter's reference voltage is +2.5V DC, the analog input voltage to be sampled by U12 can only vary between 0V and +2.5V — 0V produces the converter's minimum digital output of 00 hex, while +2.5V produces its maximum output of FF hex. So our vertical input amplifier, designed around op-amps U5a and U8b, is arranged to deliver its output in this range.

Vertical amplifier

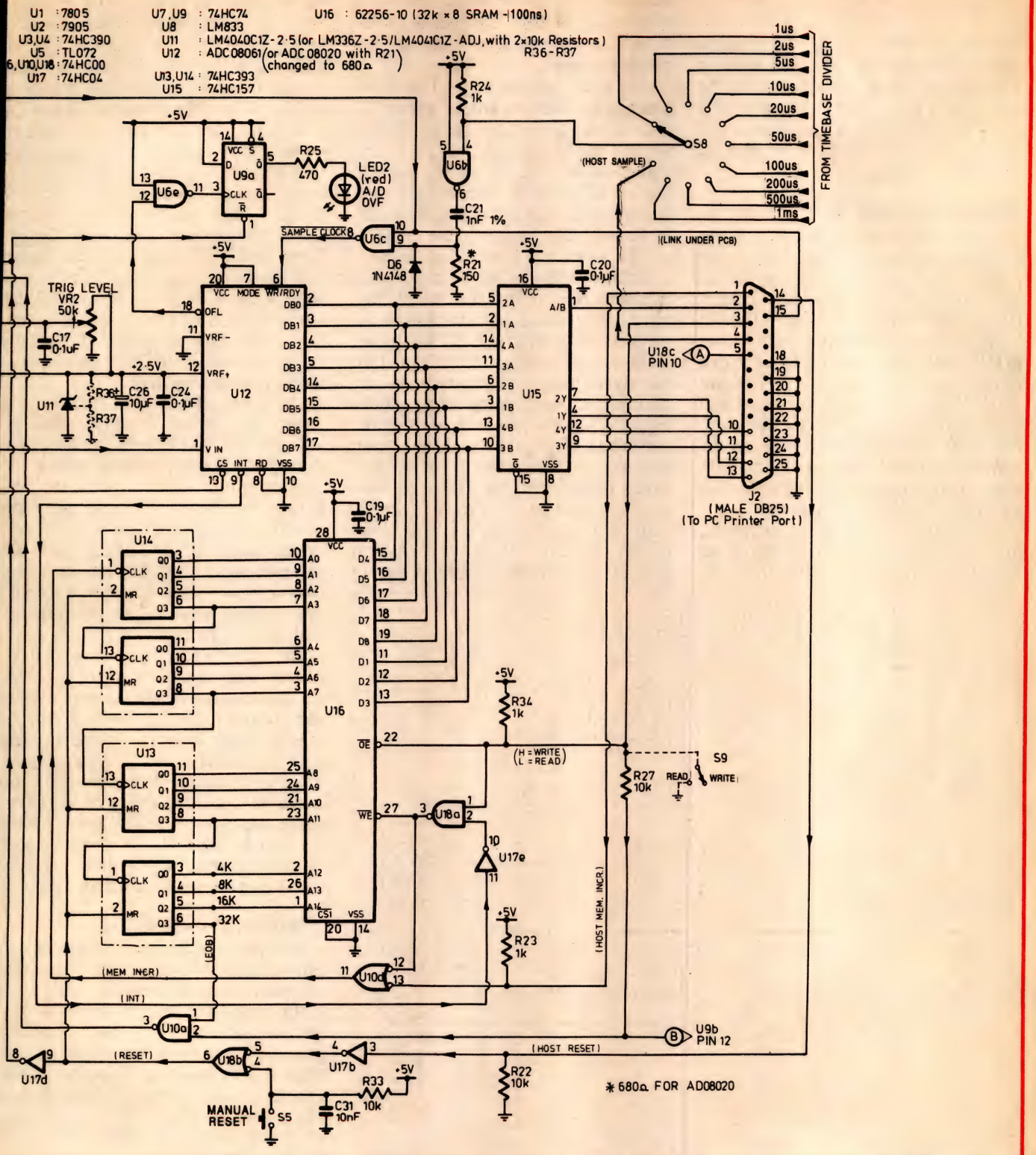
U5a is half a TL072 FET-input device, used as a unity gain buffer. This allows us to provide the vertical amplifier with a standard input impedance of 1M, so it is directly compatible with standard scope probes. Resistors R1 - R6 are connected as an input divider, and this together with a further divider formed by R13 and R14 at the output of the buffer provides a range of input sensitivities while also limiting the signal amplitude handled by U5a, to prevent distortion. Resistor R7 and diodes D1 and D2 are used to protect U5a against damage from gross overload.

Note that there are six ranges, selected by the two poles of switch S2 and labelled here in terms of the peak-to-peak signal amplitude corresponding to 'full scale deflection' (not the volts per major deflection division, as is more usual with analog scopes). Trimmer caps CV1 - CV4 are used to adjust the frequency compensation for the various ranges.

The signal selected by S2b is fed to U8b, which is half of an LM833 low noise dual op-amp. This is connected as a wideband amplifier stage, with a gain set to approximately 2.5 times by the negative feedback divider formed by R15, R18, R19 and trimpot RV1. The trimpot is used to balance the gain of the stage against the exact reference voltage provided by U11, for calibrating the adaptor's vertical sensitivity.

As you can see, the basic vertical amplifier chain formed by U5a and U8b is DC coupled, right through to the A/D chip input.

To provide the adaptor with the ability to measure AC signals separately from any DC component, switch S1a allows



coupling capacitor C6 to be switched in series with the input. However when this is done, the DC reference level of the vertical amplifier must be raised above ground, to allow the signal to swing in either direction without leaving the 0V - 2.5V 'input window' range of the A/D converter chip. In fact the reference level needs to be moved up to +1.25V — halfway up the range, in order to allow equal positive and negative swings.

We do this by means of U8a, wired again as a unity gain buffer. Divider resistors R10 and R11 are used to derive an accurate +1.25V from the 2.5V reference produced by U11, and this is duplicated at the low-impedance output of U8a. The output is then fed via stopper resistor R35 to the 'bottom end' of R6, R14, VR1 and R18, so that it establishes the quiescent bias level of the complete vertical amplifier channel. Capacitor C25 is used to ensure that the bias line is at ground potential for all AC frequencies of interest.

In the DC position of S1, its second pole S1b shorts the junction of R10 and

R11 to ground, moving the vertical amp's reference level down to within a millivolt or so of ground. Hence the amplifier's bias level is automatically switched between +1.25V and 0V, depending on whether S1 is switched for AC or DC coupling.

Triggering facilities

Now let's look at the triggering facilities. As noted earlier, U9b is the 'master write control' flipflop, which determines whether or not sampling is taking place. When U9b is set (Q output high), U6c admits sampling clock pulses to U12; at the same time the Q-bar output of U9b pulls the 'chip select' (CS) input of U12 low, allowing it to operate and enabling its data output lines. LED1, connected in series with R26 between the +5V rail and the Q-bar output, thus indicates when sampling is taking place. Accordingly it's labelled 'Sampling'.

To commence a sampling sequence, then, we need to trigger U9b into its set state (i.e., 'on'); conversely to end the sequence or otherwise stop sampling, we need to reset U9b. The circuit is arranged to perform these functions in a number of ways.

First of all, we can trigger U9b on by pressing the 'Manual Trigger' button S4. This toggles the bounce control flipflop formed by U10b and U10c, and this delivers a short negative-going pulse to pin 9 of U18c, due to differentiating components C30, R30 and clamp diode D7. U18c and U17a pass this pulse to pin 10 of U9b, which is the 'set' (S-bar) input.

Similarly U9b can also be triggered on by a pulse delivered to U18c pin 10, from pin 5 of connector J2. This allows the software running in the PC to initiate sampling, when desired. In addition, U9b can also be triggered on in the same way as a conventional analog scope can be triggered — at a particular point in the waveform of the analog signal being measured, or in response to another (external) triggering signal. These functions are controlled by switches S6 and S7, connected to the data (D) and clock (CLK) inputs of U9b respectively, and also by S3. Switch S3 allows you to select either an external trigger signa from J3, or the internal analog signal it self, derived from the output of U8b vi isolating resistor R20. The selected signa is then fed to U5b, via series protectio resistor R7 and clamp diodes D3 and D4

U5b, the second half of the TL072, i connected as a trigger level comparato The trigger signal is fed to its positive input, while its negative input is fed with a DC voltage variable between 0V and the +2.5V reference level, from 'Trigge Level' pot VR2. Thus when the instantaneous trigger signal amplitude is even slightly *above* the level set by VR2, the output of U5b will swing positive; conversely when the trigger signal is slightly *below* the level set by VR2, the output of U5b will swing negative.

The output of U5b thus tends to be a rectangular wave swinging between +5V and -5V, with its vertical edges coinciding with the instants where the selected trigger signal matches the triggering level set by VR2, on either the positive-going or negative-going slopes. Series resistor R9 and clamp diode D5 are used to convert this bipolar signal into one switching between +5V and ground (approximately), for compatibility with the CMOS logic.

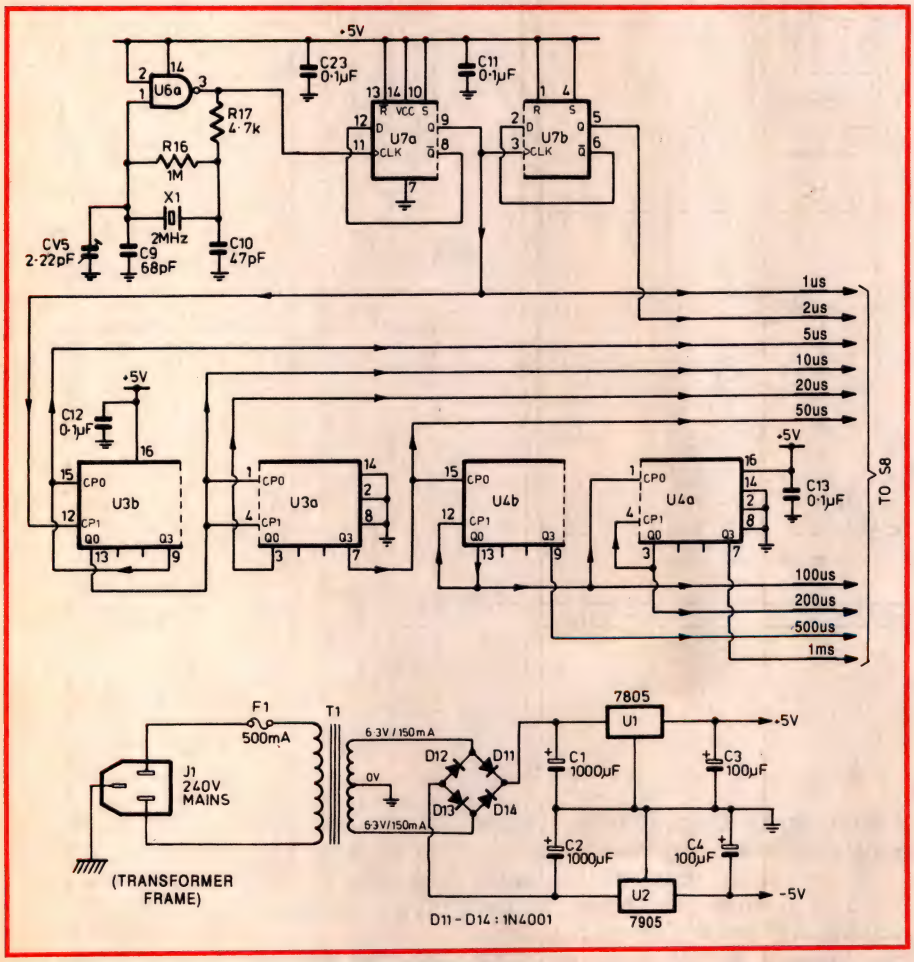
The signal across D5 is then fed both directly and via inverter U17c to switch S7, to make it available in both normal and inverted forms. As the clock input of U9b responds only to a positive-going edge, this means that S7 effectively allows us to trigger U9b potentially on either the positive-going or negative-going slopes of our signal, and at a level adjusted by VR2. We therefore have all of the basic triggering facilities normally found on a conventional analog scope.

Start/stop triggering

As it happens, though, I've been able to provide an additional facility — one that can really only be provided easily on a DSO. This is the ability to have the trigger signal event *stop* the sampling process, if you wish, rather than *start* it. This is very handy at times, because it can let you see what the signal looked like *before* the trigger event, rather than *afterwards* (which is what we see on an analog scope).

The additional facility is provided by using 'Trigger Action' switch S6 to manipulate the data (D) input of U9b — which of course determines what state the flipflop assumes, when a triggering edge is fed into the CLK input.

For the more usual 'start' mode of triggering, S6 is open circuit and the D input (pin 12) of U9b is pulled to the high logic level by resistor R27, which connects to



The schematic for the remaining crystal timebase divider chain and power supply sections of the DSO adaptor. Only three divider ICs and a single-gate oscillator are used to generate 10 different sampling clock frequencies in a 1/2/5 sequence.

PARTS LIST

Resistors

R1	470k 1% metal film
R2	330k 1% metal film
R3	100k 1% metal film
R4	47k 1% metal film
R5	33k 1% metal film
R6	20k 1% metal film
R7,R8	2.2k 5% 1/4W
R9,R17	4.7k 5% 1/4W
R10,R11	47k 1% metal film
R12,R25,R26	470 ohms 5% 1/4W
R13,R14,R22,R27,R30,R31,R32,R33	10k 5% 1/4W
R15	1.5k 1% metal film
R16	1M 1% metal film
R18	1.2k 1% metal film
R19	3.3k 1% metal film
R20	3.3k 5% 1/4W
R21	150 ohms 1% metal film (or 680 ohms: see text)
R23,R24,R29,R34,R35	1k 5% 1/4W
R28	33k 5% 1/4W
R36,R37	10k 1% metal film (optional: see text)
VR1	20k linear trimpot, horiz PCB mount (small)
VR2	50k linear pot

Capacitors

C1,C2	2200uF 16VW RB electrolytic
C3,C4	100uF 16VW RB electrolytic
C5,C7,C11,C12,C13,C14,C15,C17,C18, C19,C20,C22,C23,C24,C29	0.1uF monolithic ceramic
C6	0.1uF 100VW metallised polyester or MKT
C8,C16,C25,C26,C28	10uF 25VW TAG tantalum
C9,C33	68pF NPO ceramic
C10,C32	47pF NPO ceramic
C21,C30	1nF 1% 63V polystyrene
C31	10nF monolithic ceramic
C34	390pF ceramic
CV1,4,5	2-22pF plastic trimcap
CV2,3	10-60pF plastic trimcap

Semiconductors

D1-7	1N4148 or 1N914 signal diode
D11-14	1N4001 or similar power diode
U1	7805 positive 5V regulator (TO-220)
U2	7905 negative 5V regulator (TO-220)
U3,U4	74HC390 dual decade counter
U5	TL072 dual FET input op amp
U6,U10,U18	74HC00 quad NAND gate
U7,U9	74HC74 dual D-type flipflip
U8	LM833 dual low noise op amp
U11	LM4040CIZ-2.5V reference (or LM336Z-2.5 + R36,R37)
U12	ADC08061 A/D converter (or ADC0820: see text)
U13,U14	74HC393 dual four-bit counter
U15	74HC157 quad two-input multiplexer
U16	62256-10 SRAM 32K x 8, 100ns
U17	74HC04 hex inverter

Miscellaneous

S1	DPDT miniature toggle switch
S2	Two pole, 6 position rotary switch
S3,S6,S7	SPDT miniature toggle switch
S4,S5	Miniature pushbutton, SPDT momentary
S8	Single pole, 11 position rotary switch
S9	SPDT miniature toggle switch (optional: see text)
LED1	3mm round LED, green
LED2	3mm round LED, red
X1	Quartz crystal, 2MHz (10 x 3.5 x 13mm case)
T1	Power transformer, 12.6V CT at 150mA
PCB	PC board, 143 x 123mm, code 94dso5
J1,J3	BNC coaxial socket, single hole mounting
J2	13 x 2 length of DIL pin header
J4	IEC 240V male chassis connector
F1	Screw-in 3AG cartridge fuse-holder, with 500mA cartridge fuse

Plastic instrument case, 200 x 160 x 70mm (or 200 x 160 x 65mm); front panel, photo-sensitive aluminium or silk-screened; three instrument knobs, 20mm diameter; 51 x PCB pins; 2 x 8-pin DIP sockets; 8 x 14-pin DIP sockets; 3 x 16-pin DIP sockets; 1 x 20- pin DIP socket; 1 x 28-pin DIP socket (0.6"); 100 x 30mm piece of 1mm aluminium sheet; 100 x 35mm piece of tinplate, for switch shield; 80 x 45mm piece of blank PCB laminate, for PCB shield; 1 x 26-way DIL IDC connector; 1 x DB25 plug, IDC type; 2m length of 25-way IDC ribbon cable; 4 x 3mm x 10mm machine screws with nuts and lock-washers; 2 x 3mm x 6mm PK screws; hookup wire, TC wire, sleeving, etc.

the Write/Read-bar control line driven by pin 3 of connector J2 (or optional switch S9 — more about this shortly). In the adaptor's sampling or 'Write' mode, the W/R-bar control line is pulled high by R34.

With the D input at logic high, U9b therefore switches into the set state when the triggering edge occurs, and sampling begins. To achieve the opposite effect, S6 is simply switched to the 'stop' position, shorting pin 12 of U9b to ground (logic low). This means that if we begin sampling say manually, by pressing the Manual Trigger button S4, the effect of the triggering edge sent to the CLK input will now be to force U9b to *reset*, stopping the sampling (and leaving in memory the samples that have just been taken).

How do we arrange for sampling to stop normally, in 'start' mode? Basically this is done in the same way as the original design, by arranging for our 'master write control' flipflop U9b to be reset when we reach the end of our memory (i.e., when we have a full sequence of samples). This is done by gate U10a, which takes an 'end of buffer' (EOB) signal from a selected output of memory address counter chip U13, and sends a reset signal back to U9b via OR gate U18d and inverter U17f.

By selecting different outputs from U13, to derive our EOB signal, we can stop the sampling after differing numbers of samples have been taken — effectively varying the 'length' of our sample memory.

A choice of four outputs is provided on the board, from the full 32K available in the SRAM (used for maximum resolution) down to 4K (for faster 'snapshot' sample sequences). If desired, an optional switch can be provided on the adaptor's rear panel, to select whichever memory length is desired.

Note that when S6 is switched to 'stop' mode, this resetting of U9b by the EOB signal is disabled, because S6 also controls the logic level at pin 2 of gate U10a. So in this mode, the sampling is *not* stopped when the end of the memory is reached; it continues indefinitely, with samples being stored in the full 32K of memory continuously until U9b is reset by the selected trigger event.

Actually there *is* one other way that sampling can be stopped, at any time. This is by deliberately resetting U9b, either manually or by means of a 'host reset' pulse sent from the PC software. Manual resetting is performed using pushbutton S5, which pulls pin 4 of OR gate U18b low (power-on reset components R33 and C31 normally hold this pin high). Similarly the PC reset pulse enters the adaptor via pin 14 of connector J2, and after inversion by U17b is applied to pin 5 of U18b.

In either case, U18b not only resets the master write control flipflop U9b via U17d, U18d and U17f as before; it also resets the memory address counter chips U13 and U14, so the memory is 'sent back to the start'. This is fine if we've taken the samples in 'start' mode, because we'd normal want to read them back out again from the start anyway. But if we have taken them in 'stop' mode, resetting the memory counters will lose our stopping address and we won't know where the sampling sequence ended...

Overload indicator

There's one more section of the circuit, involved in the sampling or 'write' mode operation, which we haven't yet mentioned: that involving U6e, wired as an inverter, and flipflop U9a. These are used to indicate if the A/D converter has been overloaded and 'sent off scale' during the sampling.

If we have set our input range switch S2 to a range that causes the A/D chip to overload at some point in the signal waveform, the chip responds by driving its OFL-bar output (normally high) down to logic low, at the end of the conversion cycle(s) concerned. However as this out-

put then goes high again at the start of the next conversion cycle (which might begin within a microsecond), we can't use this output to drive an indicator directly. Instead we have to use it to trigger a latch, which will remain on long enough for us to *see* that overload has occurred.

U9a is the latch, triggered on by U12's OFL-bar signal after it has been inverted by U6e. In turn the Q output (pin 5) of U9a drives LED2 via R25, so that if LED2 (labelled 'A/D OVF') glows during a sampling sequence, we know that the converter is being driven into overload and we need to set S2 to a higher range. Note that U9a is only reset by the manual or 'host reset' signals from U18b, via U17d. So after an overload, the complete triggering circuit (and memory address counter) must be reset either manually or by the PC software, before taking another sample sequence.

Reading the samples

Now let's look at the *second* main phase of the adaptor's operation — where the stored samples are read back out of the memory, and sent to the PC...

To change the circuitry into this mode, the Write/Read-bar control line is pulled down to logic low level, either by the PC software (via pin 3 of J2), or by means of optional write/read mode switch S9. This does a number of things, one being to disable gate U18a, so that its output goes high along with pin 27 (WE-bar) of memory chip U16 — preventing any further writing into the memory.

At the same time, pin 22 (OE-bar) of the memory chip is taken low, enabling its data output buffers so that they are ready to provide the read out data. And finally, the logic low on the Write/Read-bar line also pulls the D input of U9b (pin 12), via R27, so that the master write control flipflop cannot be triggered on. This prevents U12 from being enabled, for any further sampling.

The stored sample data is then read from the memory chip and back into the PC, under software control. As there are only five 'input' lines on a standard Centronics parallel port, multiplexer chip U15 (a 74HC157) is used to read each sample byte back as two four-bit 'nibbles', one after the other, via pins 10, 11, 12 and 13 of J2. (The fifth port input, at J2 pin 15, is connected to the Q output of U9b, so the PC software can tell when sampling has stopped.)

The control pin of U15 is pin 1, and to read the data the software first pulls this line low via pin 2 of J2. This causes U15 to make available the 'low nibble' (i.e., bits D0 - D3) of the data byte from the current memory address, at pins 10 - 13 of J2. Then when the software has read this nibble, it toggles pin 1 of U15 high, which makes the 'high nibble' (bits D4 - D7) available instead. This completes the actual read operation, but the final step is for the software to send down a negative-going pulse via pin 1 of J2, to increment the memory address counters U14 and U13 ready to read the data in the next memory location.

This 'read high nibble/read low nibble/increment memory' sequence is therefore repeated over and over, until the PC has read all of the sample data from the memory. Obviously the software has to be told in advance how much memory is being used (i.e., 32K or 4K, etc), so it knows how many bytes are to be retrieved.

So that's basically all there is to reading the sampled data back into the computer, for display and further processing. To ensure that the readout process starts at the beginning of memory, in the case of a sequence of samples made in 'start' triggering mode, the software can send a 'host reset' pulse at the beginning, if desired. However this can't be done in the case of a sequence made in 'stop' triggering mode, because the readout has to begin at the very next memory address from the one where sampling stopped.

In any case, an initial reset pulse is really only necessary when a memory length shorter than the full 32K has been selected (for faster setup), and the samples have been taken in 'start' triggering mode. If the full 32K memory has been used, sampling will have stopped at the end of memory anyway — ready for readout from the start again.

Power supply

The power required by the DSO adaptor's circuitry is very modest, thanks to the use of CMOS devices. The overall drain is typically less than 100mA, in fact, so we are able to power it from one of the smallest transformers in common use: a 2VA unit supplying 12.6V centre-tapped at 150mA (type 2851 or similar).

By grounding the centre-tap and using a full-wave bridge rectifier, we use the transformer to produce raw DC outputs of both +9V and -9V with respect to ground, across reservoir caps C1 and C2. Regulators U1 and U2 are then used to produce regulated supply rails of +5V and -5V, to power all of the adaptor circuitry. The negative rail is used only for the op-amps, to ensure in particular that those in the vertical amplifier can handle the required voltage swing without distortion.

By the way, as the DSO adaptor can be used to take samples away from the PC, its low current drain would allow it to be powered from a battery pack, if you wish. All you'd need is a set of say 12 'D' size cells, connected in series so that they produce a centre-tapped 18V DC. This can be fed into the adaptor's PCB power input pins, instead of the AC from the transformer.

And that's about all we have space for, this month. In the second of these articles I'll describe the construction of the adaptor, as well as how it's set up and used.

(To be continued) ❖

Software for the DSO Adaptor Mk2

As mentioned elsewhere in this article, David Jones (the designer of the original DSO Adaptor) of Tronnort Technology has written a new and expanded version of the updated software for his own adaptor, especially to suit our new model. The new Version 3.0 DSOA software takes advantage of the extra features of the Mk2 Adaptor, and also offers many new 'user friendly' enhancements of its own, including:

- A full on-screen measurement graticule, which allows you to update its legends according to the DSO ranges chosen.
- Much faster waveform display updating than previous versions.
- The ability to perform one-shot measurements from the PC keyboard, with a single keystroke.
- 'Real time' repetitive sampling and screen updating, again controlled very conveniently from the PC keyboard.
- The ability to take individual samples under PC software control at programmed intervals, for data logging.
- Storage of printer port address, DSO buffer size, etc. in a config file, so the software 'doesn't forget'.

At the time of writing, the software doesn't yet provide for direct screen printout, to produce a 'hard copy' version of any display, but David Jones is hoping to have completed this very useful feature by the time the May issue is published.

In short, the new DSOA Version 3.0 software is an excellent program, and one which allows you to make very good use of our new DSO Adaptor Mk2. At the price being asked — only $30 plus $5 postage anywhere in Australia — it seems to us to represent really good value for money, considering how much work has been involved in writing it.

The Version 3.0 software is available from Tronnort Technology, 12 Copeland Road, Lethbridge Park 2770.

We understand that some kits for the DSO Adaptor Mk2 may include this software, by arrangement with Tronnort. However constructors may still wish to register with Tronnort itself as a user of the software, so David Jones can keep you posted on any further upgrades he releases in the future.

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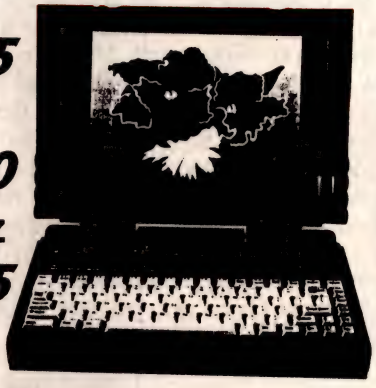
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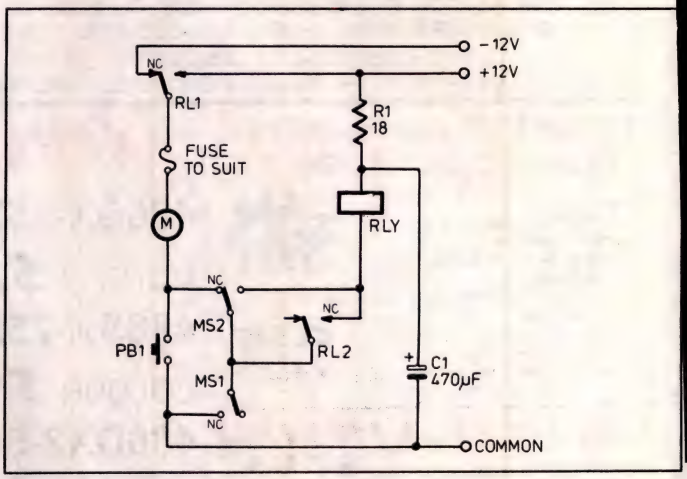
Circuit & Design Ideas

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

Garage door circuit

The complexity of the garage door opener described in Circuit & Design Ideas in January 1994 has prompted me to forward a copy of my own design. The system uses a dual polarity power supply, with a microswitch at the top and bottom of the door, and a DPDT relay to reverse the motor.

The circuit shows the conditions with the door closed. When the operate button is pressed, the motor starts, raising the door and thus operating the lower microswitch MS1. This switch closes and keeps the motor powered when the pushbutton is released. The door continues to rise until it trips the upper microswitch MS2, which removes supply from the motor and energises the relay. The relay is latched on by contact A2. Contact A1 swaps the polarity of the DC supply to the motor, in readiness to close the door. When the button is pressed again, the door starts to close, causing MS2 to change state. When the door is closed, MS1 is operated, isolating the motor and causing the relay to drop out, returning the circuit to its original condition.



Fred Kemsley,
Mudgeeraba, Qld. **$45**

Dirty finger switch

There have been numerous circuits published for finger-tip control of devices like lights or radios. Most of these rely on conductivity, which can be poor if the finger is dry (old?), oily or dirty. Because this circuit works from finger capacitance as well as conductivity, it is more reliable.

Feedback around IC1a via R1 and C1 causes it to oscillate at about 2MHz. This signal is fed to IC1b via R2, so that under normal operation IC1b inverts and buffers the output of IC1a.

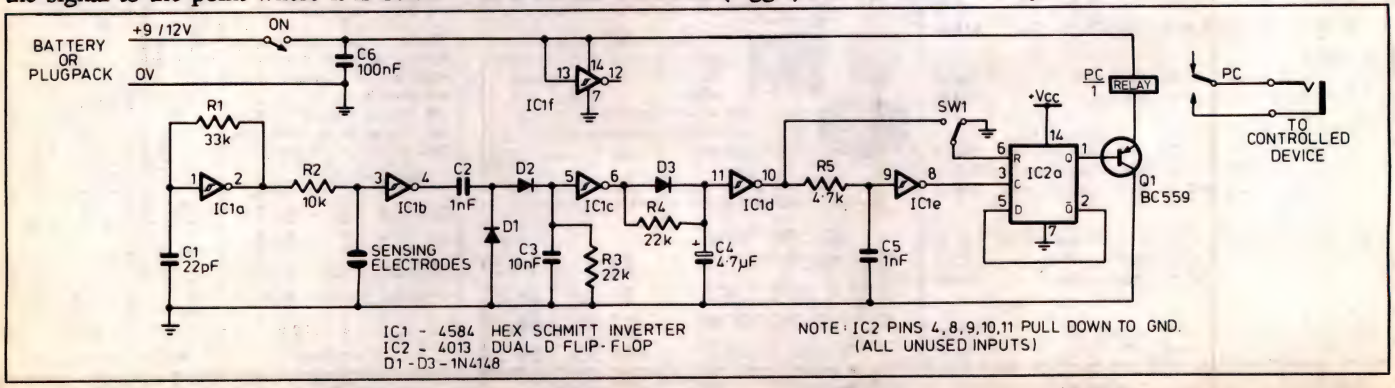
However, the input to IC1b can be attenuated or biased off by applying a finger across the sensing electrodes. A clean finger is usually conductive and biases the input of IC1b to cutoff. Otherwise, any finger is conductive internally and so will increase the capacitance presented by the electrodes and thus shunt the signal to the point where it is below the hysteresis voltages of the input. In either event, IC1b output becomes 'stuck' instead of switching at 2MHz. The change is detected at the input of buffer IC1c as a drop in the DC output of the voltage doubler formed by C2, D1, D2 and C3. From there, network R4, D3 and C4 respond quickly to a finger signal, by taking the input of IC1d high, but holding over for any small break due to hesitant movement. IC1d gives further buffering and IC1e gives inversion of the logic level.

Otherwise, the action depends on the setting of SW1. As drawn, IC2a will toggle (alternatively high and low) each time the output of IC1e goes high due to finger application. If SW1 is moved to its other position, then each finger-on pulse from IC1e clocks IC2a to a high, after a small delay caused by C5 and R5 to ensure reset has ended. Finger-off allows IC1d to reset IC2a. Consequently, SW1 allows the unit to act in either bistable (toggle) or monostable (pushbutton) mode. The output of IC2a is connected to an emitter follower (Q1) which in turn drives a suitable relay. Note that a quenching diode is not needed. If toggle mode is not needed, IC2 can be dispensed with by wiring the base of Q1 to the output of IC1e.

The circuit can be powered from a 9V or a 12V battery. If used in 'button' mode, battery drain is not a problem. For toggle mode, a plug-pack or rechargeable batteries might be needed.

The sensing electronics can be a pair of pads (say 20 x 20mm) etched on a PCB, perhaps at one end of the board containing the circuit. I found it better to mount a small pair of stainless steel handles, like parallel bars, on the face of a plastic box containing the electronics. Just be sure to keep their capacitance down — separate their wires rather than twist them together.

E. Gordon Wormald,
Florey, ACT. **$50**

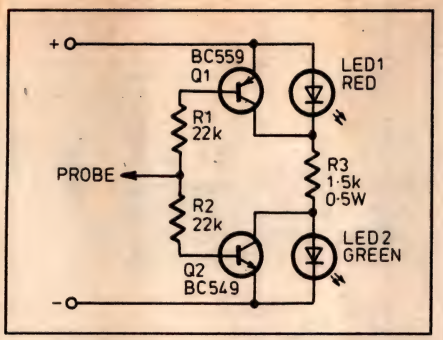


Compact logic probe

I wanted a very compact +/- indicator, so I built this circuit into the empty casing of a ball-point pen. In order to get it to fit into the casing, I did not use a PCB, but assembled the components as shown. They fitted — with a bit of poking and pulling! Two 3mm LEDs were used, with the red LED indicating positive polarity and the green one negative.

The wires to the LEDs should be insulated, and the other components simply have their leads soldered to each other. I used bits of insulation tape wherever there was any risk of leads touching. By pulling the probe wire, and pushing down the circuit with a small screwdriver, the whole assembly was worked down the casing until the LEDs lined up with their holes.

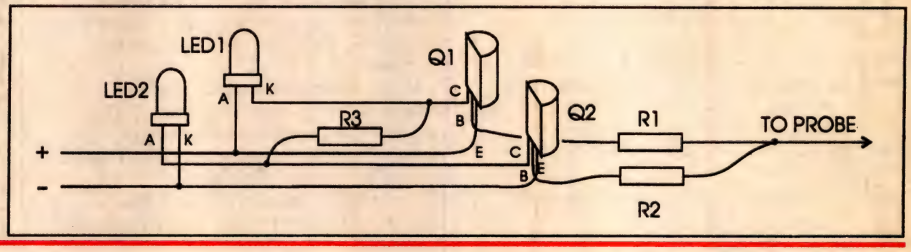
A Pentel pen was chosen, because of its soft case which made it easier to work with. It was dismantled and washed, and two 3mm holes were drilled for the LEDs near the top of the casing, but far enough



down to leave room for the cap to be replaced. Another hole was drilled in the cap for the power leads. To make the actual probe, I pushed out the ball of the nib, and inserted a pin which was soldered to the probe wire. The nib was then placed back in the plastic casing.

The probe works by simply biasing on one of the two transisotrs Q1 and Q2, which lights the appropriate LED (green for positivde and red for negative). The tester works well on a voltage range of 3 - 24V; though if you intend to use it mostly at one end of the range, you may like to increase or decrease the value of resistor R3. I found it very handy with alarm systems and for automotive use. It is rugged enough to be kept in the tool box.

Chris Reinback,
Toorak, Vic. **$40**



Active guitar electronics

A guitar magnetic pickup is a high-impedance voltage source, with an inductance in the order of henries. Because the cable capacitance and the pickup inductance form a parallel resonant circuit, this can alter the overall frequency response of the pickup.

Hence, when the cable hits any solid surface, clicks and rustles are induced by the cable dielectric polarisation. Such unwanted signals, which also include hum and RF interference, decrease the output signal dynamic range.

An active electronic circuit can be offered as a solution, consisting of a battery-driven low-noise preamplifier, built inside the musical instrument. Obviously, a circuit which has an external power supply, but shares the same cable and connectors would be more convenient. Hence, this is the setup given in the schematic.

The preamplifier uses a field-effect transistor (Q1) in common source mode, which is connected by shielded cable to a current-to-voltage converter built around IC1 (5532). Resistor R3 in the main circuit isolates the summing point of op-amp IC1a from the cable capacitance (shown as C_{cable}), while the multiloop feedback through resistor R5 and capacitor C4 forms a low-pass filter.

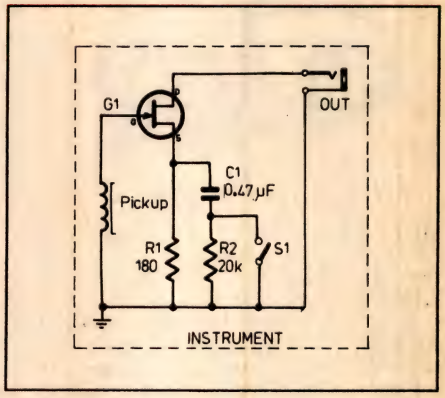
The circuit transfer function is given by: $A = g_{m1}.R4 / (s^2/\omega_0^2 + \alpha s/\omega_0 + 1)$

where s is a complex frequency, g_{m1} is the input stage transconductance, while $\omega_0 = (R4.R5.C4.C_{cable})^{-1/2}$ is a resonant frequency, and the damping factor α is given by $w_0.C4.(R4+R5+R4.R5/R3)$.

With the component values shown in the diagram, the low-pass filter cut-off frequency lies above audio range (f_{-3dB} = 45-65kHz) and the circuit is uncritically damped ($\alpha < 1.4$) with cable length up to 60m (and C_{cable} up to 8nF). The low-pass filter effectively attenuates RF and pulse interference from thyristor-operated lighting. The non-inverting integrator IC1b restores DC conditions on the inverting input of IC1a, thus holding the DC output offset near zero. The circuit operates well with both magnetic and piezo-electric pickups.

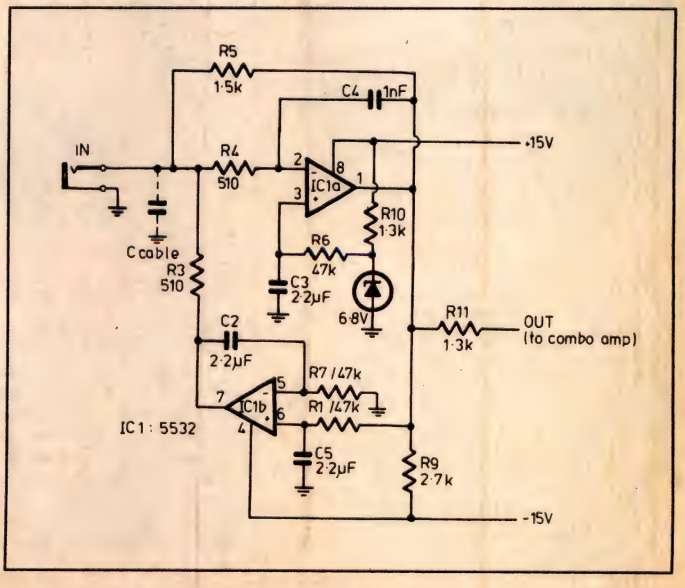
Transistor Q1 is a 2N4416, 2N5270, 2N5459 or similar, with I_{dss} = 10mA and $-V_{(p)gs}$ = 3V. The pinch-off voltage - $V_{(p)gs}$ must exceed the peak output value of the pickup being used. The quiescent gate-to-source voltage is set by resistor R1 and should lie exactly in the middle of the transistor input operating range of $-V_{(p)gs}$ to +0.5V. Capacitor C1 boosts frequencies over 4kHz and implements the 'presence effect' when switch S1 is closed.

If you don't want to place the FET and its associated components inside the guitar, then Q1,



R1 (and an additional 5.1M resistor from the FET gate to ground) may be mounted in the cable jack.

D.Danyuk and G.Pilko,
Kiev, Ukraine. **$50**



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Have you been looking everywhere for a special MIDI adaptor cable or "breakout box" so you can use your MIDI port on your sound card with external music keyboards or synthesizers? Well stop looking! This low cost MIDI breakout box does just that. And for a fraction of the cost of a commercial unit. We supply the PCB and electronic components only - no hardware allowing it to be built into existing equipment. E.A FEB. '94.
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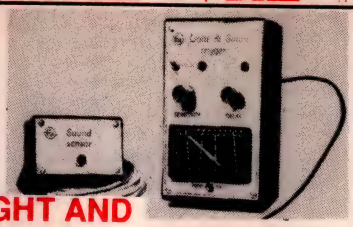
A WEEKLY REMINDER TIMER

A timer to remind me to put out the rubbish!!! :"What a Load of Garbage"
But that's what you'll get if you do forget bin night! However, with this handy little kit you'll never forget again. A timer which sounds an alarm and flashes a LED exactly after one week has passed since it was reset. It will remind you to do anything that has to be done once every week at a specific time. After the weekly duty is performed a button is pressed to reset the alarm, if the button isn't pressed the button will automatically stop after about 80 minutes. It's easily built, low in cost, and fits into a small utility box. E.A APRIL '94.
PLEASE PHONE FOR PRICE & AVAILABILITY.



AN IMPROVED DSO ADAPTOR FOR PC'S-1

This kit is similar to the low cost digital sampling scope adaptor for PC's which was published in Electronics Australia February 1993, but with additional features such as calibrated vertical amplifier and timebase and a more flexible triggering facility. It also allows the sampling write / read mode switching to be controlled directly by the PC software instead of a manual switch. There is also circuitry to allow the a PC software to supply the adaptor's A/D convertor directly with sampling clock pulses. REF: ELECTRONICS AUSTRALIA MAY 1994. PLEASE PHONE FOR PRICE AND AVAILABILITY



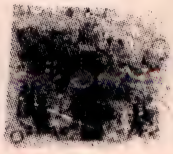
LIGHT AND SOUND TRIGGER

Always wanted to create special effects with your camera by capturing that exact moment when something occurs? For example, a light bulb breaking, a drop of water splashing into a puddle or bowl or a tennis or squash ball impacting with a wall or racquet! Well with this light and sound trigger you can . This kit activates the camera flash from a sound source. You can also trigger a second flash from the main one or even delay the flash by a controlled time.
The kit includes the following: 2 PC boards, 2 boxes, audio transformer, solar panel, mic insert, 3.5 socket and all specified components.
Extension sync lead flash is not supplied. These are available from most camera stores.
REF. ELECTRONICS AUSTRALIA APRIL '94
PLEASE PHONE FOR PRICE & AVAILABILITY.



SOUND & LIGHTS FOR LEVEL CROSSINGS

It's probably every model railway enthusiasts ultimate aim to make their railway as realistic as possible. This kit, which is intended to be controlled by the level crossing detector published in March '94 "Silicon Chip", drives LEDs or miniature incandescent lamps for level crossing signs and produces an most convincing bell sound as an accompaniment.
Apart from the lifelike effect of the flashing lights, the particular attraction of this project is the uncanny sound of the bell. If you've ever stopped at a level crossing on a rainy or foggy night you may recall the eerie sound of the bells as their rate of ringing wavers up and down. This circuit reproduces this effect and thereby greatly adds to the realism. REF. SILICON CHIP APRIL 1994.
PLEASE PHONE FOR PRICE & AVAILABILITY.



LOW-NOISE UNIVERSAL STEREO PREAMPLIFIER

This universal preamplifier can be easily constructed for use with a magnetic cartridge, cassette deck or a dynamic microphone. It uses a single dual op amp IC & has very low distortion. This preamp uses the industry standard LM 833 dual op amp IC which has very low noise and distortion. Perhaps the prime use will be for those people who have an integrated stereo amplifier which they are keen on but which has a phono or tape which could be improved. REF: SILICON CHIP MARCH '94.
PLEASE PHONE FOR PRICE & AVAILABILITY.

KITS KITS KITS

CAT	Description	R.R.P
K10005	SOLAR VOLTAGE REGULATOR	$13.95
K10040	ETI 480 50W AMP	$27.95
K10045	ETI 480 100W AMP	$34.95
K10050	ETI 480 POWER SUPPLY	$28.95
K10055	GENERAL PURPOSE PRE-AMPLIFIER	$14.95
K10060	BALANCED MICROPHONE AMPLIFIER	$12.95
K10065	GENERAL PURPOSE AMPLIFIER	$14.95
K10070	BALANCED INPUT DIFFERENTIAL PREAMP	$19.95
K10075	FLOAT NICAD CHARGER	$14.95
K10080	TRANSISTOR TESTER	$22.95
K10085	300W PLAYMASTER AMP	$119.00
K10095	2 TONE ALARM	$9.95
K10100	1.5V TO 9V DC CONVERTER	$13.95
K10105	3 DIGIT COUNTER	$23.95
K10110	ELECTRIC FENCE	$23.95
K10115	ELECTRIC FENCE CONTROLLER	$61.95
K10120	TV PATTERN GENERATOR	$109.00
K10125	UNIVERSAL POWER SUPPLY	$12.95
K10130	DISCO LIGHT	$165.00
K10135	LED SCANNER	$17.95
K10140	LOW FUEL INDICATOR For CAR	$11.95
K10145	SCREECHER CAR ALARM	$36.95
K10150	12/24V LIGHT CHASER	$21.95
K10155	LOW VOLTAGE CUTOUT FOR CAR / BOAT	$22.95
K10200	50 MHz DIGITAL FREQUENCY	$1495
K10205	VHF POWERMATCH	$74.95
K10215	TEMPERATURE PROBE FOR MULTIMETERS	$19.95
K10225	18V / 1AMP BENCH TOP POWER SUPPLY	$79.95
K10295	LOW OHMS METER	$29.95
K10300	TEMPERATURE ADAPTOR	$24.95
K10305	VOICE OPERATED RELAY	$19.95
K10310	IGNITION KILLER	$22.95
K10315	HEADPHONE AMP	$34.95
K10320	VIDEO RF MODULATOR	$17.95
K10325	50W AUDIO AMPLIFIER	$54.95
E10325	P.C.B FOR K10325	$19.95
K10330	RS232 FOR COMMODORE 64	$24.95
K10335	RGB TO PAL ENCODER MODULE	$49.95
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K10345	KARAOKE BOX	$27.95
K10350	REMOTE CONTROL EXTENDER	$32.95
K10355	HIGH ENERGY IGNITION	$55.00
K10360	LOUDSPEAKER PROTECTOR	$29.95
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K10395	MESSAGE RECORDER	$65.95
K10400	WOOFER STOPPER	$55.95
K10405	COLOUR VIDEO FADER	$32.95
K10455	PRINTER STATUS INDICATOR FOR PRINTERS	$65.95
K10465	LOW COST 25W AMPLIFIER MODULE	$18.95
K10460	VERSATILE 40V / 3A LAB POWER SUPPLY - 1	$165.95
K10445	IMPROVED DECODER FOR ACS SIGNALS -1	$19.95
K10415	PC-CONTROLLED EPROM PROGRAMMER	$98.95
K10450	A SIMPLE LOW VOLTAGE SPEED CONTROLLER	$13.95
K10475	90 SECOND MESSAGE HOLDER	$98.00
K10480	CONTROL STEPPER MOTORS WITH YOUR PC	$65.95
K10485	EGO TESTER KIT	$19.95
K10490	LOW COST MIDI BREAKOUT BOX	$13.95
K10500	VOICE OPERATED AUDIO SWITCH	CALL

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see our other ads in this magazine for addresses & phone numbers of our stores.

eskitmag

NEW COMPONENTS

TOROIDAL CORES

NEW



"Powdered Iron" Type.

SMALL

Outside Diameter:	14.8mm
Inside Diameter:	8mm x H 6.35mm
Grade:	1003
Saturation Flux Density:	15000 gauss
Maximum Operating Frequency:	500KHz

L12125 1-9 $3.95 10+ $3.65

MEDIUM

Outside Diameter:	33mm
Inside Diameter:	20 x H 10
Grade:	1003
Saturation Flux Density:	15000 gauss
Maximum Operating Frequency:	500KHz

L12130 1-9 $10.15 10+ $9.15

LARGE

Outside Diameter:	44mm
Inside Diameter:	24 x H 10mm
Grade:	1003
Saturation Flux Density:	15000 gauss
Maximum Operating Frequency:	500KHz

L12135 1-9 $13.75 10+ $12.35

TRANSFORMER POT CORES

NEW



Outside Diameter	26mm
Inside Diameter	11.1mmx H 16mm

Material: FA Ferrite Equivalent to Fx 2240 pot core

L11403 2 per pack 1-9 $5.95 10+ $5.45



TRANSFORMER POT CORE BOBBIN

L11404 1-9 $0.95 10+ $0.75

BALUN CORES

NEW



SMALL BALUN CORE
7.4mm x 13.2mm x 6.6mm
Operating Frequency : 40 - 220MHz
Material: F14 Ferrite
L11410.....$0.95



7.4mm x 13.2mm x 13.5mm
Operating Frequency: 40-220MHz
Material: F14 Ferrite
L11406.....$1.00

FERRITE SUPPRESSION BEADS

NEW



Outside diameter:	4.0
Inside Diameter:	2.0mm x Length 5.0mm
Material:	F8 Ferrite
Frequency Range:	50KHz - 500KHz

L11430 1-9 $0.25 10+ $0.20

SUB MINITURE FORMER WITH CORE, CAN AND BASE

NEW

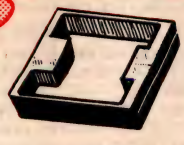


5 mm type 722-1 - to be used with 4mm F16 slug or as open air type. All four parts are supplied as a complete kit.

L11416 1-9 $3.50 10+ $3.25

E CORE

NEW



2 halves 34 x 26 x 8mm
E20050.....$6.95



E CORE BOBBIN TO SUIT ABOVE E CORE 34 x 26 x 8mm
E20052.....$1.00

3.5" HIGH PERFORMANCE REMOVABLE CARTRIDGE HARD DISK DRIVE.

NEW





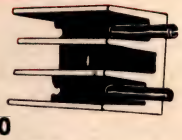
The 3.5" SQ3105 drive was designed to give you superior performance in all laptop/desktop computers requiring a removable, expandable storage subsystem for multimedia, desktop publishing, and other data intensive imaging applications in your PC & Macintosh systems. At 105MB formatted capacity on each cartridge, these drives let you add as much storage as you'll ever need. Plus, they feature proven technology and innovative firmware to assure reliable performance across a variety of operating environments. Our 3.5" drives also provide universal inter-changeability through the use of an embedded servo system and adaptive read channel, while including comprehensive self-diagnostic capabilities and programmable power-saving modes. Combined with their low cost and high performance, these features make our 3.5" drives the smart alternatives to any other storage media on the market.

- ANSI ATA interface (IDE SCSI available as option) provides 14.5msec access time
- Air circulation system provides a Winchester Class environment for the head disk interface.
- The small cartridge fits easily into your shirt pocket.
- Offers primary and secondary storage in one drive.
- 64K intelligent read "Look Ahead" caching buffer.
- Data transfer rate at the host interface up to 4.0MB per second
- Data transfer rate from the head / media interface is upto 2.3 MB per second.
- Programmable power modes - sleep, stand-by idle and active
- 20,000 cartridge insertion cycles
- 100,000 start/stop cycles
- Heads never come in contact
- Ergonomic engineering for reliable and easy cartridge loading and unloading
- 100,000 hours MTBE with 100% duty cycle
- On-the Fly error correction
- 1-7 RLL modulation recording foe maximum read window margins.
- Removable storage advantages - including unlimited capacity and off-line storage, data transportability, system sharing, data security and fast backup.

C11860 Removable Drive Mechanism....$495.00
C11880 105MB cartridge $149.00
You need C11860 & C11880 together.

PCB MOUNT HEATSINK

NEW



TO-220
- Suits TO-220 flat pack semis

This heatsink mounts vertically and has two PCB pins to increase stability and has a 3mm hole so the heatsink can be attached to the device.
- Thermal resistance 18°C /W
- Demensions; 16W x 16L x 20H mm

P10326.....$2.45



TOP-3
- Suits TOP-3 flat pack semis. This heatsink mounts vertically and has two PCB pins to increase stability and has a three mm hole so the heatsink can be attached to the device.
- Thermal resistance 9°C /W.
- Dimensions: 34W x 12L X 50H.

H10609.....$1.95

UNIVERSAL POWER ADAPTOR

Suits: Gamegear, Master system, Megadrive, NINTENDO: NES Super NES.
- **Input: 240V 50Hz**
- **Output: 12 VDC 1.0A**

M18000.....$34.95



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The CD ROM drive is fast becoming a standard feature in home computers. Why? Because an average 1.2 Gigabytes of data can now e stored on a single CD using these new dual speed CD ROMs. A key component to multimedia is the CD ROM Drive as multimedia applications are data intensive and a CD is capable of holding so much information without filling up your hard drive. A CD ROM drive will also fit into any 5.25" half height dive bay on your IBM compatible (XT's not compatible.)



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X17150 (+ $150 for Sound Blaster 16 ASP)

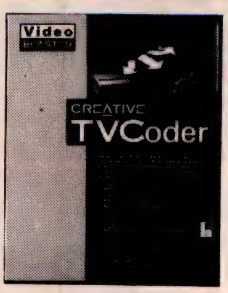
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- Allows simultaneous VGA and video display
- Works best with Video Blaster for Multimedia productions
- Comes with Windows applications software TV Panel **X17198...$349.00**

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SOUND BLASTER VALUE EDITION

NOW WITH LEMMINGS INDY 500

The Sound Blaster Value Edition is the ultimate sound board that easily plugs into any slot in your IBM, PC, XT, AT, 386 etc.

- Text to Speech synthesizer
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- Digitized Voice output with 4 KHz to 44, 1KHz Sampling rate.
- Digitized voice input (8 Bit Analogue to Digital conversion)
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THE NEXT GENERATION IN CD-ROM TECHNOLOGY



Creative CR563 is set to become the next generation of high performance CDROM drive. Superior features include double speed transfer rate, multi-session capability and CD-ROM XA readiness that wil boost the performance of your multimedia PC.

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- **Connects to the Creative/Panasonic proprietary interface on the Sound Blaster 16 series of audio cards**
- **EIAJ - CP340 serial digital audio interface for connection to external recording devices.**
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- **Meets and exceeds MPC2 specifications**

Package includes: CR563 CD-ROM drive 40-way Data Cable, CD Audio Cable, CD-ROM Software drivers

Cat.No. C11910 **$395.00**

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486DX-33 MULTIMEDIA SYSTEM



This is a true 486 machine not a 486SX machine sold by "The Big Stores". What you get is the latest technology. Double speed CD ROM drive which will play the new video software coming out. WHAT YOU GET: • DOS 6.2 & Windows 3.11 • Works for Windows • 4 Meg of RAM • 255M Hard Drive • 1.44 Floppy D.D • CR563B CD ROM Drive (Double Speed) • Sound Card - Sound Blaster Pro • "Power Beat" Magnetically Sheilded Speakers • VESA I/O card • VESA Motherboard & Video Card • Joystick 101 Keyboard • Microsoft Ergonomic Mouse • Supa VGA 1024 x 768 .28" D.P Monitor • Pentium P24T upgradeable motherboard • Augat zero force socket ($2200 for P24T on upgrade) • 4 year P & L warranty

INCLUDES GROLIERS ENCYCLOPEDIA CD.

$2895 $2400 Tax Ex.

Includes: **Works for Windows**



This is one of the best programs available when it come to having the right tools for your business or personal needs - word processing, financial analysis, database management, charting & illustration. The essential tools for everyday computing are here.

ATTENTION: This is the minimum system you should buy. Otherwise in two months time you will be unable to run the latest video software. This system is designed for high speed graphics & CD ROM usage.



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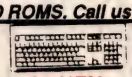
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Black, White & grey emulation scanner with powerful photo/ image & multilingual omnifont OCR **$199.00**

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	STUDENT	FULL
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Construction Project:

Remote-controlled Light Dimmer - 2

This month we explain how to construct, test and use the author's remote-controlled light dimmer, whose circuit was described in the first article.

by JEFF MONEGAL

This project has no special construction difficulties, but you'll need a fine-tipped soldering iron as some of the tracks and pads on the PCB are quite small. A magnifying glass to examine your work is also a good idea. When drilling the transmitter case and the dimmer case, we suggest you use the front panel artwork as a template.

Construction

As usual, start by inspecting the PCB for any manufacturing faults. Then fit all resistors. Note that the resistors in the R-2R network are metal-film types and their colour coding is difficult to read. You might check each one with an ohmmeter because if these resistors are not the correct value, the lamp brightness will be 'all over the place'.

Next fit the capacitors and diodes and transistors, taking care with their polarity. Also solder the three trimpots in place.

There are some 25 links on the component side of the PCB and two long links on the track side. Because some of the links are under IC sockets, these should be fitted before you start with the ICs. IC sockets are not essential, but they will make servicing easier and are therefore recommended.

The receiver module solders directly to the PCB, with the components facing out. We used terminal blocks for the transformer and triac gate connections, but these can be directly soldered to the PCB if you wish.

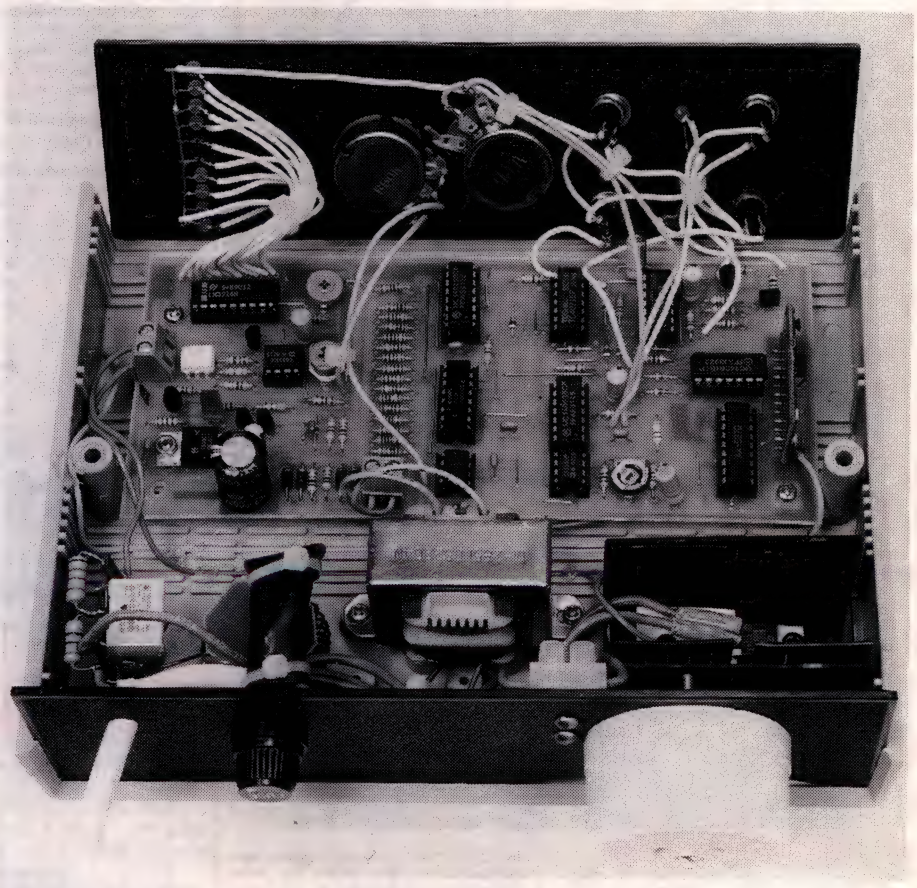
Once you've completed the PCB, check it carefully as it's tightly packed with components. Then go onto the front panel controls and the associated wiring.

The easiest way is to mount all front panel controls, then run wires from the PCB to the pots and switches. The LEDs in the 10-LED bargraph are fitted to the front panel by inserting them into holes drilled in the panel. There are 10 wires, plus the supply to the anode of the LEDs. Make sure you connect the wiring from the LEDs to the PCB correctly as otherwise the display will be meaningless.

An 8V supply is required at each pushbutton, to the UP and DOWN indicator LEDs and to each LED in the bargraph. As the layout diagram shows, the 8V supply is the right-most connection on the PCB.

Preliminary testing

At this stage, you can run some preliminary tests before the mains wiring, triac and associated components are installed — as the LED indicators give enough information to tell if the circuit is working correctly. Set the front panel controls fully clockwise



This photo shows the PCB and front panel wiring from inside the case. There have since been a couple of minor changes to the PCB design, mainly around R45 and R46.

and the internal adjustments to their mid position.

Connect an AC supply of between 10V to 15V to the PCB. When power is applied, LED1 (in the constant current source) should light.

Press either of the manual buttons and check that the direction LEDs for that button come on and go off as the button is pressed or released. You should also see the bargraph rise as the UP button is held down, and fall when the DOWN button is pressed. The rate of change should vary with the 'speed' control and the maximum indication should be adjustable with the 'master level' control.

If the bargraph falls to zero then rises back to maximum while the DOWN button is pressed, adjust VR4 to the point where the bargraph falls to zero and stays there.

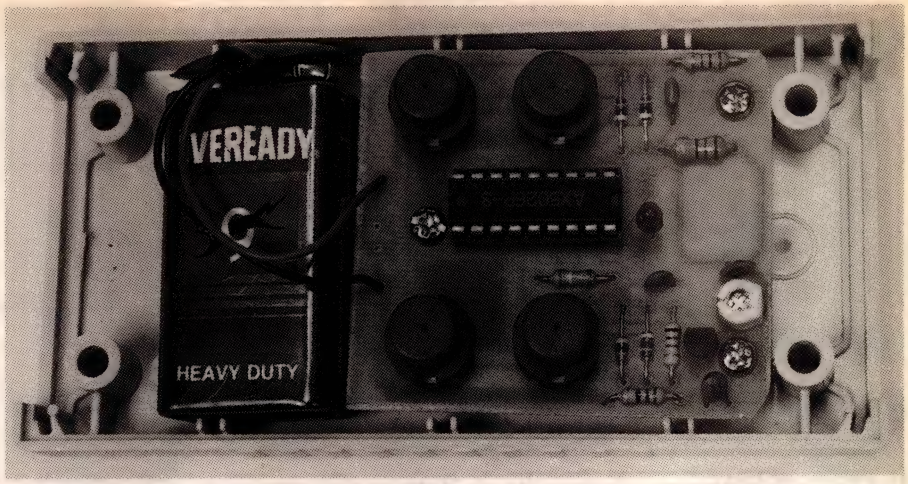
Now press either of the automatic buttons. The associated direction LED should come on and stay on after you release the button. You should also find that pressing these buttons again halts the sequence, providing the speed of the fade is not too fast.

Most problems will be due to faulty wiring, and it's therefore impossible to give more than a few general faultfinding hints. If the unit isn't working, first check that LED1 is on and also measure the 8V supply. If so, check for a high on pin 1 of IC4A when the UP button is pressed and a high on pin 2 of IC4A when the DOWN button is pressed.

Also, the oscillator should run when pin 3 of IC4A is high. However, this can only occur if the counter is between its two limits when pin 11 of IC4D is high or pin 6 of IC10 is high.

If the counters are being clocked, check the top of the R-2R ladder (pin 3 of IC9). You should see a DC voltage that rises and falls at a speed governed by the 'speed' adjustment.

If you can't find the fault, CTOAN Electronics offers a repair service. See the end of the article for details.



The transmitter PCB mounts on 10mm spacers so the switches can extend through the top of the case. Also, fit a 20mm spacer at the rear of the PCB for support.

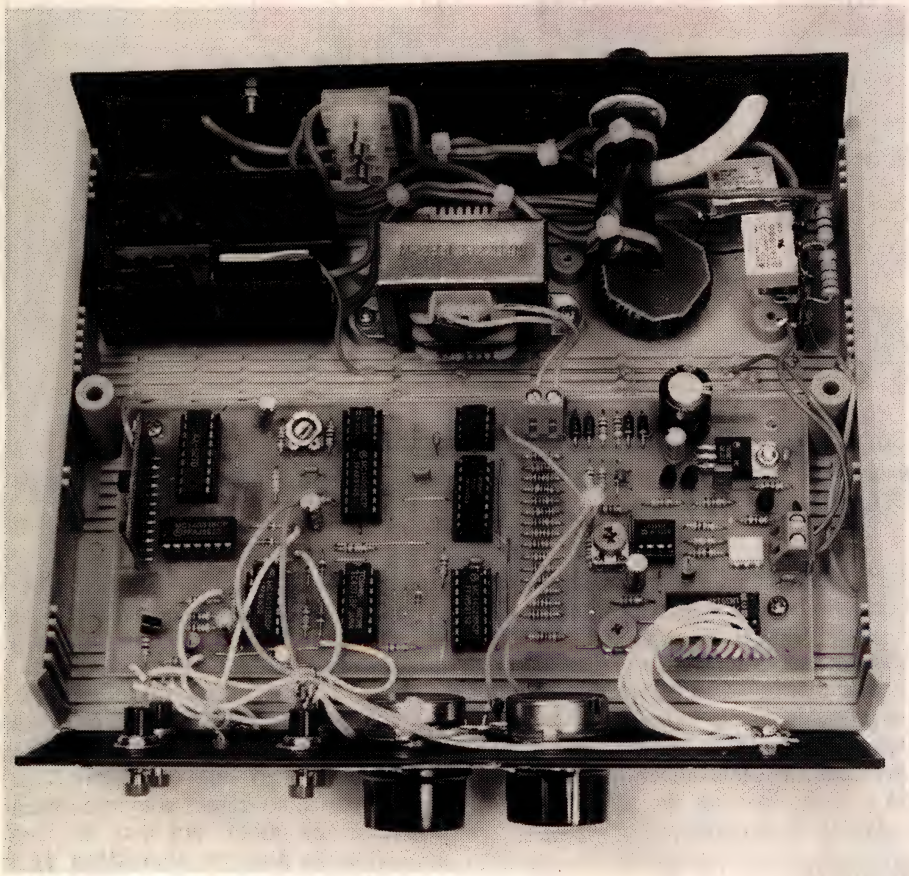
Mains wiring

Next comes the mains wiring. The layout diagram shows where components were placed in the prototype, and all of this wiring should be made with 240V rated cable. As the layout diagram shows, C9 mounts on a two-lug tag strip and C8, R13 and R14 mount on a five-lug tag strip. However, the layout is not critical and can be varied to suit the case.

The inductor (L1) is wound on an iron-powder toroid using a 1.5m length (or so) of 0.8 to 1mm diameter winding wire. Wind about 40 turns on the toroid core, keeping the turns evenly spaced and tightly wound. To hold the toroid in place, we made a washer out of scrap PCB — which was placed on top of the toroid and bolted to one of the case mounting pillars with a 4BA bolt.

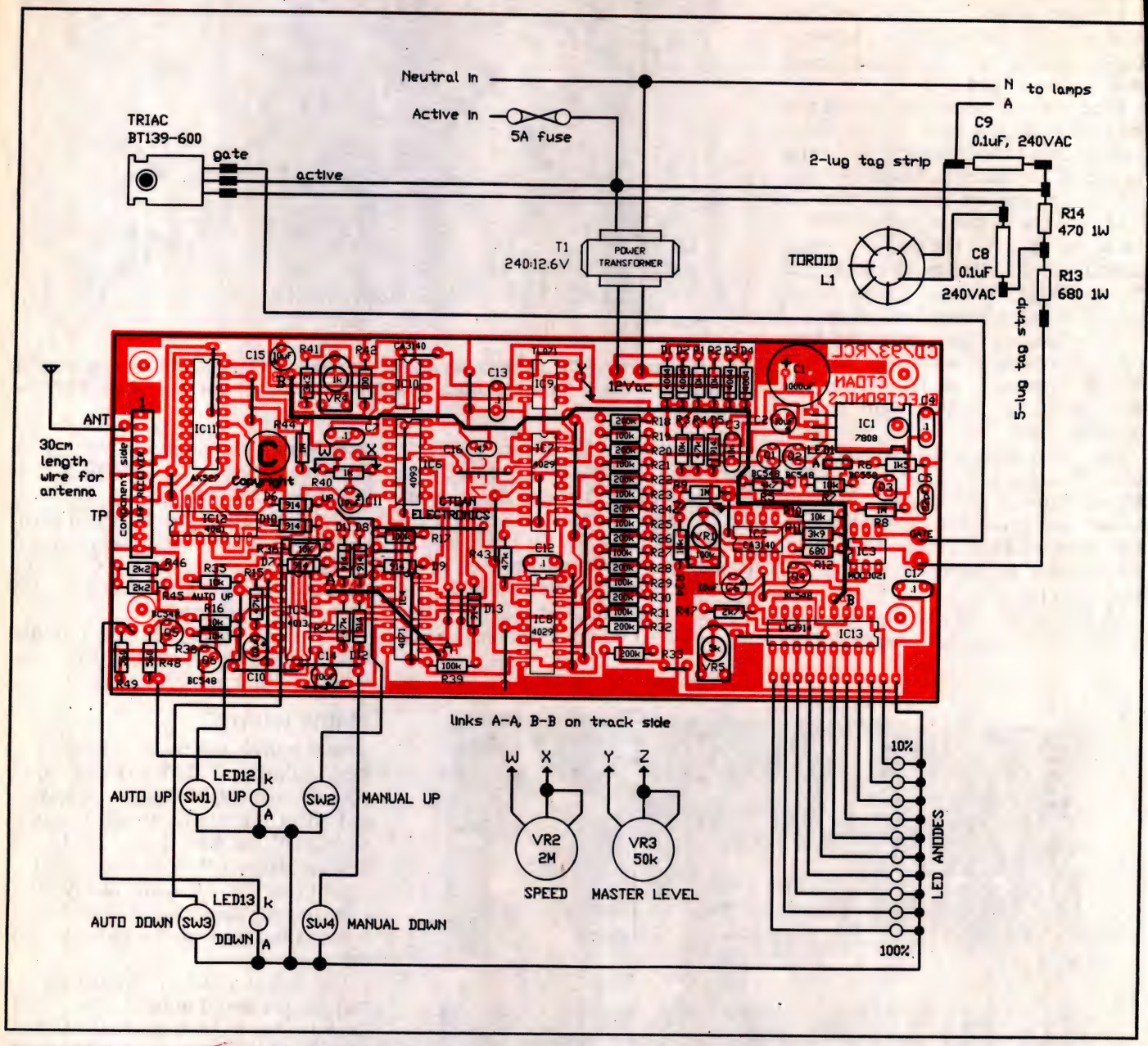
The triac is mounted on a heatsink, and because the metal tab of the triac is at mains potential, we recommend using a mica or mylar insulating washer. This will prevent the heatsink also being at mains potential and make the unit safer to work on.

It's a good idea to check with an ohmmeter that the triac is successfully insulated from the heatsink. All connections to the triac should be insulated with sleeving to prevent possible short



The mains wiring is shown here. The toroid is held in place with an insulated washer and a 4BA bolt through its centre. The heatsink is held with two self-tappers, with one also through the tab of the triac.

Remote-controlled Light Dimmer - 2



Fit the 25 links on the component side before the IC sockets are installed. Also don't forget the two links on the track side of the PCB. Components C8, C9, R13 and R14 mount on tag strips.

circuits between the triac terminals or to the heatsink.

Note that the heatsink supplied in the kit is suitable for loads up to 1200W. To increase the power rating you'll need a larger heatsink, which will possibly mean a larger case. However, no other modifications are needed except to make sure the mains wiring is rated at 10A or more.

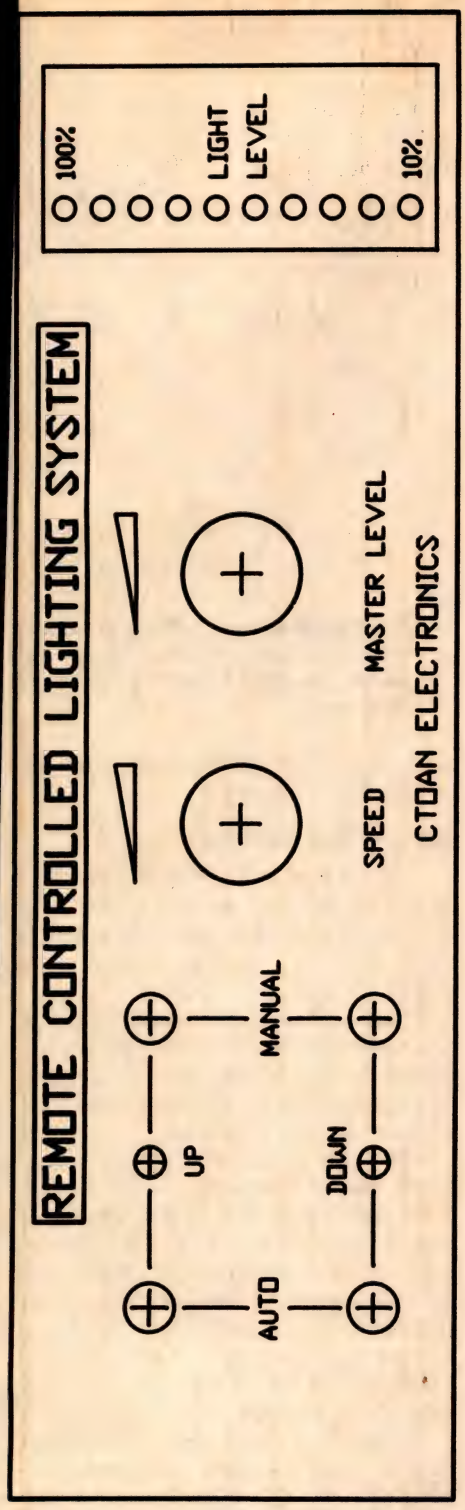
We fitted a three-pin 240V socket to the rear of the case to connect the lamps, but an extension socket could also be used. In a more permanent installation, you would probably connect the lights directly with screw terminals. Because there is a relatively high load current, it's most important to make sure all connections are solid and well made.

Note that an earth connection should be provided to the lighting circuit, and that the transformer should be earthed. We used a terminal block bolted to the back of the case for the active, neutral and earth connections.

Testing

Before you go on to the final testing stage, check the mains wiring once again, confirming for instance that you haven't somehow got a short-circuit between the active and neutral. Then, insert the mains fuse, connect a test lamp as a load and switch on the power.

Assuming the fuse doesn't blow, then go through the test routine described before. You'll need to set VR1 so the lamps go out completely. This setting can also affect the maximum brilliance and might vary with the load applied to the dimmer. Also adjust VR5 so the bargraph display agrees with the light output of the lamp(s) connected to the dimmer. Then, if all is working correctly, it remains to build the transmitter.



The front panel artwork for the dimmer case is reproduced here full size, so you can use it as a template. For an effective front panel, take a photocopy, spray the copy with plastic lacquer, then glue it to the case.

PARTS LIST

DIMMER

Resistors

All 1/4W, 5% unless otherwise stated:

R1-3,10,16	
R34-36,38	1Ok
R4,15,37,43	47k
R5	4.7k
R6	1.5k
R7	18k
R8,9,44	1M
R11	3.9k
R12	680 ohm
R13	680 ohm 1W
R14	470 ohm 1W
R17,39	100k
R18,20,22,24,26,R28,30,32,33	200k 1% metal film
R19,21,23,25,R27,29,31	100K 1% metal film
R40	1k
R41	3.3k
R42	100 ohm
R45,46	2.2k
R47	2.7k
R48,49	560 ohm

Potentiometers

VR1	100k trimpot
VR2	2M linear, panel mount (see text)
VR3	50k linear, panel mount
VR4	1k trimpot
VR5	5k trimpot

Capacitors

C1	1000uF, 16V electrolytic
C2,6,10,11,C14,15	10uF, 16V electrolytic
C3	10nF disk ceramic
C4,7,12,13,17	0.1uF monolithic
C5	22pF ceramic
C8,9	0.1uF, 240V AC polyester
C7	22uF 16V electrolytic
C8	33nF, 240V AC polyester
C16	0.47uF monolithic

Semiconductors

D1-4	1N4004 1A diode
D5-13	1N914 signal diode
LED1	green rectangular LED
LED2-5,12	3mm green LED
LED6,7,13	3mm red LED
LED8-11	3mm orange LED
Q1,2,4-6	BC548 NPN transistor
Q3	BC558 PNP transistor
Triac1	BT139-600 16A triac
IC1	7808 8V regulator
IC2,10	CA3140 CMOS op amp
IC3	MOC3021 opto-coupler
IC4	4071 quad OR gate
IC5	4013 dual D flipflop
IC6	4093 quad Schmitt NAND
IC7,8	4029 counter
IC9	4071 OR gate
IC11	AX527 trinary decoder
IC12	4081 quad AND gate
IC13	LM3914 LED bargraph driver

Miscellaneous

PCB 172mm x 750mm coded CE/93/RLS; 15mm OD, 8mm ID toroid (iron powder core); 240:12.6V 150mA transformer; 4 x pushbutton switches, panel mount; 304MHz UHF receiver module (prebuilt and prealigned); IC sockets as required; 3AG fuse holder and 5A fuse; knobs to suit controls; plastic case to suit (e.g., 200mm x 155mm x 65mm Altronics cat no H0480); 2 x tag strips; heatsink for triac (see text), TO-220 insulator, 10A rated mains lead; 240V plug; 240V socket; mains rated hook-up wire; low voltage hook-up wire; 1.5m length of 0.8-1mm enamel coated winding wire.

TRANSMITTER

Resistors

All 1/4W, 5% unless otherwise stated:

R1	2.2k
R2	18k
R3	1M
R4	100 ohm

Capacitors

C1	47uF, 16V electrolytic
C2	2.2pF disk ceramic
C3	0.1uF monolithic
C4	3.9pF disk ceramic
C5	1nF disk ceramic
C6	2-6pF trimmer

Semiconductors

Q1	BF199 HF NPN transistor
IC1	AX526 trinary encoder
LED1	3mm red LED

Miscellaneous

PCB 51mm x 58mm coded JEN; 10uH choke; four PCB mount pushbuttons; 9V battery and battery clip; plastic case 60mm x 120mm x 30mm (Altronics cat no H0216)

A kit for this project is available from CTOAN Electronics. The cost of a complete kit including all parts, including cases for the transmitter and the dimmer is $159.95, plus $10.00 P&P. A short-form kit is also available that contains the AX526 and AX527 ICs, both PCBs, the UHF receiver module, 2 x CA3140 op amps, the toroid and winding wire and a BF199 transistor. Cost of the short form kit is $68.95 plus $8.00 P&P.

CTOAN Electronics also offers a full back-up and repair service for the kit. Maximum cost of any repair is $45.00 including return postage. CTOAN reserves the right to refuse repair on a kit if it has been badly soldered or constructed.

CTOAN also offers ready-built and fully tested PCB assemblies for the dimmer and the transmitter for a cost of $75.00. However the company is not offering completely built versions of the kit.

To order or obtain further information, contact:

CTOAN Electronics
PO Box 211
Jimboomba, Qld 4280
Phone (07) 297 5421

Note that copyright for this project is retained by CTOAN Electronics.

The transmitter

The construction of the transmitter is quite easy, as everything mounts on the PCB. Make sure you don't get the small ceramic capacitors interchanged. Also note that inductor L2 looks like a resistor. At this stage, as with the decoder (IC11) in the dimmer, leave all the address pins of the encoder IC1 open-circuit. The four pushbuttons mount flush onto the PCB, and the LED mounts so its top is about level with the top of the buttons.

You'll need to drill holes in the trans-

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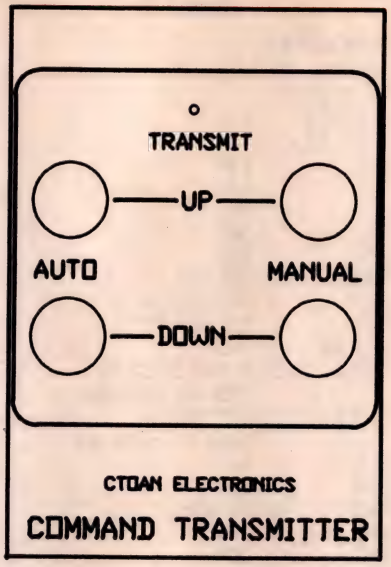
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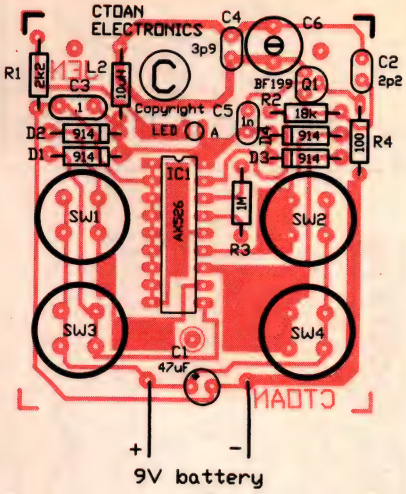
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Remote-controlled Light Dimmer - 2



This is the artwork for the transmitter, again shown full size.



The transmitter pushbuttons are fitted flush to the board and the LED should be about the same height as the top of the buttons.

mitter case for the pushbuttons and the LED. The artwork as above will serve as a guide for the size and position of the holes. The PCB mounts on 10mm spacers and is held to the bottom of the case with self-tapping screws.

Now the frequency of the transmitter has to be set. This can be done with an oscilloscope, a multimeter or by trial and error. If you have a 'scope or a multimeter (set to AC millivolts, and connected in series with a 0.1uF capacitor) connect it to the test point of the receiver. The other lead goes to earth, such as the tab of the voltage regulator. Be very careful not to touch the nearby mains wiring!

Press any transmitter button and adjust the trimmer capacitor for a peak in the signal measured at the test point. As an indication that the transmitter is at least working, hold it right up against the receiver PCB.

In this position it doesn't matter whether the transmitter is tuned to the correct frequency or not, as RF energy will burst through and you should get some sort of signal. If you can't get the transmitter aligned, CTOAN will do it free, providing it works properly.

Once you've aligned the transmitter, it remains to code the address pins of IC1 (transmitter) and IC11 (in the dimmer). The transmitter and the dimmer PCBs have tracks for logic 1 and logic 0 placed near the eight address pins of these ICs. Choose an 8-bit code (which can include pins left open-circuit) and connect the address pins accordingly. The address pins for both ICs are pins 1 to 8, and naturally they have to be encoded the same way.

Using the dimmer

Here's a few hints on using the dimmer. The dimming action happens over 256 steps and when the fade speed is very slow, you'll probably notice slight jumps in the lamp brightness.

When the fade speed is fast, the lamps will appear to come on faster as they approach full brightness. This is an optical illusion and is more apparent when a lot of lights are being dimmed.

When it's turned almost fully clockwise, the speed control (VR2) gives a wide variation in fade speed. To reduce this effect, the value of VR2 can be made smaller, assuming you don't want the two seconds to one hour range of adjustment. A value of 50k will give a lowest dimming speed of about 90 seconds, but retain the fast dimming time of two seconds.

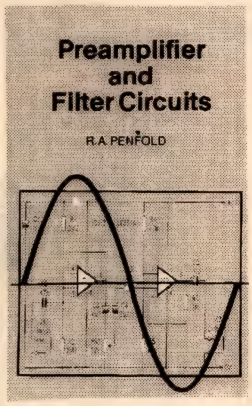
The range of the prototype transmitter was about 35 metres, increasing to about 50 metres in open space. As with all radio transmitters, the range is subject to the environment it is working in.

To get a smooth change in brightness with the remote control, set the speed control to give a delay of a few seconds. To prevent a delay when the lamps are being dimmed from maximum brightness, set VR1 so the lamps are just fully on when the DAC output is a maximum.

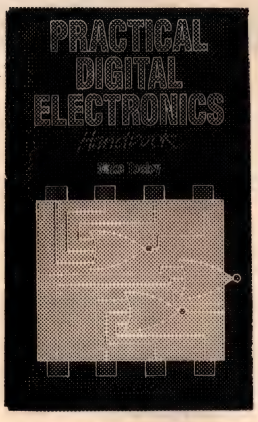
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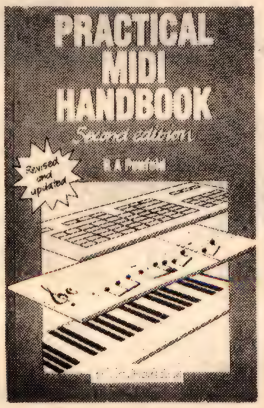
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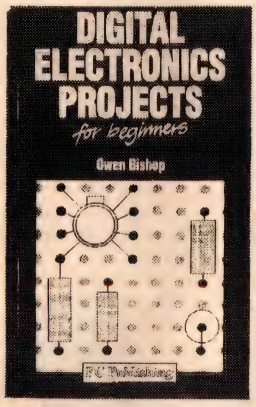
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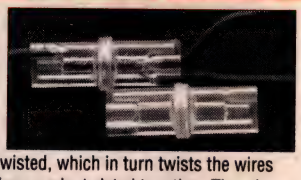
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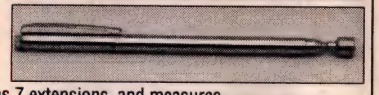
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Ideal tool for the hobbyist. Clean up the edges of a hole you have just drilled or cut out in your project. Suitable for steel, plastic, wood etc. Blades are fully ground for safety. SK2 steel blades are hardened to HRC64. Supplied with spare blade. Will de-burr virtually anything.

NEW

Cat: TH-1845 $5.95

Fifteen Piece Jewellers Screwdriver Set

NEW

This set includes 6 Phillips head screwdrivers and 6 normal slotted style. It also includes a magnifying glass, pearl catch pick-up tool and a pair of tweezers. It is all housed in its own plastic case. Very comprehensive!!!



Screwdriver types:

Slotted - Tip size: 1, 1.4, 2, 2.4, 3 and 3.8mm

Phillips - #: 0-0, 0-2, 0-3, 0-4, 1-1 and 1-2

Cat: TD-2003 $14.95

Open An Account With Jaycar

Jaycar is now accepting account applications from all established companies who can exhibit good trade references. For application details see our Store Managers or phone (02) 743 5222

Mini, Wide Angle Pulse Count Passive Infra Red Detector - Its Tiny!!!

NEW



This amazing new PIR has it all! It's not much larger than an egg, measuring 65(H) x 65(W) x 42(D)mm. It has 180° wide field detection, which includes protection either side of the PIR if mounted on a flat wall. It can also be mounted in a corner or on a roof. It has pulse count, which is switchable between one and two triggers. There are 4 different lenses supplied, these are wide angle, curtain A, pet and hall.

Other features include: •ultra high level RFI/EMI protection •temperature compensation •calibrated angle scale •dual element low noise pyroelectric detector •silent relay •tamper protection •ultra reliable •miniature size

Specifications: •Power supply: 9-16VDC •Pulse count: 1 or 2 selectable •Current drain: 25mA •Alarm output: 0.5A @ 24VDC •Temp: -10°C to 50°C

Cat: LA-5022 $69.95

Bellmate Pulse Count Passive Infra Red Detector

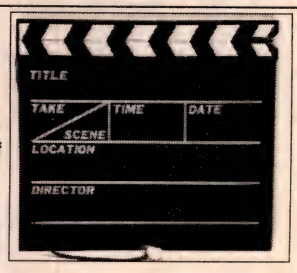
1000's SOLD



Used by many alarm installers. The Bellmate 100 has switchable Pulse Count operation with single and 3 pulse triggers which virtually eliminate false alarms. Other features include: •wide angle 90° coverage •15 x 15 metre coverage •sensitivity adjustment •LED indicator •sliding PCB •NC terminals •two year warranty

Cat. LA-5016 $49.95

Directors Clapper Board



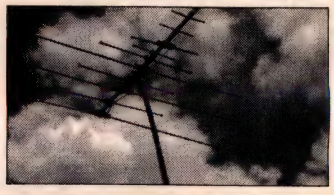
You see these used all the time in commercial movie making. It allows you to number each take, if you take more than one and also allows the camera operator to correctly focus on the board. It's even supplied with a piece of chalk on a string. Size: 280 x 255mm.

Cat. AV-6530

Normally $16.95 Now $12.95

Save $4.00

UHF/VHF BARGAIN ANTENNA - You won't Buy Cheaper?



A QUALITY UHF/VHF ANTENNA FOR UNDER $40?

That's right, due to Jaycars' buying power we can now offer this ideal suburban antenna which is suitable for good to medium reception areas. Receives UHF channels 28 to 36 (Band 4) and VHF channels 0-11. Sturdy construction designed for the do-it-yourself user. Boom length 1.2m

Cat. LT-3140 $39.95

Monitor OFC Speaker Cable



NEW

If you want THE BEST speaker cable this is it. Its OFC (Oxygen Free Copper) and has 273 strands of 0.12mm per conductor. Its also flat sided rather than round, so it lays better under carpets in cars etc. $350 per 100 metre roll

Cat. WB-1735 $3.95m

JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

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METEX NEW GENERATION DIGITAL MULTIMETERS FROM JAYCAR ELECTRONICS

Features common to both meters •Dual Display •RS232 Interface •Transistor •Capacitance •Temperature •Auto Hold •Data Hold •10 Memory •Bargraph •Min/Max Display •Relative Offset •Logic •20 Amp

1 YEAR WARRANTY

THESE DMM'S HAVE IT ALL

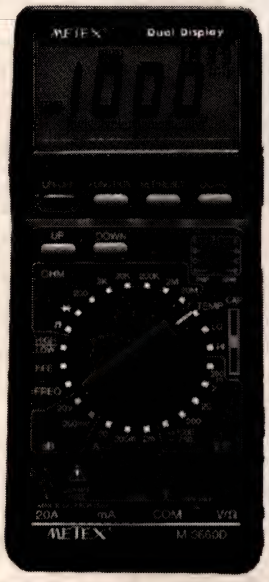
As well as what's listed above, they can also compare stored readings (ie highest and lowest). They have an inbuilt temperature probe which displays the ambient temperature in °C or both °C and °F simultaneously using both displays. There is also auto power off to save batteries, overload and transient protection, low battery indicator and auto polarity indication. Includes carry case and two position tilt bail which allows the unit to hang on the wall. With the optional interface kit and temperature probe they will do even more.

M3660 Features

NEW

- •True RMS
- •AF Output (dB)
- •20MHz Frequency

Cat QM-1250 $209.50





M3850 Features

NEW

- •4000 Count
- •Back Light
- •40MHz Frequency
- •Auto/Manual Range

Cat QM-1260 $229.50

OPTIONS FOR BOTH METERS

Interface Kit

Includes IBM DOS software on both 3.5" and 5.25" disks and a custom RS232 lead. This allows you to view, store, retrieve and print the readings from this meter onto your computer. You can view the information as a string of readings or graph the readings showing the current, minimum and maximum readings at the top of the graph. Pull down menus for easy use.
Required: IBM PC with spare RS232 port, VGA monitor, 1 floppy disk drive 3.5" or 5.25".
Optional: Mouse, printer and hardware

Cat QM-1280 $18.95

Temperature Probe

This plug in Thermocouple Probe allows you to measure external temperature readings from -40°C to +1200°C.

Cat QM-1282 $18.95

Rubber Holster

Handy protective rubber holster available to suit both units.

Cat QM-1510 $19.95

For full specifications on all these products see our 1994 catalogue.

Extremely Low Cost Extension / Car Speakers

CAR SOUND ON A 3RD WORLD BUDGET.



When we were told the price of these we had to see a sample! Whilst they are dead set cheap, they work OK! The enclosure itself is moulded in a cheap plastic - so we do not recommend them for rear parcel shelf installations in cars in hot climates. The 4" wide range speaker has a pleasant sound about it though.

NEW

They will handle about 5 watts RMS (Don't beleive what is printed on the carton), are supplied with about 2 metres (total) of speaker wire which you will have to solder yourself. Ideal for workshops, cool cars, sound blasters etc. Measure 130W x 25H x 63Dmm each.

Cat. AS-3150 Only $6.95 a pair

If you want DATA - We've got it!!! Jaycar/Silicon Chip Giant Data Wall Chart

AN ABSOLUTE MUST FOR ALL ELECTRONIC ENTHUSIASTS!!!

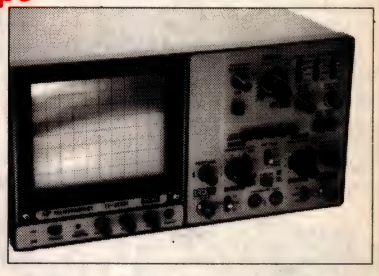
This will become your definitive source of standard data! This chart measuring 850(W) x 578(H) is printed on quality art paper. It contains completely up to date technical information on (but not limited to) the following: TTL (all families) & CMOS both pinout and schematic; Bipolar transistors; Op amps; Static RAM ; Dynamic RAM; Voltage regulators; Opto semiconductors and other semi data. Full resistor colour codes - both 4&5 (1%) band, E12 - E96 decades included as well as capacitor markings for E-12 series values. Data on heatsinks, wire gauges, meter shunts is also included. Along with this is a full list and explanation of all schematic circuit symbols including latest devices. Theres more! Wiring connection diagrams are included for Alcatel/Cannon XLR type, DIN and Scart connectors.There is a full ASCII character listing, DOS command summary as well as I/O port, RS-232, PC games port, Centronics port (printer) and also Bus connection schematics.
This chart is ideal for the wall of your workshop, in schools, labs, universities, repair centres etc. Whether you are a professional working daily in electronics or a weekend solderer, you will save hours and hours because you will no longer need to chase important data in impossible to find places!We are very proud of this joint effort between the technical staff of Silicon Chip and ourselves in putting this together. It was a monumental task - our effort will save you time! You can buy this chart in two ways: folded or in a cardboard mailing tube. We strongly recommend the tube as the chart looks better on a wall without creases.

Cat. BC-6000 Folded $12.95 + $2 post
Cat. BC-6005 Mailing Tube $14.95 + $4 post

25MHz Dual Trace Oscilloscope

NEW

BRAND NEW MODEL FOR 1994. THIS CRO GIVES YOU A 25% INCREASE IN BAND WITH - FROM 20 TO 25MHZ FOR "NO EXTRA COST"!



Other features included in this unit, but weren't on the old model are • Component tester • Uncal LED Indicators • Screen Back Lighting. This new Jaycar 25mHz CRO sports a large 5" high brightness tube with scale illumination. This is a selectable altenate/chopping feature to allow viewing of waveforms with different frequencies - CH1 output for use with frequency counters - CH2 Polarity inversion switch. Other features include • single sweep mode for viewing one of/sudden events •Adjustable DC balance for CH1 and CH2 on the front panel • Vertical and horizonal deflection controls can be uncalibrated with indication of such happening • A very user frienly front panel layout • High and low frequency filters for external triger circuit • Wide bandwidth • Low power consumption • High sensitivity X-Y mode • Z-Axis modulation • TV-Video Sync filter • High frequency rejection filter in the trigger circuit • Front panel electrical trace rotator • regulated power supply. For full specifications see our 1994 catalogue. Unit supplied with instruction manual, power cord and fuse. Requires two CRO Probes for Dual Trace - Cat QC1902 $39.50 each

1 YEAR WARRANTY

Cat. QC-1900 $699

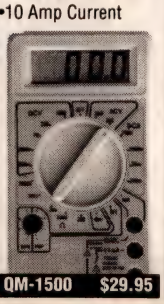
Digital Multimeter Price Breakthrough - Excellent Value!

BRILLIANT RANGE OF MULTIMETERS ALL OFFER UNBELEIVABLE VALUE FOR MONEY
For full specifications and list of all the features associated with each model see our 1994 catalogue.

Low Cost

1 YEAR WARRANTY

- 3.5 Digit 12.5mm High Display LCD
- Transistor Test
- Diode Test
- •10 Amp Current



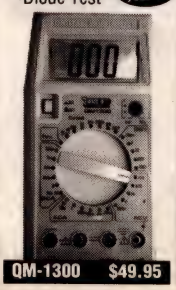
QM-1500 $29.95

30 Range

1 YEAR WARRANTY

- •Large Display
- •Transistor Test
- •Audible Continuity
- •20 Amp
- •Diode Test

NEW



QM-1300 $49.95

Freq. Counter

1 YEAR WARRANTY

- •Transistor, Diode & Continuity Test
- •Capacitance
- •Auto Power Off
- •Large Display •20 Amp

NEW



QM-1310 $79.95

4.5 Digit

1 YEAR WARRANTY

- •Freq Counter •20 Amp
- •Transistor/DiodeTest
- •Capacitance •Data Hold
- •Large Display •Auto Power Off •Overload Protected •19999 Count

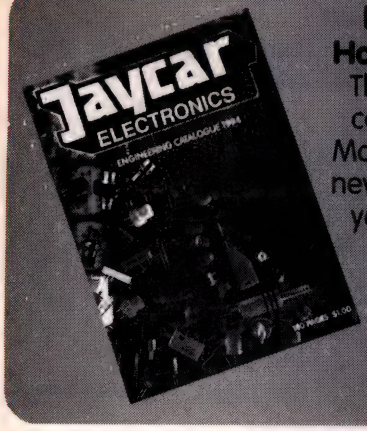
NEW



QM-1330 $129.50

CAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

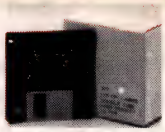
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NEW CATALOGUE!!! Have You Got Yours Yet?

The Jaycar 1994 180 page catalogue was released in March. It includes hunderds of new and interesting products. If you haven't got your copy yet call into any Jaycar store or dealer and pick one up for $1, or send $2 to Jaycar, PO Box 185 Concord. 2137, and we'll post you one.

Quality Disks At Silly Prices Slashed Even Further!!



•LIFETIME WARRANTY ON ALL THESE DISKS

5.25"	DSDD	Cat: XC-4730	$4.50 Pkt 10	
5.25"	DSHD	Cat: XC-4732	$7.95 Pkt 10	Was $8.50
5.25"	DSHD-F	Cat: XC-4733	$9.50 Pkt 10	Was $9.95
3.5"	DSDD	Cat: XC-4736	$7.95 Pkt 10	Was$8.50
3.5"	DSHD	Cat: XC-4738	$10.50 Pkt 10	Was $12.95
3.5"	DSHD-F	Cat: XC-4739	$12.50 Pkt 10	Was $14.95

New Generation Rechargable AA Penlight Batteries - 1.1A/Hr

NEW



These new generation batteries are Ni-MH which is Nickel Metal - Hydride which is often referred to as the "Green" battery because they are free of toxic or hazardous elements such as cadmium, lead, mercury or lithium.

Advantages of Ni-MH batteries:

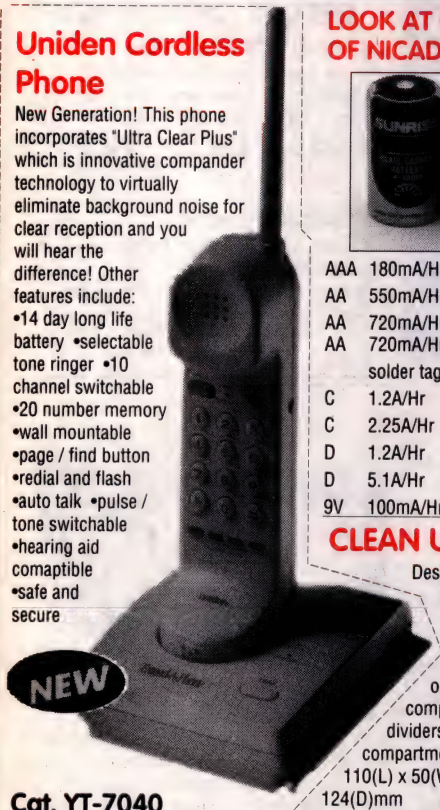
- •Higher current capacity
- •Flat discharge curve
- •Recharge for 14 hours at 100mA
- •No memory effect
- •High drain performance
- •Capacity: 1100mAh

Cat. SB-2455 **$7.50**

Uniden Cordless Phone

New Generation! This phone incorporates "Ultra Clear Plus" which is innovative compander technology to virtually eliminate background noise for clear reception and you will hear the difference! Other features include:

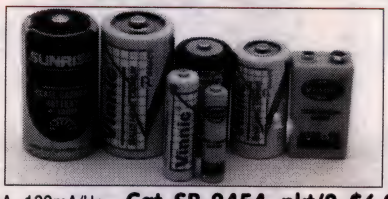
- •14 day long life battery
- •selectable tone ringer
- •10 channel switchable
- •20 number memory
- •wall mountable
- •page / find button
- •redial and flash
- •auto talk
- •pulse / tone switchable
- •hearing aid comaptible
- •safe and secure



NEW

Cat. YT-7040
Only $229

LOOK AT OUR POWERFUL RANGE OF NICAD BATTERIES



AAA	180mA/Hr	Cat. SB-2454	pkt/2	$6.95
AA	550mA/Hr	Cat. SB-2452	ea	$2.50
AA	720mA/Hr	Cat. SB-2450	ea	$3.50
AA	720mA/Hr with solder tags	Cat. SB-2451	ea	$3.75
C	1.2A/Hr	Cat. SB-2459	ea	$5.95
C	2.25A/Hr	Cat. SB-2464	ea	$9.50
D	1.2A/Hr	Cat. SB-2460	ea	$5.95
D	5.1A/Hr	Cat. SB-2466	ea	$16.95
9V	100mA/Hr	Cat. SB-2458	ea	$16.95

Magnavox 12" Woofer Special Model 12W - Cat Price $59.95



•Paper cone •Foam roll surround •High temperature 25mm voice coil •350g magnet •80WRMS

Cat. CW-2122 **Now $29.95 Save $30**

Manufacturers - Contact our Wholesale Department for prices on bulk quantities.

CLEAN UP THAT WORKBENCH

Designed to hold all your "bits & pieces":- resistors, capacitors, semiconductors, drill bits, nuts & bolts, nails, etc. The unit is grey with clear drawers. There are key holes in the rear for easy wall mounting. Drawers have a stopper so when pulled out they won't come all the way out spilling your components. Each drawer will accept up to 3 plastic dividers which can divide the drawer into 2, 3 or 4 separate compartments. 16 drawer dividers are supplied. Drawer size 110(L) x 50(W) x 34(D)mm Total size 185(H) x 242(W) x 124(D)mm



Cat. HB-6320 $13.95ea May Special 6 for $66

Save $17.70

Free Call for Phone Orders 008 022 888

VGA Colour Monitor Lead Bargain

WITH ELECTRONIC NOISE SUPPRESSORS



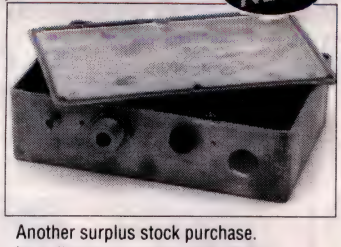
NEW

Save a fortune over normal price. These have a High Density D15 Plug on each end. Also included in the lead at each end is Electronic Noise Supressors. These are a mated pair of ferrite absorbers which selectively couple electromagnetically with unwanted high frequency signals. Length 1.2 metres. Normal price is $9.95 without noise suppressors. Limited quantity.

Cat. PL-0930 Only $6.95

Eddystone Die Cast Box Bargain

NEW



Another surplus stock purchase. Its a diecast box measuring 185(L) x 120(W) x 55(H)mm. It has some holes drilled in it and has a SPDT mini toggle switch, a 6.5mm mono socket and a brass coupling already mounted. To buy new today, these would cost about $35-$40. Grab one today - Limited quantity.

Cat. HB-5020 Only $9.95

1/2W 1% Mini Size Metal Film Resistor Pack - 300 Pieces

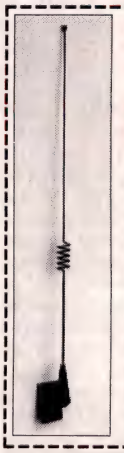
NEW

This brand new pack includes five of virtually each value from 10 ohm to 1 Meg. Have that 1% resistor when you need it. Five of each of the following values supplied.

10Ω, 12, 15, 22, 27, 33, 39, 47, 56, 68, 75, 82, 100, 120, 180, 220, 270, 330, 390, 470, 560, 680, 820, 910, 1k, 1k2, 1k8, 2k2, 3k3, 3k9, 4k7, 5k6, 6k8, 8k2, 10k, 12k, 15k, 18k, 22k, 27k, 33k, 39k, 47k, 56k, 68k, 82k, 91k, 100k, 120k, 150k, 180k, 200k, 220k, 270k, 330k, 390k, 470k, 560k, 750k & 1M.

Total 60 values - 300 resistors. You know exactly what you are getting when you buy Jaycar resistor packs.

Cat. RR-0680 **$13.95**



Car Cellular Telephone Antenna Whip Only

If your car cellular antenna whip has been broken, lost or stolen you will need a replacement. Includes the whip and the small base which sticks onto the window.

Cat. DC-4050
Normally $19.95
Now $9.95
Save 50%

BUY 10 - LESS 10%

JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

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NEW KIT - NEW KIT - NEW KIT

Remote Control Extender Kit For VCR's



Ref: Silicon Chip April 1994.
Many homes now have a second TV set, either in the bedroom or kitchen. Whilst its quite easy to connect the second set to the VCR (usually located in the living room) controlling the VCR from a remote location is another story altogether. This kit solves that problem by relaying the remote control signal transmitted from the second location, down figure 8 flex, to the VCR in the living room. It is also ideal for operating your Hi Fi if you have a remote speaker set-up. Kit is supplied with instrument case, 10 metres of cable, IR LED's, PCB, labels, plus all specified components. Plug pack extra - use MP-3007 $15.95.

Cat. KC-5158 **$49.95**

Video Camera Battery



This battery is a universal type that fits Sony, JVC, Panasonic,Hitachi & Canon camcorders. It is 6 volt 2000mAh and it uses quality Japanese cells. Size: 90(H) x 45(W) x 43(D)mm.

Cat. SB-2320 **$69.95**

Tripod - Small



Table tripod. Ideal for use with our video transfer system. Extremely small when folded - about 180mm long. Height when opened 120mm. Very stable.

Cat: AV-6532 **$22.95**

Remote Control Switch With Two Transmitters for under $100



Ideal for controlling central door locking car alarms and many more applications. The remote control has a distance of 28 metres and has an amazing 6,561 different codings avaialable. For full specifications see page 65 of our 1994 catalogue. EXTRA TRANSMITTERS ARE ONLY $22.95 - CAT. LR8823

Cat. LR-8822 **$79.95**

Six Way Power Outlet

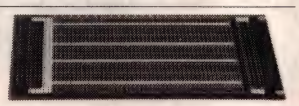


WITH MAINS FILTER
Not only is it a six way power board, it also incorporates a voltage surge, spike protector and noise rejection filter network. Supplied with 2 metre cord and mains plug, safety shutters in each outlet, illuminated master on/off switch and even a safety circuit breaker.

Cat. MS-4030 **Was $52.50** **Now $42.95**

Quality Prototyping Board

NEW

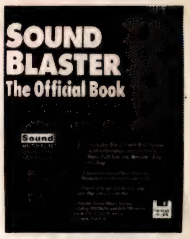


AT LAST, A QUALITY EUROCARD STYLE PROTOTYPING BOARD AT A VERY REASONABLE PRICE.
The HP-9565 is a prototyping board for use with through-hole components. It has a ground plane on the component side to ensure excellent high frequency performance. The array of holes (all plated through) are arranged in accordance with IEC-978603-2 standards. Provision is made (as per Eurocard convention) for convenient location of supply decoupling capacitors, as well as power and ground rails etc. The board is designed to accept 32, 64 and 96 way Eurocard connectors. It will also mate with many ribbon connector launchers or connectors.The entire board is solder masked both sides. This high quality Australian made product was made for the local defence research establishment and passes all of their stringent standards. It sells for far less than half the price of similar European made boards. An Australian agent that imports this board from England sells it wholesale for $64.00 plus tax.. For full specs see p110 of our 94 catalogue.

Cat. HP-9565 **$39.95**

NEW BOOKS - NEW BOOKS

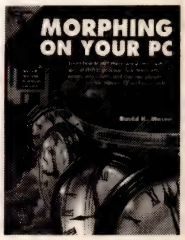
Sound Blaster - The Official Book



This book and disk covers the whole sound blaster family including Sound Blaster, Sound Blaster Pro, Sound Blaster 16 and Multimedia Upgrade Kit. Includes: •Dozens of sound files •Lots of songs and musical jingles •Popular utilities including SPUTMON and BLASTER MASTER •Trouble shooting tips •Top tech support questions and answers •Tips and tricks to enhance recording and play back •Survey of speakers and third party software plus more. Includes: Software 3.5" disk. Softcover - 490 pages - size 230 x 185mm

Cat. BT-1382 **$59.95**

Morphing On Your PC



Learn how to metamorphize images with this special effects package. Turn bears into owls, people into robots and dust into planets - as seen in movies, TV and music videos. There's also tips and tricks eg. find out how to make a genie pop out of a bottle, or make someone appear to fly! A portfolio of pre-assembled animations is also included for reference, inspiration, and as a resource for your own creations. This program uses a lot of hard disk memory, 20Mb minimum, 80Mb efficient, 500Mb ideal. You should also have an 80486SX (80Mb) or preferably 80486DX/66 or Pentium. Includes: Software 2 x 3.5" disks. Softcover - 173 pages - size 226 x 177mm

Cat. BW-3516 **$59.95**

The Marine Electrical & Electronics Bible



This book is a professional practical handbook for cruising yachts. There are many drawings, tables and diagrams with easy to read text. Subjects covered include •batteries •charging systems •alternative energy systems •DC electrical installations •lightning protection •corrosion protection •lighting •refrigeration •water systems •diesal heaters •anchor windlass •engine electricals •desalinators •AC systems •inverters •generators •radar •radar reflectors •autopilots •instrumentation •SSB •VHF •weatherfax •computers •TV •entertainment systems •security and more! Softcover - 400 pages - 250 x 175mm

Cat. BB-3806 **$49.95**

6.5" Triaxial Rear Mount Car Speakers



We're originally 6" 2 way systems and our supplier sent us 6.5" 3 way systems. These excellent quality Hi Fi loudspeakers are precision engineered to suit automotive applications. Specifications: •Freq Resp: 60Hz to 20kHz •Power Handling: 80WRMS •SPL: 91dB @ 1w/1m •Res Freq: 80Hz

NEW

Cat. CS-2262 **Normally $75 a Pair**
This month only $49.95 a Pair **Save $25.50**

Jaycar ELECTRONICS

HEAD OFFICE
6 Leeds Street Rhodes 2138
Telephone (02) 743 5222
FAX (02) 743 2066

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$25 - $49.99	$ 4.50
$50 - $99.99	$ 6.50
OVER $100	$ 8.00

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Experimenting with Electronics

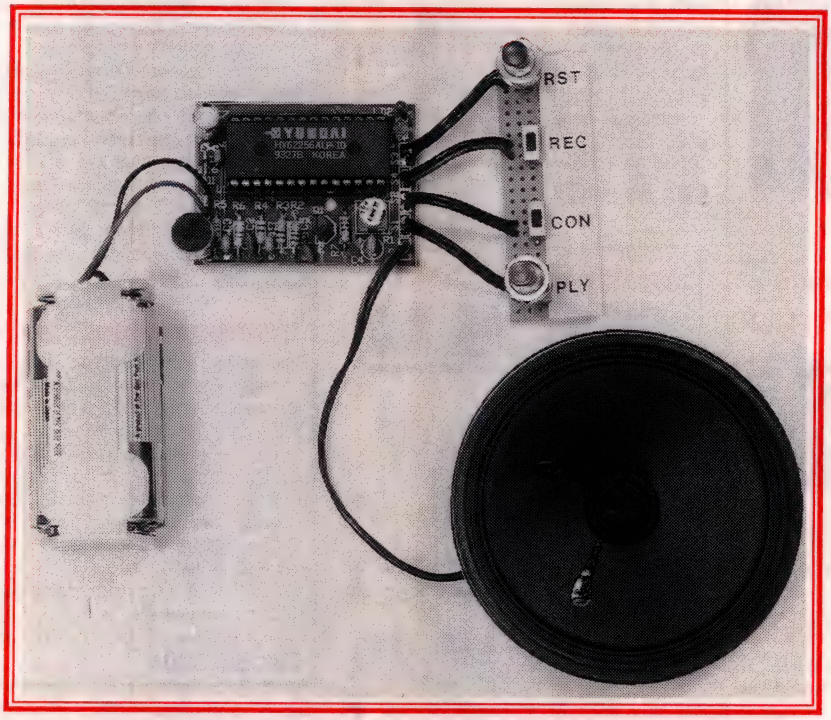
by PETER PHILLIPS

A solid-state message recorder

In case you haven't noticed already, there are a few changes under way in this section. To launch its 'new image', we're presenting here a simple but very different beginner style project, one that should appeal to many readers.

Since its introduction three years ago, Experimenting with Electronics has been directed specifically towards newcomers to electronics. Presenter Peter Murtagh was therefore given the unenviable job of finding an interesting project each month, based around nothing more complex than a few transistors. And I'm sure you'll agree Peter succeeded very well, presenting some excellent and educational beginner projects.

But Peter Murtagh has now moved on, and the Editor suggested that yours truly might like to take on the challenge of this section. I was not totally enthusiastic about this to begin with (I couldn't think of any more transistor-only projects, for a start!), but when the Editor suggested a change in focus, I warmed to the idea.



Record up to 28 seconds of sound, then hear it played back at the press of a button with this simple to build solid-state audio recorder. This kit comes from DIY Electronics.

So where are we heading now? Well, it's still going to be a section for beginners. But that's no reason why it can't also be a section for everyone — because first and foremost, we're going to present circuits and ideas for the *experimenter*. And even people who are quite advanced in electronics still like to experiment, don't they? In fact, an interest in experimenting is one of the things that link together just about everyone in electronics, from beginners to CSIRO researchers...

So from now on, the emphasis here is very much going to be on just what the heading says: experimenting with electronics. You'll find that each month we'll present one or more simple design ideas — but we won't always show you how to build it on a prototyping board, or on strip board. Sometimes we mightn't even have a PCB pattern. These things will be left to you. But you can be sure the designs will be easy to build, innovative and cheap. Sometimes we might follow a 'cookbook' approach, presenting a number of circuits based around a new IC. I'm hoping importers and parts suppliers might help me here.

I'm also hoping readers can help with ideas and circuits. I'll be building and testing all circuits presented here, unlike our 'Circuit and Design Ideas' section where the circuits are not tested by magazine staff.

So now I've introduced myself and the new focus for this section, let's get on with this month's offering...



This photo shows how Oatley Electronics built the sound recorder. The microphone pokes through a hole in the top of the case, and the speaker fits inside. A kit of parts is available from Oatley Electronics.

Our first project

As the title says, the design I'm describing is a solid-state message recorder. Is it complex? Yes, very; but fortunately just about all of the complexity is contained in an IC. Construction is also very simple, thanks to a nicely designed PCB. The recorder is based around a 51-pin audio processor IC type C9301, which comes already soldered to the PCB, eliminating the need to even handle the device.

In fact, this project is also a good way

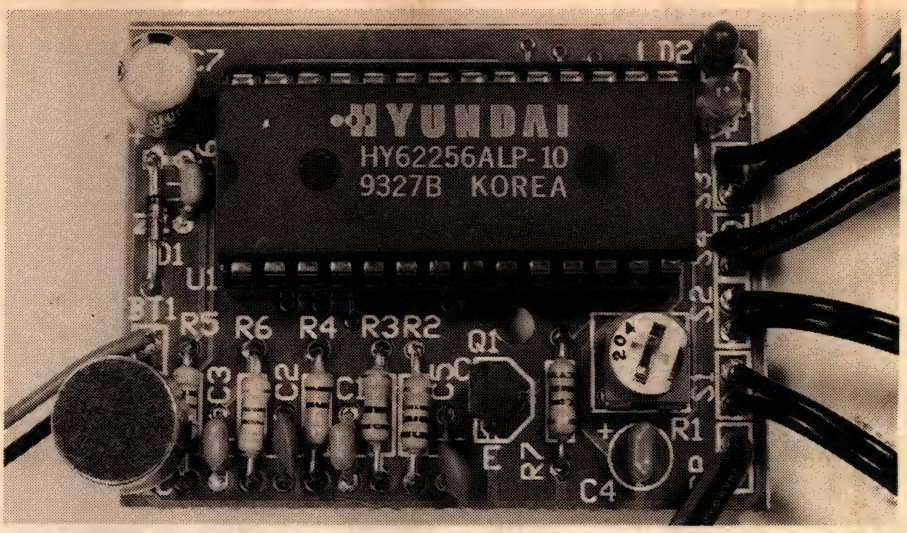
become familiar with 'chip on board' (COB) technology, as used in many items of modern equipment. The processor chip is bonded directly to the copper tracks of the PCB itself, and protected with a blob of epoxy. Basically, the message recorder gives up to 28 seconds of recording time, via an on-board electret microphone. Once the message is stored, it can be replayed at the press of a button. You can even have the message continually repeat. The sampling rate is set by a potentiometer, and the sound quality can be dramatically changed by adjusting this pot.

I think you'll agree that this project meets the guidelines I described in my preamble. After all, it's entertaining, useful, educational, and beginners and engineers alike can use it to explore the realm of solid-state audio recording.

How it works

These days, rather than use a conventional cassette tape, many telephone answering machines, faxes and other devices around the office and home have an electronic voice recording system. The principle is simple: convert the analog sound to digital samples and store it in digital memory. On replay, the digital information is retrieved and converted back to analog before being sent to a loudspeaker. So this processor doesn't work with inbuilt phonemes or voice synthesis; it records the actual sound after it's been converted to digital. A compact disc is similar, where the original sound is converted to digital, stored on the CD as a series of 1's and 0's, then retrieved by the player. A digital to analog converter in the CD player restores the sound back to its original form.

The audio processor IC in this project therefore contains an analog to digital converter (ADC) and a digital to analog converter (DAC) and all the electronics to operate with external memory. It also has an internal audio amplifier to amplify the signal from the microphone.



Here's a close up of the PCB showing the components and overall construction.

The memory IC is a standard 256K static RAM (SRAM) IC, type 62256. This IC can be replaced with an EPROM that contains a pre-recorded message. There are some 26 connections (15 address lines, eight data lines, three control lines) connecting the SRAM and the audio processor, making the PCB design quite complex. Still, that's not our concern!

The circuit of the project is shown in Fig.1. The circuit is controlled by two pushbuttons and two switches, and the status of the circuit is shown by two LEDs. The microphone connects to the internal amplifier of the audio processor IC through C3 and R6. DC bias for the microphone is through R5. The internal amplifier has two stages that can be used separately. In this case, the output of amplifier stage one (AMP1O) is connected to the input of amplifier stage two (AMP2I) through C1 and R3. Feedback from the output of amplifier 1 back to its input is provided by R4 and C2.

The output of amplifier stage two (AMP2O) connects to the input of the internal analog to digital converter (ADIN). There's also some feedback around AMP2 provided by R2 and C5.

The output of the internal DAC comes from the pin marked COUT, which in this circuit drives a very simple (almost crude) transistor power amplifier. Connecting COUT to an audio amplifier will give better sound quality than that provided by Q1.

The frequency of the internal oscillator of the audio processor IC is controlled by R1, a trimpot on the PCB. This determines how many samples per second the internal ADC makes of the

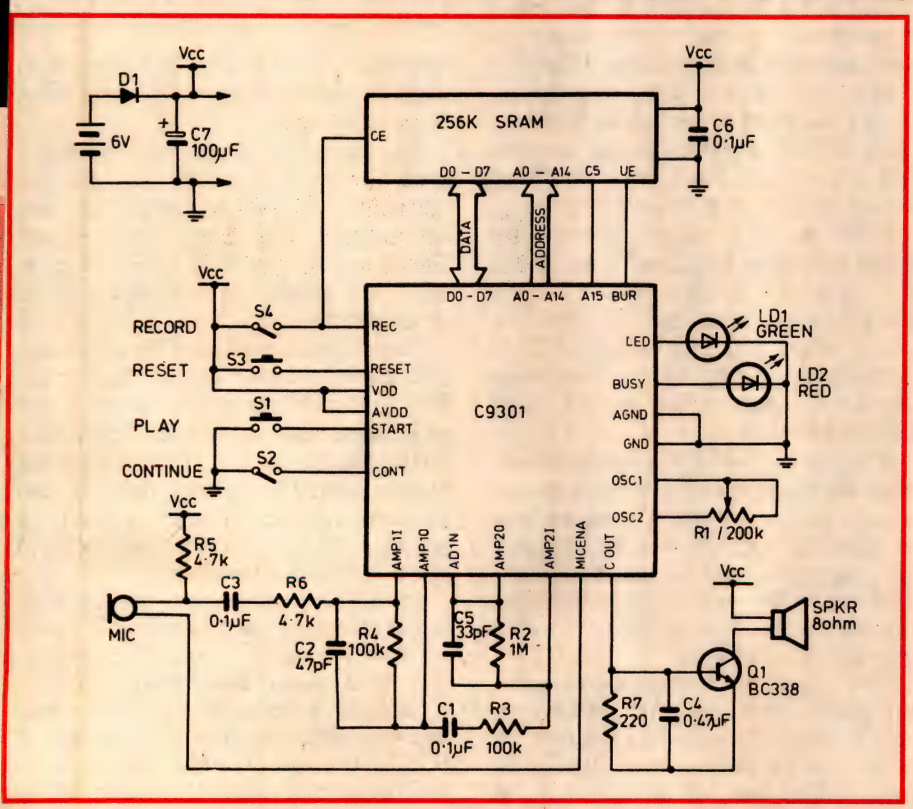


Fig.1: During recording, the audio processor IC amplifies the incoming signal from the microphone and converts it to digital form for storage in the SRAM. On playback, the digital information is retrieved, converted back to analog and sent to the speaker via Q1.

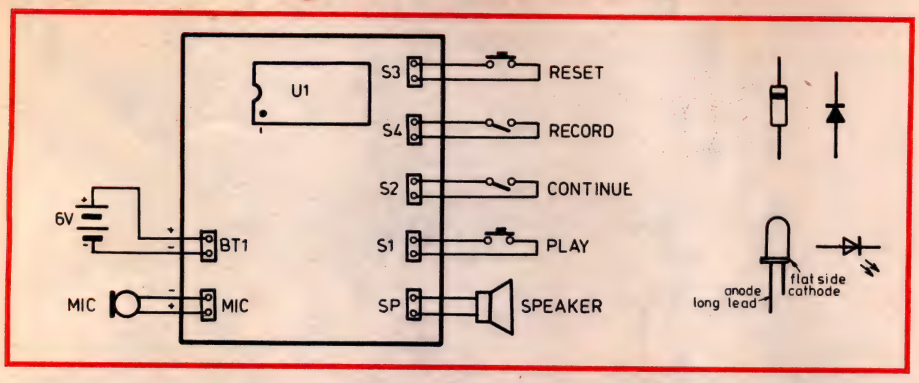


Fig.2: This simplified layout diagram shows the connections for all the off-board components. The case of the microphone is the negative terminal.

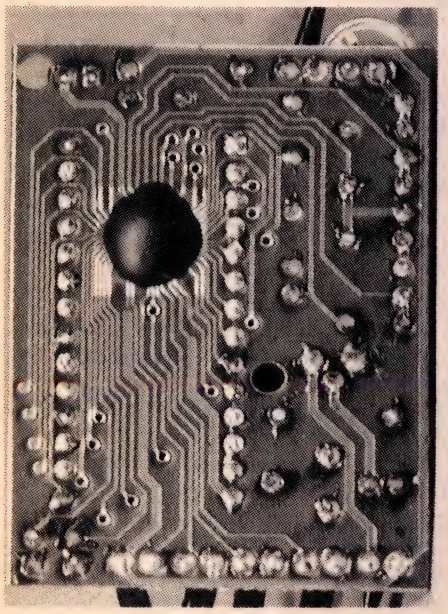
incoming audio. The greater the number of samples per second the better the fidelity, but the shorter the recording time.

The analog signal is converted to 8-bit digital values, and the SRAM in the circuit can store about 32,000 8-bit samples. An 8-bit digital code can represent 256 analog levels, which is generally regarded as low fidelity. However, it's quite adequate for speech.

We'll explain the purpose of the switches and what the LEDs do shortly, but by now you're probably keen to build the circuit. Here's how...

Building the project

This project is only available as a kit. The kit shown here was supplied through Oatley Electronics from its designer DIY Electronics, based in Hong Kong. Oatley Electronics also has a cheaper version of the original kit. See the end of this article for more details.



The processor chip is mounted directly on the underside of the PCB, protected by a blob of epoxy resin. This 'chip on board' or 'COB' construction is now quite widely used in low cost consumer equipment.

Construction of the project is very simple. As supplied, the kit included three pages of documentation, which gives construction details and also information about the audio processor IC. The PCB is a quality hole-through-plated double-sided board, with a silk-screen pattern to show component location. A solder mask makes soldering easy.

You'll need a fine-tipped iron, thin solder and a steady hand for this job. I recommend a magnifying lamp as well, as solder bridges can be difficult to find and can cause all kinds of problems. Solder is applied to one side of the board only, and all soldering should be done quickly. If you have never soldered before, practice on something else first.

I fitted the seven resistors first, then the seven capacitors. Incidentally, the kit and the original circuit has a 3.3uF electrolytic capacitor for C4. While the circuit works with this value, you'll get better sound quality with a lower value capacitor. I used a 0.47uF monolithic capacitor instead.

The rest of the PCB components include the diode, the IC socket, the transistor and the microphone. The microphone is polarised, with the negative terminal (its case) connected as shown in Fig.2. You can either mount the microphone directly on the PCB or connect with a length of shielded lead.

The kit designer suggests mounting the pushbuttons and slide switches on strip board (not supplied). I followed his advice, as the photos show. This is the most fiddly part of the construction. To mount the pushbuttons to the strip board, first solder tinned copper wire to the terminals of the pushbuttons. Then pass these wires through the board for soldering to the track. Don't forget to clean the copper surface of the strip board before soldering!

The terminals of the slide switches need to be bent a tiny amount, but otherwise these switches fit directly onto conventional strip board. The kit includes a length of twin cable which is used to connect the switches and the speaker to the PCB.

Tin the exposed wires of the cable first, then pass the tinned section through the PCB to its solder pad. Don't bend it over as it might short to another connection. Solder the connection, then snip off the excess lead. Of course, you can add whatever types of switches you choose and fit them, and the whole assembly, in a box as shown in the photos.

The LEDs mount directly on the PCB and as the layout diagram of Fig.2 shows, the long lead is the anode. The orientation of the diode is also shown.

Once all components have been fitted and all connections made, fit the SRAM IC. To prevent damage due to ESD (electrostatic discharge), touch the metal case of an earthed appliance before handling the IC. Then fit the IC into its socket, making doubly sure you have it correctly orientated. See Fig.2.

PARTS LIST

Resistors
All 1/4W, 5%:

R1	200k trimpot
R2	1M
R3,4	100k
R5,6	4.7k
R7	220 ohms

Capacitors

C1,3,6	0.1uF mono
C2	47pF ceramic
C4	0.47uF mono
C5	27 or 33pF ceramic
C7	100uF 16V electrolytic

Semiconductors

D1	1N4148 signal diode
U1	62256 SRAM
Q1	BC338 NPN transistor
LD1	3mm green LED
LD2	3mm red LED
MIC	electret microphone

Miscellaneous
2 x SPDT switch; 2 x push-on push button; 50 x 38mm PCB with 'COB' bonded die sound processor IC; 8-ohm speaker; 28-pin IC socket; 4 x AA battery holder; twin hookup wire to suit.

Kits of parts for this project are available from:
Oatley Electronics
5 Lansdowne Parade,
Oatley West, NSW 2223.
Phone (02) 579 4985
Postal address (mail orders):
PO Box 89, Oatley West NSW 2223.

Full kit, includes PCB and all components	*$25.00*
Plastic box to suit	*$4.00*
Post and pack charges	*$4.00*

Using the recorder

Before you fit the four AA batteries to the battery pack, set R1 to its mid position, and turn both switches off. In this case, off means the switch is open-circuit. When you first apply power, neither of the LEDs should light. Pressing the PLAY button (S1) should light the red LED (LD2), but because there's no message in the SRAM, you'll only hear hiss.

To record a message, switch on the RECORD switch (S4) and press the PLAY button. Both LEDs should light. Hold the play button, and with the microphone about 200mm away, speak until the green LED goes out. This indicates when the SRAM is full.

To play the message, switch off the RECORD switch and press PLAY. If you want the message to repeat, instead of pressing PLAY, switch on the CONTINUE switch (S2).

The CONTINUE switch can also be used when recording. If the PLAY pushbutton is operated during recording, the SRAM is cleared and recording starts at the first memory address. However, if CONTINUE is switched on instead pressing the PLAY pushbutton, recording will start at the first unused address.

The RESET switch interrupts playback when in single play mode. This switch resets the audio processor IC and is not used a great deal.

Experiment with the setting of R1. Record times of 15 seconds or less give reasonable quality speech, but anything longer is noticeably worse. A small change in the setting of R1 can cause a large change in the playback sound. You can completely change the character of the original recording this way.

Experimenting

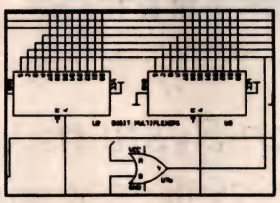
There are quite a few things you can do with this recorder. The nature of the message can be anything from a dog bark, music, weird sounds to a spoken warning. As we've already mentioned, a prerecorded EPROM type 27C256 can be used instead of the SRAM. Obviously you lose the record facility, so the record LED (LD1), S3 and S4 are not needed.

A relay or another pushbutton can be connected in parallel with the PLAY pushbutton for remote triggering of the unit into play mode, perhaps from an alarm system. The recorder might be used as a doorbell, an alarm clock, or in continuous mode as a sales promotion device.

Connecting the COUT terminal to an audio amplifier will not only improve the sound quality, but give an increase in volume. So there's really quite a bit of scope with this project. Have fun with it — and don't forget I'm looking for similar projects or ideas to present here. ❖

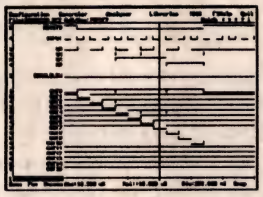
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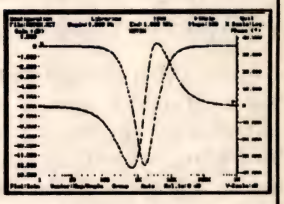


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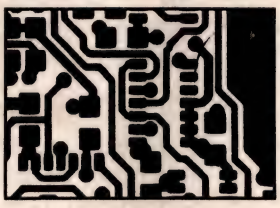
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AUTOMOTIVE ELECTRONICS



with MAJOR AL YOUNGER (USAR, Ret.)

Electronic Ignition Systems

Converting your standard 'Kettering' ignition system into an electronic system will extend point life (almost forever!), as well as improving starting and top-end performance, and improve fuel economy. There are no permanent modifications required, and if you do it right there's no risk of damage to your vehicle.

I have often thought that 'Detroit' was watching us car owners and our use of 'aftermarket' products, as many of these third-party innovations have soon been incorporated in production models. In ignition systems, Detroit followed the aftermarket and made electronic ignition modules, while still retaining the mechanical points. This was the era of the so-called high energy ignition (HEI).

Detroit had decided to 'up' the power output — i.e., the voltage of the systems. Of course, the diagnostic equipment owners were not too happy, as their ignition analysers had to be replaced or modified to read the higher voltages. Detroit had their problems too, as the first units (like anything new in electronics) were not too reliable.

The most reliable HEI units are 'outboard', meaning not an integral part of the distributor. There are exceptions, of course — the GM Delco HEIs are very reliable. Incidentally, GM was able to 'cop' the title HEI or High Energy.

As a rule, any system with an output over 25kV is considered high energy. But the rise in outputs is not over yet — GM has a 300 watt system in North America which puts out 80kV! You should see the warning signs under the bonnet — this unit can ZAP a heart pacer device...

How they evolved

Like many automotive innovations, electronic ignition systems were under the bonnet long before 'Detroit' put them there. My first system was a capacitive discharge ignition (CDI) system, which I built in 1957. (That's nearly 40 years ago — I must be getting old!) I built my first transistorised ignition type in 1961. It was just an electronic switch, known today as a transistor assisted contact (TAC) system.

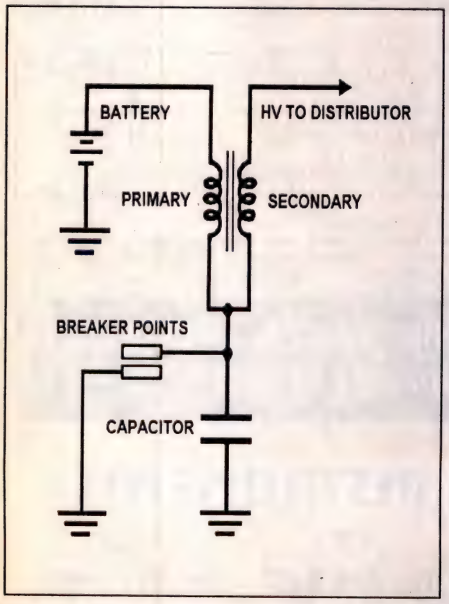


Fig.1: The conventional Kettering ignition system.

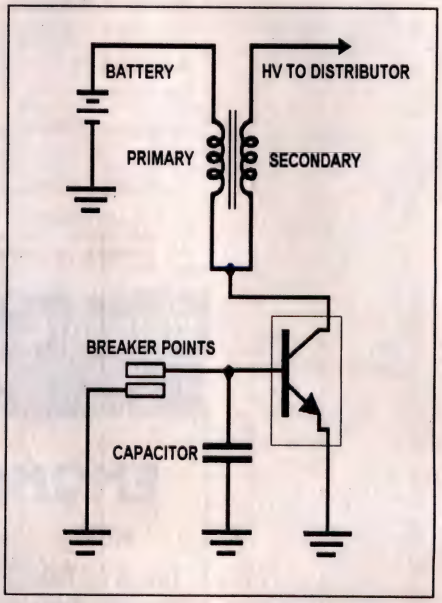


Fig.2: Using a power transistor to assist the breaker contacts.

Of course in the distributor used in most modern cars, the contact (ignition) points have been replaced with various pickups. The pickups may be Hall Effect, reluctance or optical. In the electronic evolution of the automobile, electronic ignition is second only to the alternator regulator.

If you wish to get rid on the mechanical points, I suggest you purchase a late-model distributor from your friendly wrecking yard. This article deals with what you can do while still retaining the points — which is the cheapest way to go.

By the way, to refresh your memory about the standard Kettering type ignition system, the schematic is shown in Fig.1. There are only three components: the ignition coil itself, the contact points and the capacitor. The distributor rotor is simply a rotary switch which connects the high voltage (HV) output from the coil to each of the spark plugs in turn.

Transistor assistance

The TAC system, also known as a transistor assisted ignition (TAI) system, is shown in Fig.2. As either name implies, it uses a transistor to *assist* in switching the ignition coil's high primary current, normally carried by the points themselves.

TAC systems have not changed much since they were first developed, but modern units do use components with better electrical ratings, which has made them very reliable. Motorola makes an integrated circuit for such systems and this is very reliable.

I built a TAC for my 1961 Volkswagen Beetle. I drove it across North America, on the Southern route, through the Great American Desert with no problems. My son converted it into a Baja Bug in 1971, and it's still running (albeit on weekends) with the same TAC.

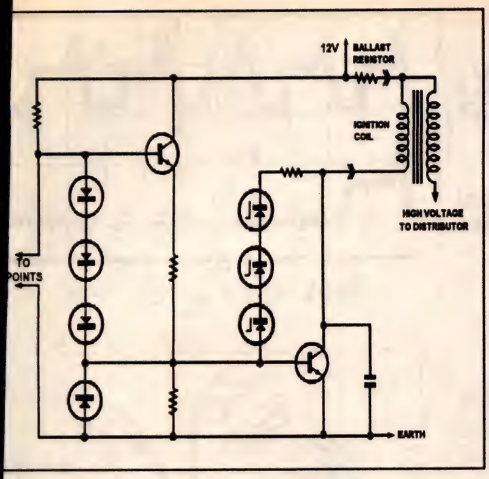


Fig.3 (above): The circuit of a practical TAC system contains various protective devices.

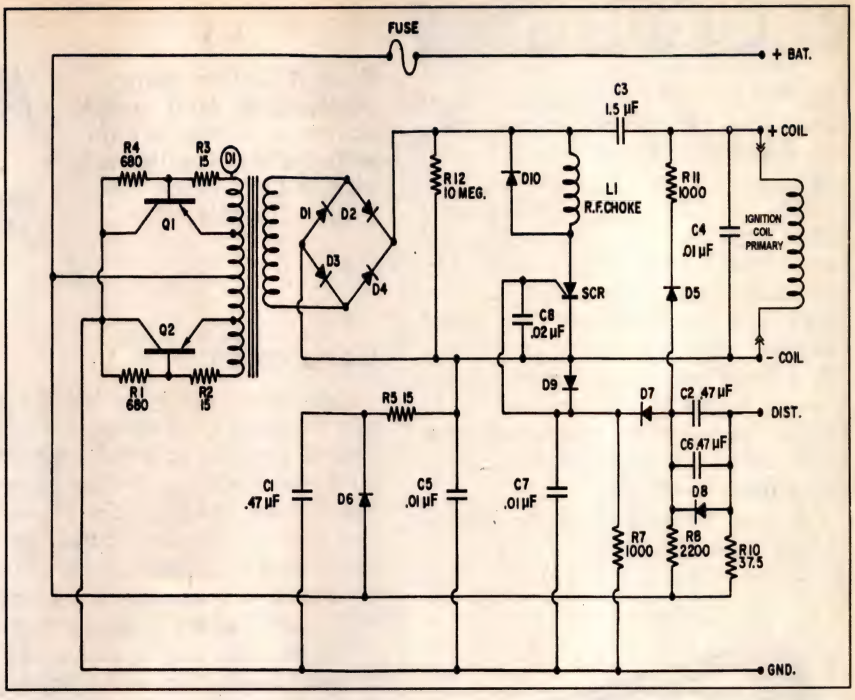


Fig.4 (right): The circuit for the Knight-Kit 'Mark Ten' CDI, which was very successful in the USA. Unfortunately it's no longer sold.

A TAC system simply uses the points to turn a power transistor device on and off (Fig.3). The transistor now carries the bulk of the current, and the current through the points is now very low — so point arcing is eliminated. This extends point life, to virtually the life of the rubbing block. Electronic circuitry can be added to eliminate point bounce.

CDI systems

Capacitive discharge ignition (CDI) systems require significantly more parts than TAC. (Fig.4 shows the schematic for the famous Mark Ten CDI.) As the name implies, a capacitor is charged to a high DC voltage (say 400V), and then discharged through the ignition coil primary. This results in a secondary voltage of 35 - 50kV (with a 150:1 coil).

That first CDI system I built in 1957 was for a 1932 Ford Model 'B' truck. As far as I know, it's still running on a coffee plantation in South America.

I lived on a Caribbean Island for several years and to solve my ignition parts problems, imported three CDI kits. I fitted them to a 1968 Simca 1500, a 1970 Peugeot 404 and a 1969 Chrysler six-cylinder. I sold the Simca in 1973 with its original set of points. I sold the Peugeot in 1988, to a French student who was touring North America — again with the original set of points.

The Chrysler was last seen in 1989, on a vineyard in southern France, converted to a truck to haul grapes — and yes, the CDI system is still working. The farmer told me the points look so good he has never changed them.

These CDI units were all the famous Knight-Kit Mark Tens, which are not made today. I still have the assembly (and operations) manual. If anyone wants a copy (24 pages), see the end of this article.

A CDI system requires a high voltage source (usually a step-up DC/DC converter running from the car battery), a charging capacitor, a discharge circuit and a trigger circuit. The diagram of Fig.4 shows the components in this proven system. The key to the system is the transformer and the charging capacitor (C3), which are part of a resonant circuit. C3 is charged to the full high voltage in only 2us (that's two millionths of a second). The unit draws 1.2 amps at idle and 7A at 10,000rpm.

TAC or CDI?

This is a perennial question. There are arguments in favour of each kind of system; here are some of them.

I prefer a system for a stock or streetrod that uses the original distributor and no changes — i.e., an add-on unit. Ideally, one that when removed, allows the car to be changed back to the stock system. This is necessary since many shops will not tune a converted system.

Old engine analysers cannot handle the voltages of a CDI system. Price wise, TAC's are cheaper than CDI units.

I personally prefer CDI units, because the higher voltage at the plugs allows firing fouled plugs. To achieve higher voltages with a TAC system, a coil with a higher turns ratio must be purchased.

With either system, the ignition (high tension) leads must be in good nick. I've heard some people say that CDI's are 'no good' because they 'arc too much'. So will *any* system that outputs thousands of volts, into wiring that's in poor condition. I had no troubles — but of course I fitted CDI's to new cars or ones with new ignition wires. Just like any device, this kind of system is only as good as its weakest link.

Kits or ready built?

There's a TAC kit available from Altronics, Dick Smith Electronics and Jaycar Electronics. It uses the latest technology, as it incorporates a Motorola 'high energy ignition' integrated circuit (IC) and has proved to be very reliable. It also features 'dwell extension', which maintains the high voltage at high rpm.

Note, however, that these units draw additional current through the coil — so make sure the coil is of high quality, or you may end up walking. This TAC kit works with the original ignition coil. If you want a hotter coil, make sure it's one designed to work with a TAC unit.

I have looked at some of the CDI kits available and after controlling my laughter, decided I would have to build my own or purchase a commercial aftermarket unit. I would suggest the latter. The CDI circuit shown in Fig.4 is a proven reliable one, but you would have to source parts, then design and wind your own converter transformer.

MSD systems

A variation on the CDI approach is the multiple spark discharge or 'MSD' system. As the name implies, these units fire multiple sparks instead of the single ones delivered by conventional systems

(Fig.5). I fitted one of these units on my cousin's auto/marine boat engine, which was always hard to start — that was the end of the problem.

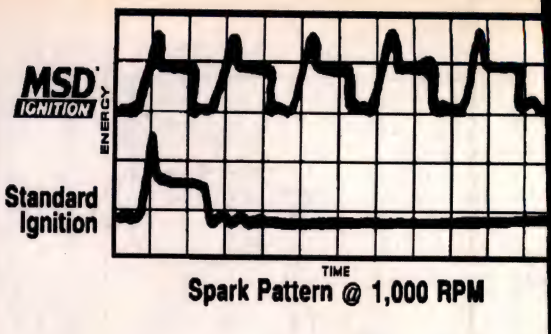
Most of the high performance (street/strip) cars that came into my garage in the USA had these units. Mechanically and electrically, they are tough units (Fig.6) and are very easy to fit. Fig.7 shows the typical installation. These units are manufactured by Autotronic Controls Corporation, of El Paso in Texas, and are sold here through local auto parts suppliers. Basic units retail at just over $200.00.

For more information or the location of your nearest supplier call Lynx, the Australian distributor, on (02) 747 3333 or fax (02) 747 3571.



Fig.6: The MSD system is made by Autotronic Controls Corporation, of El Paso in Texas. It's sold in Australia for just over $200 (see text).

Fig.5: A multiple spark discharge or 'MSD' system delivers a number of high voltage pulses to fire each plug, in place of the conventional single pulse.



Conclusion

Electronics is really the best thing that ever happened to Dr Kettering's ignition system. Contrary to what some people think, the Kettering ignition system is based on the characteristics of the ignition *coil*, as the current through it is being turned on and off. In actuality, most modern systems are just electronic 'refinements' of the Kettering system.

The best that can be said of the mechanical points, they were extremely reliable. The first electronic systems were so *unreliable* that many people paid to have them converted back to the old system. It was the same for electronic voltage regulators — 'Detroit' used us, the consumers, as the 'guinea pig' (so what's new?).

Today, electronic devices are *more* reliable because the individual components used are of much higher quality, with higher current and voltage ratings. So now I would recommend conversion of all the old units, to either of the kinds of system discussed in the article.

A warning, though. Whichever way you go, read the installation instructions very carefully and watch out for high voltage shocks. Most shock injuries occur from the physical reflex or 'jump-action', where you are thrown into a fixed or moving object. If your head comes into violent contact with the bonnet, it may ruin your day — not to mention fracturing your skull. I have personally drawn blood, so watch out.

Remember too that the spark has to go somewhere, so pulling a plug-wire off may damage or destroy your electronic ignition system.

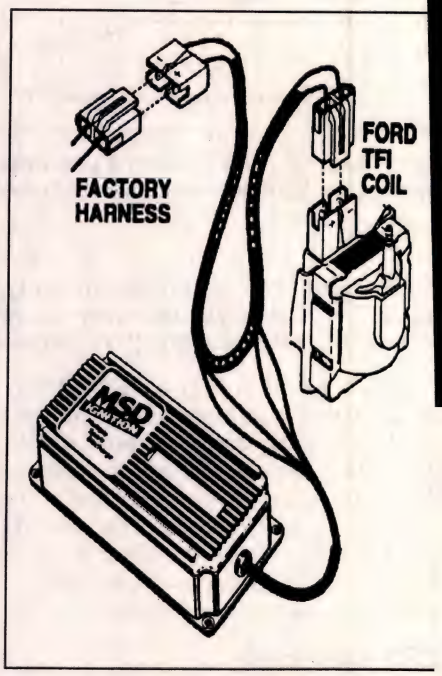


Fig.7: The MSD units are generally very easy to install, connecting straight in between the wiring harness and the ignition coil.

Information

If you don't mind tackling electronic projects the hard way, and would like to duplicate one of those Knight-Kit Mark Ten CDI systems, I can send you a copy of the original assembly and operations manual for $10. Just send your cheque to Al Younger, PO Box 477, Double Bay NSW 2028. I still have the other booklets available too, as listed last month. ❖

NEW KITS FOR EA PROJECTS

We have received the following information from Dick Smith Electronics regarding their release of kits for recently published *Electronics Australia* construction projects:

Playmaster Pro Series 3 Amplifier (February/March 1994): The DSE kit is complete with case, heatsinks and all components as described in the articles. The kit carries the catalog number K-5570 and is priced at $549.00 — but also comes complete with a 'bonus' package valued at over $40.

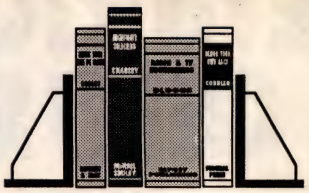
Light & Sound Trigger (April 1994): The DSE kit is complete and includes both zippy boxes, front panel labels, solar cell and all components as described in the article. With the catalog number K-3034, the kit is priced at $49.95.

Jaycar Electronics has also advised us of their release of the following kit for a recent *Electronics Australia* construction project:

Light & Sound Trigger (April 1994): The Jaycar kit is also complete, with both PCB's, cases, solar cell, electret mic insert and all components as described in the article — except the extension sync flash lead (available from any camera store). The kit carries the catalog number KA-1761 and is priced at $42.95.

NOTE: This information is published in good faith, from information supplied by the firm or firms concerned and as a service to readers. Electronics Australia cannot accept responsibility for errors or omissions.

NEW BOOKS



PCB making

MAKING PRINTED CIRCUIT BOARDS, by Jan Axelson. Published by McGraw-Hill, 1993. Soft cover, 190 x 235mm, 327 pages. ISBN 0-8306-3951-9. Australian RRP $39.95.

Making a PCB is a multistep process, from the schematic diagram to developing a board layout and finally actually making the board. These days computer software has replaced some of the manual processes, and there are now many PCB making techniques at our disposal. This book explains all the commonly used processes required to make a PCB.

It describes PCB technology, how to prepare a useful schematic diagram and select the best types of components. This is followed by chapters on designing PCB artwork, using either computer software or manual stick-on tapes. There's a full description of the various ways to transfer the artwork image to the PCB laminate and how to etch a PCB. Finally, the author discusses drilling and soldering techniques, ending with a chapter on repairing PCBs.

To round it off, three construction projects are described: a 5V power supply, an all-purpose pulser/flasher and a two-channel logic probe. The author refers to the PADS software (both schematic and PCB), so if you were lucky enough to get a copy of the evaluation PADS software (from Emona), this book will be particularly useful to you. (Emona still stocks PADS software, but the evaluation version is no longer available.)

The book is aimed at the beginner, but professionals can learn a thing or two as well. There are many illustrations and the text is easy to read.

The review copy came from McGraw-Hill, 4 Barcoo Street, East Roseville 2069. (P.P.)

Filters sans tears

PRACTICAL FILTER DESIGN,. by Jack Middlehurst. Published by Prentice Hall of Australia, 1993. Soft covers, 235 x 173mm, 259 pages with 3.5" floppy disk. ISBN 0-13-719980-5. Australian RRP $35.95.

Why do so many people shy away from any attempt to design their own filters — despite the huge number of books and papers written on almost every aspect of the subject? Basically because so many of those books/papers have been written in language so arcane and laced with maths that only specialist engineers can understand them.

This is the problem that author Jack Middlehurst has set out to solve with his latest volume. A former Senior Research Scientist with the CSIRO and contributor to *ETI*, he has set out to provide a readable introduction to the design of most kinds of commonly used filter, in a form readily accessible to technicians, students and hobbyists. Former *ETI* and *AEM* editor Roger Harrison was apparently also involved in editing the book.

To my mind Mr Middlehurst has achieved his aims extremely well. He covers the design of LC, active filters, state variable filters and switched-capacitor filters in a very satisfying fashion, and at the same time also gives a clear insight into the rationale behind the development of each type. How and why Chebychev and elliptic/Cauer filters were developed, for example, and how they differ from the Butterworth type. Another nice feature of the book is the information on practical applications, and of course its accompanying disk with GW-BASIC programs for designing each type of filter discussed.

In short, a really excellent introductory book on filters — at last!

The review copy came direct from Prentice Hall of Australia, 7 Grosvenor Place, Brookvale 2100. (J.R.)

SPICE modelling

SEMICONDUCTOR DEVICE MODELLING WITH SPICE, by Giuseppe Massobrio and Paolo Antognetti. Second edition, published by McGraw-Hill, 1993. Hard covers, 235 x 157mm, 480 pages. ISBN 0-07-002469-3. Australian RRP $120.

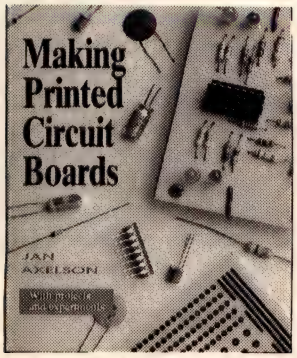
Most of the people who now use analog circuit simulators like SPICE treat them purely as design tools, and have no great wish to delve into their inner mysteries. And that's fair enough — you don't need to be a mechanical engineer to put a car to good use. But among those people who *do* want to know more about the way simulators work, and the theory embodied in their mathematical device models, the first volume of this book became a worldwide reference. This updated and expanded second edition will no doubt raise it to the status of a classic.

Author Antognetti is Professor amd Chairman of the department of Electronic Engineering at the University of Genova, Italy, and has both taught and carried out research at Stanford and MIT in the USA. His co-author Massobrio is a research associate at Genova, working in the area of device modelling. So they're both highly qualified in this area.

This edition covers semiconductor device modelling in detail from simple P-N junctions right through to modern devices like MESFETs, ISFETs, SCRs and other thyristors. It also covers models used in popular SPICE programs such as SPICE3, HSPICE and PSPICE, and has a new appendix on MOS junction theory.

Not a book for most of us, perhaps, but a valuable reference for engineers who do need to understand SPICE works.

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







HEINRICH HERTZ: A CENTENARY TRIBUTE

January this year marked precisely one hundred years since the premature death of one of radio's most important figures. In that month in 1884, what would nowadays be considered a quite trivial infection in a tooth led to a deadly generalised infection of the blood — Septicaemia — and to the premature death of young German scientist Heinrich Rudolf Hertz.

by PETER R. JENSEN, VK2AQJ

Born in the city of Hamburg in February of 1857, Hertz was just 37 years of age when the bacterial infection carried him off. Given his work on the Electromagnetic Field, and what it was to lead to in the work of other scientists and experimenters, this can only be considered a great tragedy. However it was a tragedy that in Victorian times was not easily to be avoided, and only many years of subsequent medical experimentation could change that situation. It was not until the 1940's that the first antibiotic, Penicillin, became available — and with it, the capacity to treat such a condition so that it could be cured with relative ease.

That Hertz was a capable and dedicated scientist there is no doubt, based on the obituaries and tributes that he was to receive after his death. One of those obituaries was to have profound repercussions.

Trained initially at the Berlin Academy of Science, Hertz's professional advancement was rapid and by 1885, he was already a Professor at that Karlsruhe Technical College. It was at this institution, soon after his appointment, that he commenced his most important experiments. These were to lead to a paper in July of 1888 which had the rather ponderous title, 'On the Finite Velocity of Propagation of Electro-magnetic Actions'.

This paper was the culmination of experimental work to investigate the implications of earlier studies of a theoretical nature by the eminent Scot, James Clerk Maxwell, published in 1866.

In attempting to analyse the speculations of the well known researcher in electromagnetic phenomena, Michael Faraday, Maxwell had employed a mathematical model. Contrary to his usual approach to such problems, Maxwell had *not* employed a mechanical analog but had relied entirely upon a theoretical, mathematical approach. Not only this, but in order to make the model work correctly, Maxwell had introduced the concept of the 'displacement current'.

This involved a form of electrical energy which appeared to be able to move through a dielectric substance



which he described as the 'aether'. At that time the aether was seen as a strange material of intangible form and largely unknown physical characteristics, but which was capable of allowing the passage of light.

Maxwell speculated that fluctuations of such a 'displacement current', would cause fluctuations of what he called the 'electro-magnetic field'. This was a very disquieting notion for many 19th century scientists, and one that was not received with general enthusiasm. Indeed some noted scientists such as Von Helmholtz, one of Hertz's teachers, and Lord Kelvin were thoroughly scornful of Maxwell's work.

It appears that Hertz may well have been encouraged to investigate this phenomena by his scientific colleagues, in the hope that he would show that the electro-magnetic field was a fiction and simply the product of erroneous mathematics by Maxwell.

In the event, and with the assistance of a number of elegant and quite simple experiments, not only did Hertz establish the existence of the electro-magnetic field, but he also showed that it was undoubtedly the mechanism by which light waves were transmitted. Further, he was able to demonstrate the velocity of wave propagation through the field as being the same as that which had already been established for the velocity of light — approximately 300,000 kilometres per second, or 186,000 miles per second.

To modern users of the radio frequency spectrum, the basis of Hertz's experiments involved a very familiar concept. This was the detection of 'standing waves', although in 1888 this was derived from the concept of optical interferometry.

What Hertz was to do was to project a beam of high frequency radio energy along the length of his laboratory and reflect it from a metal sheet hung on the wall at the far end. He was then able to detect the crests and troughs in the two beams of energy, where they mutually interferred with each other, to form the characteristic nodes of a standing wave. This of course remains the basis of today's method of measuring resonance in antenna feeders, described as the 'standing wave ratio' or SWR as it is now more commonly known.

In this work, Hertz used his transmitter the then-common laboratory instrument, the Induction or Rumkorff Coil and a modified form of Leyden Jar capacitor, or so he believed it to be. In reality this latter element we would nowadays call a dipole antenna with end loading elements. To Hertz it was a Leyden Jar, 'opened up' to form a radiating surface.

The detector was even more simple, consisting of a loop of wire approximately 600mm in diameter. This loop was cut to length to resonate with the transmitter dipole with its end loading. Where the loop came to a gap at the ends of the wire, a micrometer spark gap was formed. Here it was possible to see minute sparks, which occurred when the positive node of energy was intercepted by the loop and where the two beams of radio frequency energy added together positively.

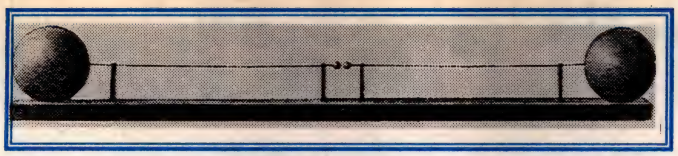
The physical arrangements for the transmitter and the receiver are shown in the attached diagram.

It might be thought that the frequency of operation of this arrangement of rods and plates would be very easy to determine. However, in 1888, this was a voyage of discovery on completely uncharted waters and there little doubt that Hertz knew only vaguely where he was, in terms of the radio frequency spectrum.

On the basis of a number of estimates of where the experiments were carried out, it appears that they were located between 30 and 200MHz (megahertz). It seems likely that the critical results came from two sets of experiments involving frequencies at both ends of this range, the higher frequency being used to establish the critical standing wave and hence the velocity of the radiated wave.

Apart from the uncertainties engendered by the novelty of the experiment, the place in which Hertz was working undoubtedly contributed to the anomalous results that he obtained initially. In particular the size of the laboratory (15 by 14 metres) was clearly quite small for even the wavelengths in use at a frequency of 200MHz.

However, worse was the existence of cast iron columns set only 8m apart, creating a central space 12m long by 8m wide. In addition, a large iron stove used to heat the laboratory was located only a metre or so away from the centre line of the laboratory. Evidently all of these physical elements contributed to distortions of the local electro-magnetic field in the laboratory.



Hertz's transmitter: a dipole antenna with capacitive loading balls at each end — driven by an induction coil.

Not surprisingly, to modern eyes at least, when Hertz increased the frequency at which he was transmitting, his results became more consistent. He was able to observe this result and draw the correct inferences from it.

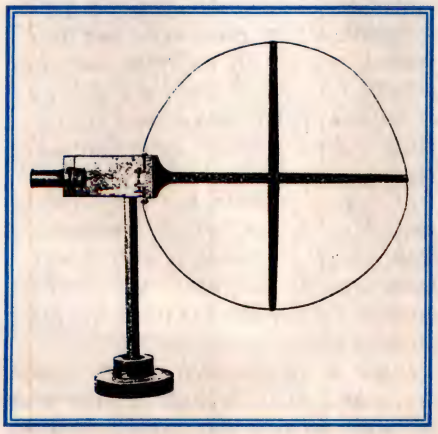
Up until the experimental work of Hertz, it was common to load a Leyden Jar capacitor across the spark gap of the Induction Coil, and this had the effect of keeping the frequency of operation of a radio frequency wave generator at a relatively low value. As noted, Hertz was to discard the conventional Leyden Jar in favour of his own radiator, in the form of an end loaded dipole. This had the effect of very substantially increasing the frequency of the radio wave and no doubt it contributed to his success, where other experimenters had failed at longer wavelengths.

While there may well have been an element of luck in the changes that were made to the operating characteristics of the apparatus Hertz employed, he was able to overcome its remaining limitations and derive elegant and conclusive results. Perhaps more importantly, they were results that were able to be duplicated by others subsequently. His work established the reality of Maxwell's elusive 'displacement current' and the electro-magnetic field, through which waves of radio frequency energy would flow.

While his untimely and premature death prevented any further personal exploration of the new domain that he had charted, it was not long before other workers would see the implications and start the procession of events which have continued to the present day.

There is little doubt that one of the most important of these later arrivals in the new field of electro-magnetic energy was a young man of mixed Italian and Irish descent who read a description of the work of Hertz in an obituary, some time in the autumn of 1894. This was Guglielmo Marconi. He was to pick up the baton dropped by Hertz and not immediately retrieved by the scientific community, and carry it forward into the history that we now remember.

The enormous contribution of Hertz's experimental work was reflected in the short term by the work of others. In the longer term it lead to electro-magnetic radiation being known for a while as Hertzian radiation. This did not persist. However, by contrast the decision of the scientific community to abandon the term 'cycles per second' in favour of 'Hertz' as the unit of frequency has clearly become completely established. It is certainly a fitting and lasting tribute to a fine scientist, tragically cut short in the prime of life. ❖



For a receiver, Hertz used this loop antenna with a tiny spark gap 'detector' — viewed with a microscope.

STOP PRESS:

NEW KITS FOR EA PROJECTS

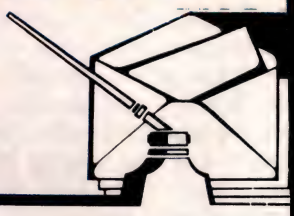
Just as this issue was going to press, we received the following advice from Dick Smith Electronics regarding their release of a new kit for an *Electronics Australia* construction project:

Improved DSO Adaptor for PC's (May 1994): The DSE kit is complete with case, punched and silk-screened front panel and punched rear panel, PCB, transformer, all specified electronic components (including the fast ADC 08061 converter chip) and a copy of the latest version of David Jones' software. It carries the catalog number K 7346 and is priced at $199.00.

NOTE: This information is published in good faith, from information supplied by the firm or firms concerned and as a service to readers. Electronics Australia cannot accept responsibility for errors or omissions.



Information centre



Conducted by Peter Phillips

UV sensors, 'painting' a PCB pattern and more

There's more ideas this month on producing a PCB board without fuss and expense, some thought on NiCad batteries, some information on UV sensors, passive IR movement detectors and othe discussion on matters various.

One of the most diverse topics to appear in Information Centre this year has been the discussion on making printed circuit boards. Each month I receive letters from readers describing yet another technique that simplifies the process.

Let's just sum up the sort of things readers have so far described. The first simplification is how to get the image onto a piece of copper laminate. Here we've had various ideas including direct transfer of toner from the original photocopy (or laser printer) image. Another is printing directly onto the copper using a plotter.

We've also been reminded that a positive resist on the laminate makes it possible to go direct from a laser printout. Here the pattern is printed on either translucent drawing paper or on a transparent sheet and the pre-sensitised PCB is exposed to UV light through the printout.

A number of techniques have been described on how to get a negative image of a PCB pattern from a printer. There's also been a brief mention of etching the PCB directly from the PCB design software with a servo-controlled router.

Key features to most of these ideas are low cost and simple equipment. After all, you can't get the process much simpler (and cheaper) than ironing a photocopy of the artwork direct to the copper, so it can be etched.

An aspect that hasn't had much attention is the software to produce the artwork. Although there are quite a few software packages available, the most popular is Protel. However, as our first letter points out, there is another way...

SuperPaint for PCBs

I was intrigued to read the article in the January 1994 issue on using laser printers to make PCBs, as I've been using my laser printer for this purpose for several months now. My method is somewhat simpler than that described, but then I design my own PCBs without the aid of a PCB design package (they cost a bundle!). The steps in my process are:

1. *Draw the exact layout of the PCB tracks using a simple painting program (I use SuperPaint on a Macintosh). The PCB tracks are black against a white background.*
2. *Select the image and flip it horizontally. This allows the final image to be on the side of the film that touches the copper.*
3. *Print onto laser printer transparency film (I use 3M CG3000 film).*

If the image on the film isn't dark enough, try feeding the sheet back through the printer and print the image again. If this has alignment problems, print the image onto two separate transparencies and superimpose them. This can give perfect results.

Sometimes I 'paint' the PCB at 200% (useful for drawing traces between the legs of an IC) then print it out with a 50% reduction. It's critical to make sure the IC symbols are exactly the right size when printed. I have now developed a library of suitable symbols and a quick copy and paste of the appropriate symbols and I'm ready to draw the tracks.

My laser printer has a 'graphics smoothing' option, which removes the staircase effect of diagonal lines. A vector mode drawing program would eliminate this, but I prefer the less restrictive pixel drawing mode.

I use a positive-etch resist, expose the treated PCB through the film with UV light, develop the board in sodium hydroxide and etch with ferric chloride. I've made many good boards using this method, the latest being a motherboard for a computer I have designed t control my hydroponic systems. (A.T Wellington NZ).

I've included a sample of A.T.'s wor in Fig.1. As you can see, there's nothin wrong with it and it has all the necessar fine detail. And all with a simple com puter Paint program! Windows 3.1 has suitable paint program, and they aboun on bulletin boards.

So if you thought the cost of the com puter software was the restriction, yo can think again it seems.

Positive PCB

Last month I gave the address of a supplier of pre-sensitised, positive PCB laminate. This supplier (Com putronics) is based in WA, and the nex letter gives details of another supplier this time in SA.

We make a lot of printed circuit boards here at the School of Earth Sciences a the Flinders University of South Australia, using a quite simple technique. We use a presensitised positive acting PCB laminate and a non-toxic developer. The brand name is Kinsten, and the product is made in Japan. We purchase the materials from Mektronics, although Radio Spares has this board and the developer.

The board is exposed through the positive film using a UV light box containing four 15W TL lamps, in our case for around four minutes. The developing time is one minute, etching takes about 10 minutes and we use a weak solution of caustic soda to remove the remaining resist. This usually takes about one minute, giving a total manufacturing time of less than 20 minutes.

The address for Mektronics is 77 Welland Avenue, Welland, SA 5007. Phone 346 0333, fax 346 2216. Boards sizes

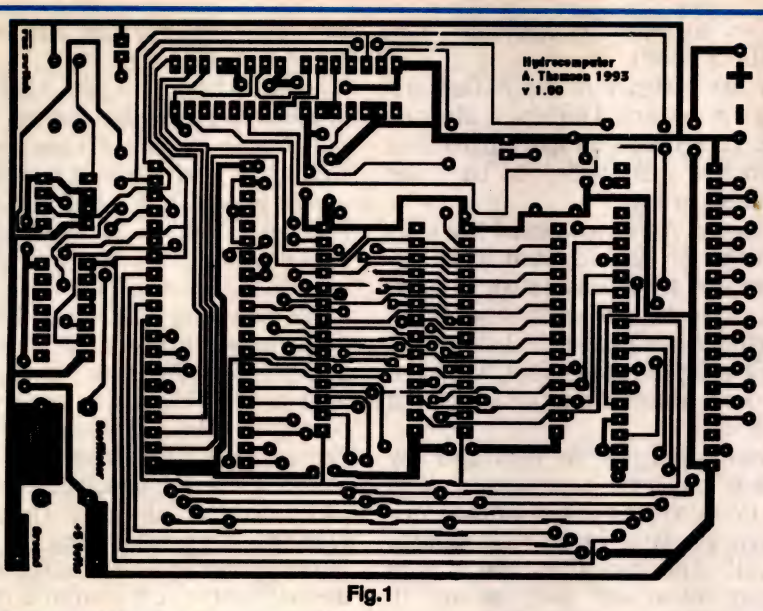


Fig.1

nge from 75 x 125mm to 300 x 450mm .6mm, with 1 oz copper foil). A piece of 50 x 300mm precoated single-sided lass-epoxy board is about $12.50.

The commercial developer can be subituted with sodium metasilicate penahydrate, available from Sigma hemical Group (product number S 514) at $16.20 for 500g. You dissolve 5g in 250ml of water which gives 80 eveloping solutions at about 80 cents ach. I hope this description will give all xperimenters a quick, cheap and easy ay of producing professional quality CBs. (J.B., Flinders University SA).

Thanks for this J.B., as I'm sure it ill interest a lot of readers. Incidenally, J.B. included a sample PCB, and it s of excellent quality. So there's no hortage of PCB making techniques uitable for the technician or hobbyist. Now to other matters...

UV sensors

In January, a reader from the Canberra nstitute of Technology wrote enquiring bout a UV sensor. We offered a possible ource, but the contributor of the followng letter goes one better...

Many schools across Australia are curently carrying out a UV monitoring prorram being conducted by Trevor Lund, Faculty of Information Sciences and Enineering, University of Canberra, PO Box 1, Belconnen 2616.

His initial idea was to supply a kit of parts so that schools could assemble an appropriate UV meter. However he found that there was a commercially available UV meter that was cheaper and more reliable. The meter is available from Diagnostic Instruments, PO Box 159, Victoria Park, Perth 6100 who are agents for Vital Technologies of Canada, suppliers of several different versions of the 'Bluewave 10' meter. These instruments measure ultraviolet A, UV B or Broadband UV. The cost of our unit early in 1993 was $192.

As a matter of interest, the BW 10 gives a read-out in Atmospheric Environment Canada skin damaging UV units. This system is based on a range of 0 to 9.9, with 9.9 corresponding to 250mW/sq.m, chosen as it represents the highest UV levels commonly encountered. The meter does 'roll over' above this, and here in Yeppoon in summer I have been getting readings up to 13.8 or 345mW/sq.m. (P.C., Yeppoon Qld)

Thanks for this information P.C., as we have had a few enquiries about UV sensors. I'm not surprised there's a commercial UV meter available, as UV measurement has surely become the 'in thing' these days. And if you are worried about high UV levels, it seems Yeppoon is definitely not the place to sunbake!

M208B IC

On the subject of 'where do you git it?' the next letter also offers information about a hard to get component. The writer starts his letter offering thoughts about other hard to get components, though somewhat tongue-in-cheek!

I wonder if you have ever bought a 'NOT' relay. They seem to abound in PLC programming languages, although they are rather hard to visualise. Perhaps these are stocked alongside negative resistors, avalanche capacitors, zener batteries and variable Weston cells, but on a shelf underneath the solar powered darkroom timers and wind powered fans.

However my main reason for writing is to help your correspondent (January 1994, page 129) who is having difficulty getting the M208B synthesiser IC used in the Stroboscope Mk2 project of May 1992. These were originally a stock item from Mostek, who have now been bought out by SGS-Thompson.

The chip was used by Hammond Organs, but they have stopped using them and only the Sydney stock remains. Unfortunately, this means the IC is now obsolete, and is no longer available commercially. However SGS-Thompson have sent me a couple of their half dozen stock, and I have sent one off to your correspondent.

I may be able to assist other readers who want this IC. (Ian Clough, Macgregor Qld).

As you can see, requests in this column do get answered, and I'm sure the original correspondent is extremely grateful for receiving an actual IC! Thanks, Ian. If anyone else needs this IC, write to me (at *Electronics Australia*) and I'll forward your letter to Ian, who may still be able get a few more of these ICs.

Infrared comms link

The next letter is also a 'where do I git it' request.

I am currently constructing a robot for the University of NSW Artificial Intelligence department. An option for the robot we are investigating is an infrared communications link between the robot and a base station.

The robot contains a '486 IBM compatible computer, and the base station is a similar machine. Has EA published any articles, or reviewed any products that would suit this application? The link needs to be bi-directional and able to be connected to a computer port or slot. (G.K., Dee Why, NSW).

We have published quite a few infrared type projects, but few to suit this application. The nearest is a 300 baud infrared data link, presented in our Circuit and Design Ideas section in March 1985. We therefore haven't tested the design, but it may be useful as a PC data link.

We don't keep records of product reviews, so I can't be sure whether we've reviewed such a device. However, I don't think so. Perhaps a reader might know of such a device.

Movement sensors

The next letter raises a couple of issues about the operation of lights triggered by a movement sensor.

I have tried two types of commercially available automatic lights operated by movement sensors, and as far as I'm concerned, they are rubbish.

INFORMATION CENTRE

One type often forgets to switch itself off after sensing something at night. The other sort is the twin-floodlight variety. This one triggers on and off for apparently no reason, and finally blows up. No amount of adjustment seems to get it to work efficiently. Have other readers experienced this problem?

I know of other people who have similar problems with movement sensors, both in security lights and house alarms. Is this due to poor construction maybe? (J.M., Aldinga Beach SA).

The usual movement sensor in these applications is the PIR (passive infrared) detector. We described one in May 1989, and they are now generally available as ready built units.

The problem with any movement sensor is differentiating between wanted and unwanted movements. A flying moth shouldn't trigger the unit, while a slow moving human should. The usual way of minimising false triggering is to integrate the pulses from the PIR detector.

For instance, a trigger pulse is generated only if a certain number of pulses are received from the PIR detector in a given time. Another way is to use the PIR detector pulses to charge a capacitor, causing a trigger pulse to be produced only when the capacitor has reached a certain charge voltage. In other words, it's not necessarily the fault of the movement detector if false triggering is occurring. Instead it's the way the pulses from the detector are processed.

However as far as the consumer is concerned, it's the end result that counts. So rather than poor construction, I'd blame poor design — which amounts to the same thing I suppose. I'd be interested to hear from other readers about their experiences with these devices.

Discharging NiCads

Most readers have an opinion about how to treat NiCad cells. Here's some food for thought, which I hope will result in some future discussion.

Having built and used the NiCad discharger (EA September 1989) for AA and C batteries, I decided to adapt it for use with 9V NiCads.

Because I didn't have any information on the value of the discharge terminal voltage, I phoned the manufacturer (Arlec) asking for information. I was told they should be discharged to 0V, as otherwise the memory effect could cause problems. When I queried this, suggesting discharging a NiCad to zero volts would shorten its life, I was assured this was not so. Now I'm confused. (V.B., Five Dock NSW).

As the designer of the NiCad discharger in question, I decided to also ring Arlec. I don't know if I spoke to the same person who spoke with V.B., but I was told the same thing.

It appears Arlec recommend that users discharge the NiCads fitted in an appliance until the appliance stops working. This should be done every few weeks. Therefore a torch should be left on until there's no light from the globe, which can only occur when the cells are virtually at zero volts.

When I designed the discharger my research suggested a terminal voltage of 1.1V means the cell is virtually discharged. Anything lower could damage the cell. And tests show that a fully charged NiCad cell takes around 10 hours to discharge to this voltage at the C/6 rate. It may be we are both right, with one of us more right than the other. I would appreciate reader opinions on this subject.

Plasma ball

The plasma ball described in January 1994 has excited some interest, for various reasons. The first letter explains one of the reasons.

I was very interested in your article on the plasma ball constructed with a light globe. Your article said to look at the end of the report for the address and price of a kit. However I could not find this information in the magazine. (G.R., Otago NZ).

Indeed you couldn't G.R., because for unknown reasons, this information was accidentally omitted. The supplier is Oatley Electronics, PO Box 89, Oatley, NSW 2223, phone (02) 579 4985.

The next letter is slightly more ominous...

I decided to construct the plasma ball described in January. I used parts of my own rather than buy a kit, and I was a to get the unit working.

However I was surprised at the amo of ultraviolet light produced by the play. It made the face of a luminous cl light up very brightly, and my white s almost glowed. I also had sore eyes next day. I think a warning should be cluded with the article about UV em sion. (R.D., Brisbane Qld).

The first thing I did when I receiv this letter was to power up the prototy and perform the same experimen described by R.D. I also spoke with t developers (Oatley Electronics). I cou find no appreciable amount of UV lig emission from the prototype, and Oatl Electronics found the same. There is lik ly to be a very small amount, but certai ly not enough to be hazardous. As we the UV light is contained in a glass e velope (the light bulb), which will a tenuate the amount of UV transmitted the outside world.

I think R.D. that your plasma ball ci cuit is probably more powerful than our You mention using your own com ponents, and it's therefore possible you circuit produces a higher voltage to caus the plasma discharge.

Still I'm glad you have raised the U issue, as it's a warning for us all. How ever if it's built as described, the plasm ball seems to produce very little UV. W would have noticed it during testing. I any case, you can avoid UV problems b using a sodium vapour lamp (a described in the article) and get a reall great looking display into the bargain.

VCR signal meter

You might recall a letter from R.V. (S Georges Basin) in January, suggesting a old VCR might make a good signa strength meter. As it happens, a reade has already done just this. Here's how...

I have developed a simple circuit to make a TV signal strength meter from a

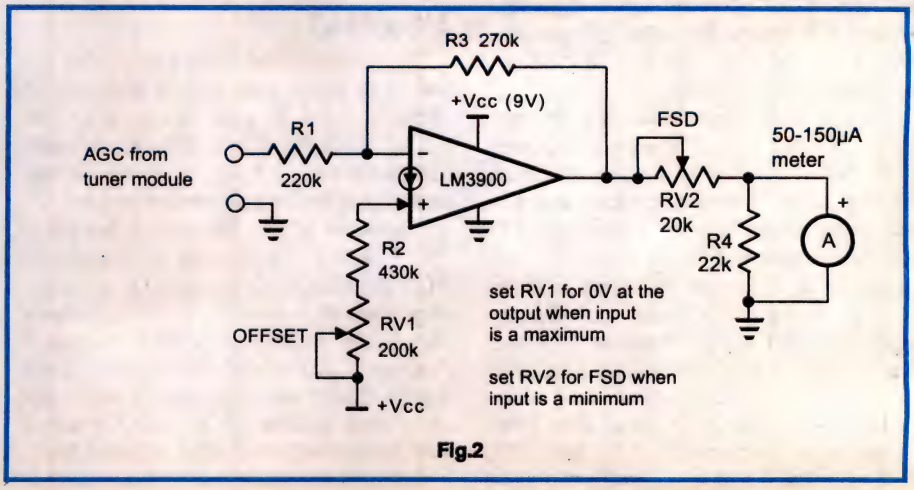


Fig.2

VCR I found at the dump. The meter river input was taken from the AGC pin of the VCR tuner module, which was conveniently marked as such. This voltage is developed by the IF stage and controls the gain of the tuner. The AGC voltage varies from 6.3V for maximum gain to 0V for minimum gain.

This voltage is converted to a current by R1, which also sets the input impedance. R2 and RV1 adjust the DC bias to give 0V output when the AGC voltage is 6.3V (that is, meter is zero, and tuner is at maximum gain). This represents the lowest signal level.

RV2 and R4 divide the output down to drive the meter. RV2 is adjusted for FSD when the input is 0V (that is, tuner at minimum gain, which means the strongest signal). The meter movement, which is not critical, was a VU meter from an old tape deck.

The VCR was a Sanyo model VHR-1110. There are still a few useful parts and if anyone wants these, they can have them for the cost of the postage.

Thank you for a great magazine. (Bruce Hannan, Brooklyn Valley Road, RD3 Motueka 7161, New Zealand).

Thanks for the nice comments, Bruce, and for sharing this information. The circuit is shown in Fig.2. Of course, you don't need a VCR, just a tuner module and an IF module, but when they're from an old VCR, they're free!

More on 2TM

Several readers have commented about the problems of receiving distant AM radio stations, in response to a letter in the January edition from a 2TM fan (J.M., of Windale NSW). Last month I included a letter from an informed reader who offered some useful suggestions on how best to receive distant AM stations. Here's another suggestion...

I think you may have set J.M. on the wrong track by suggesting TRF as a solution, unless you meant this simply as an addition to the front end of a superhet receiver. The control of bandwidth to give a sharp roll-off is better effected in the IF stages. Back in the 1940's TRF receivers were recommended as a way of improving treble audio fidelity in strong signal areas, by limiting selectivity.

As a no-cost experiment, J.M. might try using a good quality (digitally synthesised crystal-locked) car radio in a parked car (his own or somebody else's) with a decent length of elevated wire clipped onto the car's aerial, possibly via a coupling capacitor.

Such car radios are highly selective and perforce are pretty sensitive (they have to be with the standard car antenna). They invariably have extremely good AGC to cope with the varying signal strength reaching a moving car. If this doesn't work, J.M. might need to forget 2TM and buy recordings! (R.V., St George's Basin NSW).

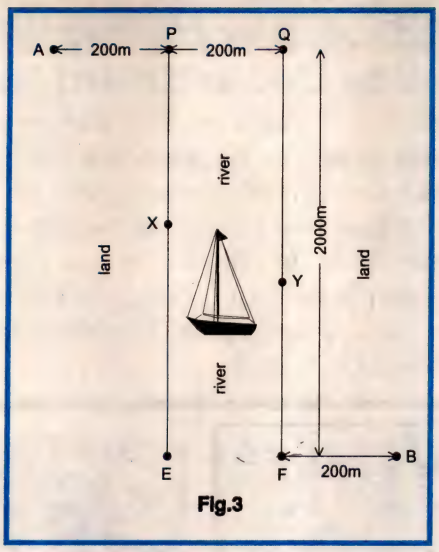


Fig.3

Several readers have commented on the need for selectivity rather than gain, and certainly the superhet is more selective than a TRF set. Using a car radio is a most sensible idea, as a good quality car radio has excellent gain and selectivity. However I'm not sure about adding extra length to the antenna.

Many car radios have a trimmer that's adjusted to peak the gain of the radio for the car aerial it's connected to. Adding to the length of the aerial will probably detune this part of the circuit, and possibly reduce the performance. Still, no harm in giving it a go.

The next letter echoes R.V.'s sentiments, this time dispelling my other suggestion of a rhombic aerial.

You comment that you are not all that familiar with antennas. I have little familiarity with them as well, but I have calculated that the wavelength of 2TM is about 420 metres. This means a rhombic antenna constructed with one wavelength per leg would be rather large.

There are some small antennas which work well and are quite directional, but they don't work with skywave reception, which is the medium by which I suspect J.M. is receiving 2TM.

A wire antenna coupled to a car radio would be the best bet. No construction required other than a simple power supply. Most have an RF stage, and are quite selective. With the move to FM, there is a glut of AM only car radios. (P.M., Maitland NSW).

Yes, I agree that a rhombic antenna would be large, in this case nearly 1km long. Hmmm — rethink that one! So, J.M., there's two readers independently suggesting a car radio.

What??

This month's question comes from Bryan Maher. See Fig.3 as you read the question. Two points, A and B on land are separated by a still river PQEF, with land on either side. A cable is to be laid underground and on the river bed to join points A and B. Point X is somewhere on the left bank and point Y is somewhere on the other bank.

Use underground cable from A to X, there join to submarine cable and run on the river bed to point Y. At point Y join more underground cable to run to point B. The resistance of the underground cable is one milliohm per metre and the resistance of the submarine cable is two milliohms per metre.

Carefully select the positions for points X and Y to give the shortest cable run and therefore the lowest overall cable resistance. What is the minimum resistance value and what is the optimum total length to give that minimum resistance? Yes, it's a bit tricky!

Answer to April's What??

The April question comes from this version: John said to Mary, 'How many children have you?' 'Three.' 'What are their ages?' 'Multiplied together they equal 36, added they come to the number of the house next door.' John, knowing he could easily look at the number of the house next door asked: 'Simple, is that all I need to know'? 'No' replied Mary, 'you also need to know that the eldest plays the piano'. What are the children's ages and what is the number of the house next door?

Going back to the original question about resistors, all possible groups of three factors for the resistor values, together with their sum (the aisle number) gives:

36	1	1	=	38
18	2	1	=	21
12	3	1	=	16
9	4	1	=	14
9	2	2	=	13
6	6	1	=	13
6	3	2	=	11
4	3	3	=	10

Notice that we have two sets giving a total of 13. If this were not the case, you would need to know the aisle number. Because the sales assistant said additional information was essential, the aisle number has to be thirteen. And because only one of the sets has a highest value (9), the resistor values must be 9, 2 and 2. ❖

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Regards Jack O'Donnell

Stony Broke Speakers by REDBACK

This speaker kit is a bit like the Volkswagon; not too pretty to look at but performs superbly. Well that's the same as the Stony Broke speakers; pretty ugly but sounds sensational. Frankly, the reproduction from these speakers must be heard to be believed. They sound simply amazing. 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 **$89.95** per pair

40 Volt 3 Amp Variable Power Supply Kit

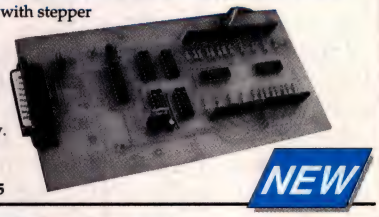


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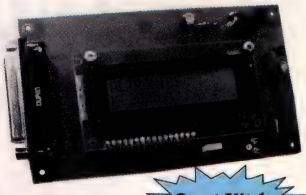
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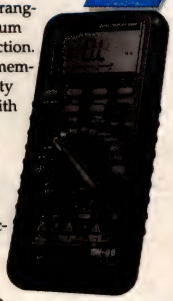
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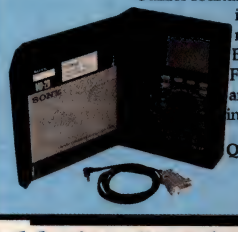
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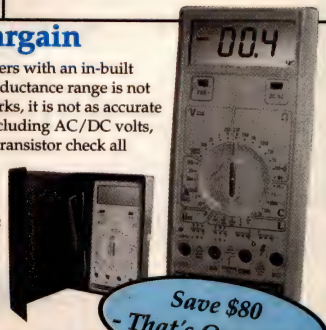
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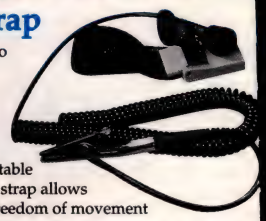


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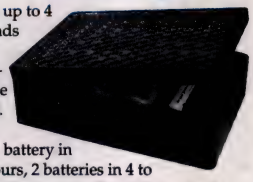


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SHORTWAVE LISTENING

with Arthur Cushen, MBE



Cook Islands Educational Radio

Broadcasting to the islands of the South acific was introduced in various ways. In e case of the Cook Islands, it was an ducational radio station that originally arted the interest in broadcasting.

During 1954 a station commenced operat- g from Rarotonga, when the New Zealand overnment gave a gift of post and legraphic transmitters and technical staff to ommence an educational radio station. The roadcasts were on an hourly basis on Wed- esdays and Fridays, from 2300 - 2400UTC nd later on July 22 an entertainment trans- ission was added. The station used various requencies including 1390kHz, 5050 and ter 6180kHz.

It was on May 1, 1957 that a frequency hange from 5050 to 4954kHz was made nd the broadcast was on the air on hursdays at 0230UTC. The transmitter was sed for telegraphic communication at other mes. At the same time, the New Zealand overnment was pressed for a commitment o extend the operating hours; but they were eluctant to do so.

It was also suggested that a radio amateur who had a commercial licence could commence the service.

Initial broadcasts of the Cook Islands Broadcasting Service were heard on ZK1ZA Rarotonga operating on 4965kHz and heard on May 29, 1957 using a power of 350W. This station was followed by the reception of ZK5 on 5045 and ZK6 3265kHz on July 19, 1962.

In the same year the Cook Islands Broadcasting Service added new calls to its transmissions and extended its service. The former callsign of ZK1ZA was taken over by the new broadcast band transmitter on 820kHz. ZK5 was the new call on 5050kHz and ZK3 on 9695kHz, according to the closing announcement of the station.

On March 21, 1981 still assigned the call ZK4, broadcasts were heard on 11,760kHz throughout the day with a relay of the mediumwave service and using a power of 500W. The transmission continued for some 10 years on this frequency until the transmitter building was destroyed.

Uruguay station upgraded

Our recent reception of SODRE on 9620kHz heard around 1000UTC has prompted one of our readers, Mr Noel Lipscombe of Beverley Park, NSW, to write with details concerning the station. Mr Lipscombe is a regular visitor to Uruguay.

The station currently houses two mediumwave transmitters on 650 and 1290kHz, and two unofficial experimental shortwave units on 6125 and 9620kHz. The 650kHz transmitter has an output of 40kW and feeds a quarter wave vertical antenna. Programme material is almost entirely classical music, which is fed via a UHF link from the studios in Montevideo. This signal is received noise-free throughout Uruguay and has good coverage into the adjacent areas of Argentina. The programme material is also radiated by the 9620kHz transmitter, which has an output of only 300W to a dipole antenna.

The 6125kHz transmitter is a similar unit but takes its programming from a mediumwave transmitter on 1050kHz, located at an old site in Montevideo. The 1290kHz transmitter is a modern solid state Gates unit radiating 10kW. Programme material serves a variety of interests and contains numerous commercials.

The Santa Vasques site is being redeveloped slowly and much of the existing station is scheduled for replacement by equipment of Spanish origin. This also applies to the outdated studio equipment in Montevideo. Our verification card and letter was signed by Daniel Munoz Faccioli and the address of the station is: Casilla 801, 11000-Montevideo, Uruguay. ❖

AROUND THE WORLD

REAT BRITAIN: The BBC World Service to the Pacific has dropped he frequencies of 7150 and 15,340kHz. The new schedule is: 7110kHz, 1800 - 2200; 9640kHz, 0500 - 0815; 9700kHz, 1100 - 1130 (RNZI); 9740kHz, 1030 - 1515; 11,955kHz, 0600 - 0915 and 2100 - 0100; and 17,830kHz, 0500 - 1030.

RAN: Radio Teheran has been heard on 11,790kHz, with news eports at 2150 and at 2210 a feature programme in English, with ign off and requests for reports at 2230. According to the BBC Monitoring Service a new transmitting site has been built in the outhern part of Iran. There are three mediumwave and 10 hortwave transmitters, and these are now in operation. The new ransmitter site will be in use to carry the external service at present n 21 languages, and in a short time the number of languages to be roadcast will reach 40.

MOROCCO: According to a news release from Marconi, they have equipped the new Voice of America relay base for the United States Information Agency at a site in Tangiers. The equipment consists of ten 500kW shortwave transmitters with a coaxial feeder, dummy loads, installation materials, cooling and power equipment while the transmitters are connected to the existing aerial system. The Voice of America has been established at Tangiers for many years and this is a progressive development in upgrading the relay base which is mainly beamed to Africa and Europe.

NEW ZEALAND: Radio Reading Service Levin is the new name for the broadcasts heard on 2KA 1602kHz, ZLXA 3935kHz and 7290kHz. Transmissions have been extended to Saturday so this means they operate six days a week 2100 - 0900UTC and on Sundays from 0600 - 0900UTC. The frequency of 5960kHz is to be used and will replace 7290 already in use. The address for reception reports is: PO Box 360, Levin, New Zealand.

PALAU: Station KHBN on Palau in the Central Pacific has added a second 100kW transmitter, and the announcements indicate the broadcasts are beamed to India and Indonesia. The first transmitter, which has been on the air for several months, remains on 9830kHz and broadcasts from 0700 - 1600 and 2000 - 0100UTC. The second transmitter is operating from 1200 - 1900, 2100 - 2400 on 9965kHz; 0800 - 1200 on 15,395kHz and 0000 - 0800 on 17,630kHz. The initial broadcasts have been heard only on 9965 with best reception around 1400UTC. The programme has been in English and generally includes religious broadcasts or gospel music. The station is requesting reception reports to: KHBN, PO Box 66, Koror, Republic of Palau 96940.

PAPUA NEW GUINEA: A new station is being built in the Northern Solomons to replace Radio Northern Solomons at Kiti on 3325kHz, and is under construction. The new station will have the power of 10kW and will be on the Island of Buka at Hutjano, according to a telephone conversation with NBC in Port Moresby. The frequency and opening date have not yet been decided.

SINGAPORE: As indicated in the last issue Singapore Broadcasting Corporation has added high powered transmitters and uses the slogan Radio Singapore International. The schedule has been very much reduced and the initial broadcasts are for nine hours a day. They are carried in English on 9530kHz from 1100UTC, Chinese 9590 and Malay 9635. The full schedule is English 2300 - 2400 and 1100 - 1300 on 9530kHz; Malay on 9635kHz and Chinese 9590kHz carry the same schedule. According to a news broadcast heard from Singapore all mediumwave transmitters have been closed down due to the coverage of the area on FM. ❖

This item is 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 NZ Standard Time.

Vintage Radio

by PETER LANKSHEAR



A closer look at moving coil loudspeakers

One of the most familiar components found in a wide range of radio, video and audio equipment i the moving coil loudspeaker. Made in countless millions since Rice and Kellog produced th ancestral RCA 104 nearly 70 years ago (as described in this column for May 1989), the basic desig has changed remarkably little.

The moving coil loudspeaker, has, in common with the conventional internal combustion engine, some fundamental weaknesses which will never be completely eliminated. But constant research, development and steady incremental improvements have so far held off any serious threats to the mass market from alternative types.

An old diagram shown here in Fig.1 shows the basic component sections: the frame or chassis, the magnet system, and the cone, with its voice coil and suspension. The basic operation is simple. A light coil of wire, attached to a conical diaphragm, is suspended with minimum clearances between the concentric pole pieces of a powerful magnet. The coil will move back and forth in response to audio currents flowing in its winding, and this motion is transferred to the cone which acts as a piston to move the surrounding air and generate sound waves.

The chassis (sometimes called the 'basket') is usually made of pressed steel — although some, especially those for high quality speakers, have been made from diecast metal. Dimensional stability is most important, for if a chassis is distorted, the voice coil may rub on a pole piece, with unpleasant results.

Attached to the chassis, generally at the rear, is the magnet assembly. This has a small circular air gap between the central core and and a matching concentric outer ring pole piece. (Some speakers have been made 'inside out', with the magnet at the front of the cone. Philips did this for space saving on some models.) No speaker can be better than its magnet, and much of the weight and cost of speakers come from the magnet system.

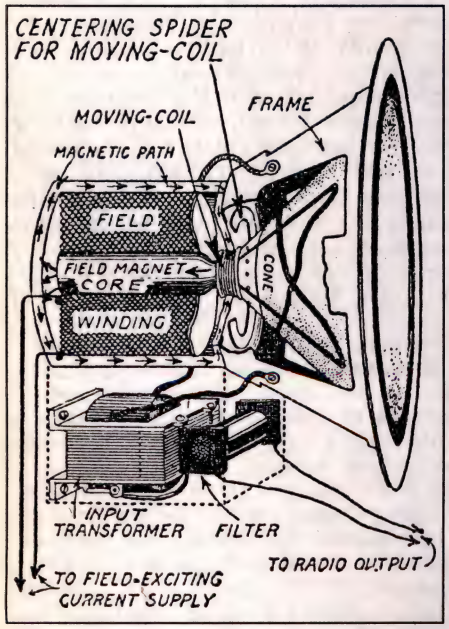


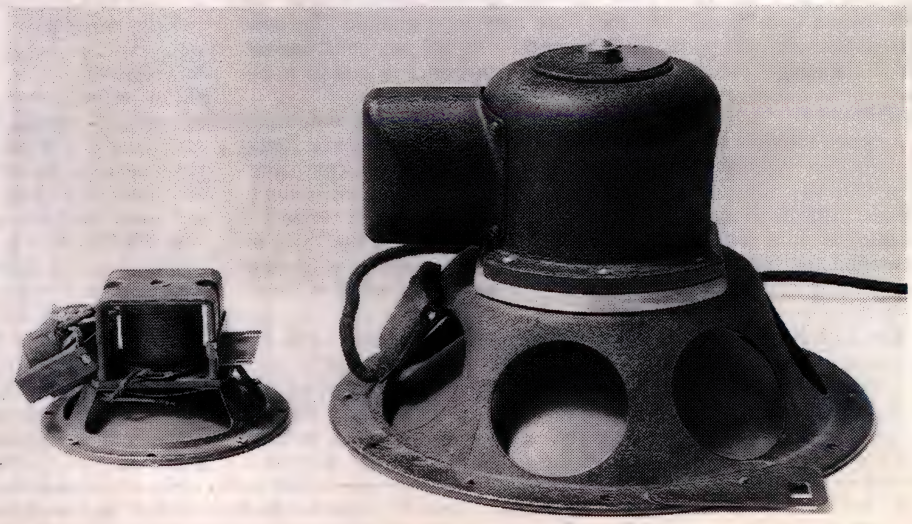
Fig.1: This 1930's drawing of a typical moving coil loudspeaker shows that the essentials have changed little in 60 years, other than the change to permanent magnet fields.

Use of electromagnets

Permanent magnets were at first incapable of providing the strong fields necessary. More powerful alloys became available in the early 1930's, but were expensive and could still not match an electromagnet for field strength. Hence all of the early moving coil loudspeakers had electromagnetic (EM) fields, and were often called 'dynamic' speakers. Typical electromagnetic field windings were operated at between 750 and 2000 ampere-turns, requiring up to 30,000 turns or even more of fine wire.

In most domestic radios, the field winding was in series with the main HT supply. Some early receivers had a field winding with a resistance of 5000 ohms or more, shunted across the supply. A variation of this was to make the field

Fig.2: Moving coil loudspeakers are remarkable for their diversity of sizes, and this pair are by no means extremes. At the left is a 5" AWA unit made around 1935. The other is a 1930 Atwater Kent type N, about 11" in diameter.





.3: Philips was pioneer in the e of permanent gnet speakers mains operated ceivers. This 30's model has a nt spider and a ain cone with rrugated sur-und.

rt of the main voltage divider. This as the method used in the Majestic odel 90 receiver described in the Au-st 1992 column — the massive G3 peaker having a field winding with early 7km of wire, operating at 50mA!

The ultimate in field windings was robably the 3.5kg of wire in shunt and eries windings used in an 18" Jensen peaker for McMurdo Silver's 1937 Masterpiece V receiver!

Sometimes, especially for cinema and A systems, field windings were de-igned for low voltage, high current op-ration, and powered from a car battery — or in some cases, their own mains power supplies with gaseous or copper xide rectifiers.

Free filter choke'

It was soon realised that speaker field windings possessed considerable induc-tance and could, as a bonus, double as a high tension filter choke. A problem was that the current had a hum compo-nent, which created a ripple in the speaker's magnetic field, producing a noticeable hum.

Several methods were used to mini-mise this difficulty. One was to provide a degree of preliminary filtering by re-taining a separate filter choke, or by using a heavy duty resistor following the rectifier. The choke meant extra cost and the resistor, although less ex-pensive, created heat and needed addi-tional HT input voltage.

A *shading ring* was another method of reducing hum. In effect a shorted turn, this was a heavy copper disc, sometimes sandwiched with iron, at one end of the field winding. This produced a measure of cancellation, with the eddy currents generated in the disc opposing the hum components in the magnetic field.

By 1932, the best solution of all had appeared: the hum bucking coil, which was thereafter to remain a standard fit-ting for EM speakers. This was a flat, single layer winding of a dozen or so turns of heavy wire, positioned similarly to the shading ring and connected in se-ries with the voice coil. Hum cancella-tion came from the ripple component in the magnetic field inducing a voltage in the bucking winding, with the opposite polarity to that induced in the voice coil. Provided that the winding was suitably proportioned, virtually complete hum cancellation was possible.

Although information about current carrying ability, and number of turns might have been useful to designers, EM speaker fields were generally only rated by resistance.

It is clear from Fig.2 that there could be considerable physical variations in field windings of similar nominal specifi-cation. The field resistance of the small AWA speaker is 1500 ohms while that of the Atwater Kent is a comparable 1100 ohms. Obviously, the larger speaker has a winding with many more turns of heav-ier wire, which, with a given current, creates a considerably greater magnetic flux than in the midget. This was, by the way, one reason why larger loudspeakers were the most efficient.

With the advent of the hum bucking coil, the speaker field alone became suf-ficient for adequate filtering. Separate filter chokes were no longer necessary, and the high value 'shunt' type of field winding disappeared.

Field resistances for series operation came in several ranges. On the lower side there were many fields of 1000 - 1100 ohms. Middle values were around 1500 ohms, with a few at 2000 ohms.

More popular in Australasia than else-where were windings with a resistance of 2500 ohms. Although this type of field generated a very strong magnetic field, it also required very high transformer volt-ages, generally in the vicinity of 400 volts, and consequently caused more stress to components, especially during valve warmup, than was the situation with lower resistance fields.

Why not use permanent magnets?

Prior to 1932, the only permanent magnets available were the traditional carbon steel 'horseshoe' type, not very powerful and prone to self demagnetisa-tion unless their length was considerably greater than their cross-sectional area. Some rather ungainly efforts were made to use this type, typically with four mas-sive magnets arranged around the back of the speaker, but in no way could they compete with electromagnets.

In 1932 the first chromium alloy per-manent magnets appeared, providing a significant improvement. 'Permag' or PM moving coil speakers were increas-ingly used in battery powered receivers, replacing the alternative moving-iron and inductor speakers.

Further progress in magnet develop-ment was dramatic, achieved through the use of cobalt steel, Alnico and Alcomax. This is demonstrated by the consequent reductions in weight and size. For a total flux of 27,600 lines, the 1932 magnet weighed 5lbs (2.25kg). The same strength of field, 12 years later, could be provided by only five ounces (141g) of Alcomax 1 — and by 1953, by using Alcomax III, the weight was down to 2.5 ounces (71g), only 1/32 of that of chrome steel.

Today, compact ring shaped ceramic ('ferrite') magnets are popular, providing inexpensive powerful and stable mag-nets in a minimum of space.

Electromagnetic speakers still contin-ued to be used in mains powered receiv-ers. Equivalent PM speakers were generally more expensive and there was the added cost of a filter choke.

One major manufacturer, Philips, did change to PM speakers for mains receiv-ers in 1933, in both Holland and En-gland. Later they overcame the filter choke problem by using resistor filtering

in conjunction with high-value electrolytic filter capacitors, anticipating a technique that was widely adopted by other manufacturers 20 years later.

Meanwhile, until radio production ceased during World War II, the majority of receivers still used EM speakers. By the time post-war radio manufacture resumed, magnets were more powerful and significantly cheaper than field windings, and the EM speaker soon disappeared.

Cone materials

Although today practically all loudspeaker cones are made from paper, they have been made from a variety of materials, including varnished or metallised cloth, polystyrene, wood, and, in the case of one infamous British GEC model, Duralumin (an aluminium alloy)!

Cones are intended to function as pistons, but in practice the flexibility of paper makes operation very complex. There is continuing research and development in the speaker industry, and although there have been many refinements and the performance of modern high fidelity reproducers can be outstanding, moving coil speakers are unlikely ever to be perfected. Consequently the reproducer remains the weakest link in the audio chain.

Modern cones are carefully engineered, often with strategically placed corrugations and made of graded fibres to control resonances and spurious responses. But many vintage speakers used quite plain paper, cut and glued into a cone shape, very much on a 'try it and see' basis. The miracle is that they sound as good as they do.

Most receiver cones are general purpose, covering a reasonable frequency range, but some console receivers used two or more speakers — with a large heavy coned model, typically 12", as a bass unit or 'woofer', and a smaller lightweight treble speaker or 'tweeter'.

Two suspensions

The cone must be free as possible to move forward and back with minimal restriction, but at the same time must be firmly restrained against any lateral movement. There must be no possibility of the voice coil touching the pole pieces, in what is a very small gap. This calls for two suspension systems, working together to provide very accurate positioning and centring.

One part of the suspension is a flexible circular component called the 'spider' and generally made of fibre, although in some cases thin metal was used. This is fastened to the cone at the base of the voice coil, to accurately centre the voice coil in the magnetic gap. Why a 'spider'? The earliest form was mounted in front of the centre pole piece and voice coil, and fastened to the cone as in Fig.3. To increase its flexibility, the disc was cut away in a pattern which, in some instances was reminiscent of the legs of a spider.

The flexibility of the front-mounted spider was found to be insufficient to permit large voice coil excursions. Longer legs on a bigger disc were needed. There was much more room available at the rear of the cone and so the rear spider evolved, as shown in Fig.4. A more expensive, adjustable mounting ring and additional hardwa were needed, but the results we worthwhile and the rear spider w widely adopted.

The next development was to simpli the construction of the rear spider. Fig shows how it was replaced by an ine pensive moulded corrugated disc. N elaborate mounting ring is needed, t disc being simply glued in position. Th is the method used in modern speaker and has the advantage of keeping du and dirt out of the voice coil gap.

The front surround

The other part of the suspension is a the outer edge of the cone, where som form of flexible mounting attaches it t the rim of the chassis. In positioning th cone at this point, there are conflictin requirements for this 'surround', as it i known. An ideal material would be infi nitely rigid laterally, and yet have no re sistance to fore-and-aft movement. A the same time it would completely ab sorb any vibrations reaching the edge o the cone. In most enclosures too, it mus provide an airtight seal. No wonder th perfect moving coil loudspeaker has ye to be produced!

Two of the early surround materials were chamois leather and cloth. Both were superior to paper, but were succeeded by the cheaper to make and assemble one-piece moulded cone with corrugations at the rim. Cones of this basic type have been used for general purpose receiver applications for the past 60 years, and show no sign of being superseded.

Some manufacturers of high quality speakers found however, that cloth suspensions gave superior results and con-

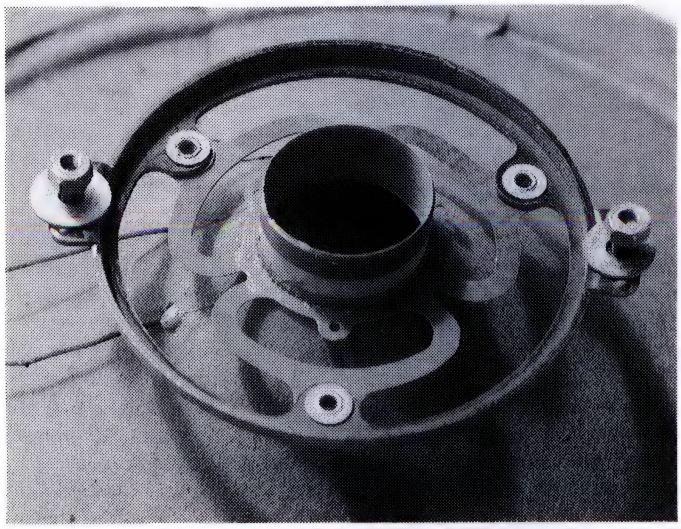


Fig.4: An advantage of the rear spider was that it could be made large enough to be very compliant. With its adjustable mount, this early type was also more complex.

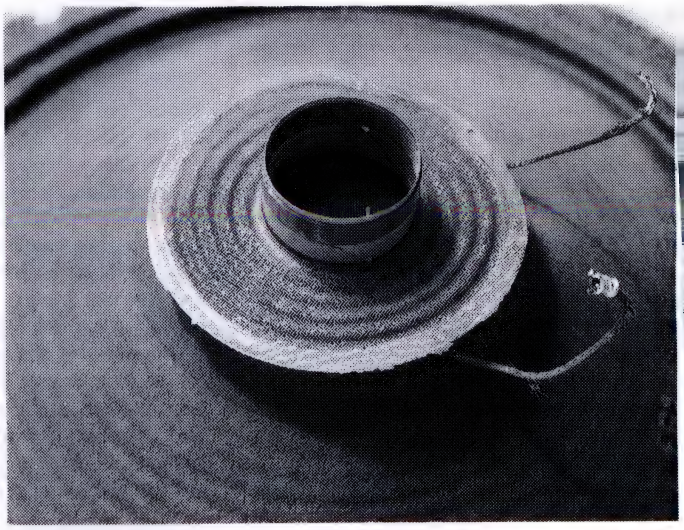


Fig.5: Inexpensively moulded from varnished or plasticised cloth, the modern spider is non adjustable. Simply glued to the chassis, it doubles as a dust seal for the voice coil.

d their use. The well known English of Wharfedale did run into trouble alternative material. Around 1956 experimented with a revolutionary material — polyurethane foam t. Not only did it have superior abtion, but it was insect proof, and was med to be everlasting.

he results were so good that product was switched from cloth, but after a ple of years — disaster! Polyurethane found to be not so everlasting, and in was disintegrating in speakers all nd the world.

common practice now is to mould a vy corrugation into the rim of the e, and soften it with a non-hardening stic impregnation.

oice coil sizes

Vintage voice coils come in only one pe, cylindrical; but there are many ferent sizes. Diameters vary from out 0.5" (12.5mm) for very small eakers, to 1.5" (38mm) or even bigger, some of the large units.

A lightweight former, generally paper fibre (although metal has been used), wound with two or more layers of re. In receiver speakers, this is almost ways copper, but high fidelity types ten use aluminium wire.

Finally, there is the question of voice coil impedances. Early speakers with large voice coils were often in the 10 to 15 ohm region, as were high fidelity and speakers for high powered operation. But for most of the valve era, small receiver speakers used 3.5 ohm voice coils and larger types had impedances in the region of 2.5 ohms.

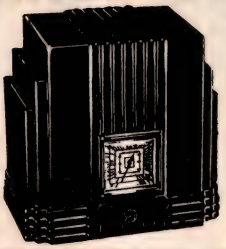
The widespread use of semiconductors saw a practically universal standardisation of voice coils at eight ohms. It must be emphasised that voice coil impedances are very nominal and are specified in the region 400 - 1000Hz where they are lowest. At other parts of the spectrum, where even the method of mounting and enclosing a speaker can alter its characteristics, impedances are often considerably higher.

Much of this impedance is made up of the resistance of the voice coil wire. As a rough rule of thumb, the nominal voice coil impedance is only 30% to 50% higher than the DC resistance. For a speaker rated at eight ohms, this resistance is likely to be five or six ohms.

Maybe the existance of such a high proportion of unavoidable resistance in circuit should give a pause for thought to those hifi purists who consider that the only way to connect loudspeakers is by way of incredibly low resistance oxygen-free gold plated litz wire cables, heavy enough for a welder!

Loudspeakers are normally remarkably durable, and are considered by some experts to improve with age. Nevertheless they do have their problems, and next month we will look at some of these. We'll also provide some hints on their care, repair and feeding. ❖

VINTAGE RADIO



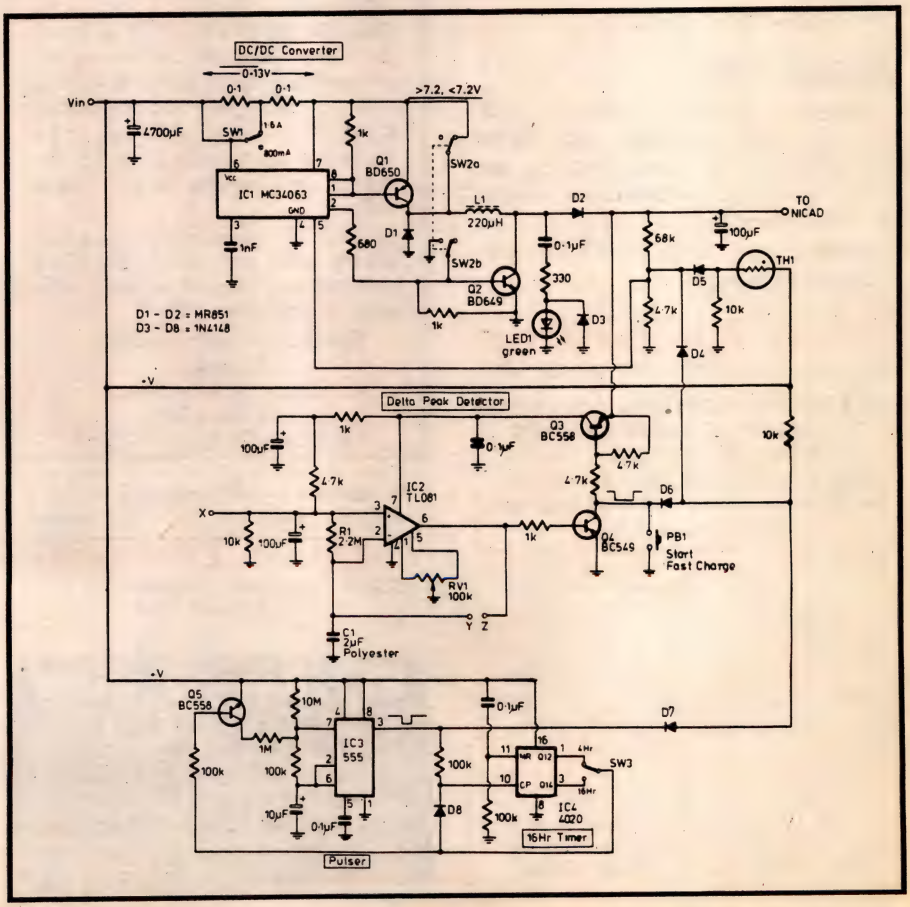
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NOTES AND ERRATA

Circuit and Design Ideas (March 994): The schematic diagram for the Inlligent battery charger on page 41 is issing a number of connections and omponents on the right hand side. Ve've reproduced it here with all secons intact.

Playmaster Pro Series 3 Amplifier March 1994): The PCB code in the parts ist on page 60 should read 93ma12 — he same as the published PCB pattern.



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The Dawn of Australia's

RADIO
Broadcasting

One of the latest books to be published under the banner of Electronics Australia.

Written by Philip Geeves, OAM, FRAHS, almost 10 years ago, it transports the reader to the beginning of broadcasting and outlines the roles played by technical pioneers, religious sects, individual personalities and politicians.

Mr Geeves' writing reflects the vast amount of historical knowledge and experience he had gathered during his years in the industry.

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

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50 and 25 years ago...

'Electronics Australia' is one of the longest running technical publications in the world. We started as 'Wireless Weekly' in August 1922 and became 'Radio and Hobbies in Australia' in April 1939. The title was changed to 'Radio, Television and Hobbies' in February 1955 and finally, to 'Electronics Australia' in April 1965. Below we feature some items from past issues.

May 1944

Television programme: WRGB, General Electric's television station in Schenectady is now operating on a telecasting schedule of four evenings each week, according to programme manager, Robert B. Stone.

WRGB telecasts on Sunday from 7 to 9pm; Monday from 8 to 10pm (relay from NBC in New York City); Thursday and Friday from 8 to 10pm.

In general, the Sunday, Thursday and Friday shows consist of one hour of film and one hour of studio presentation. The first hour on Sunday takes the form of a studio show of interest to children.

German 45-ton plane: The German transport plane, Bloehm and Voss 222, some of which have been shot down over the Mediterranean, is probably the largest aircraft of its kind in the world. It has six engines and is capable of carrying 80 fully armed men. It is much larger than the Lancaster and the Flying Fortress.

Fully loaded the machine weighs about 45 tons. Its cruising speed is 150mph, with a top speed of 190mph at 10,000ft.

May 1969

Satellite communications: A new system designed to make more efficient use of communication satellites was demonstrated recently between the UK earth terminal at Goonhilly and the earth station at Etam, USA.

The system, known as SPADE, was developed for the International Telecommunications Satellite Consortium (Intelsat) by its managing company, Com It uses a technique called demand signment which allows unoccupied cuits to be allocated to any route wh they are needed. The existing sys used by Intelsat, allocates a fixed bl of circuits to each route.

Ceduna radio sation: A natio mediumwave broadcasting station is be established in the Ceduna/Strea Bay area of South Australia. The stat should serve about 8000 at Cedu Streaky Bay, Penong, Wirrula, Minni Poochera and Elliston. The daytime s vice should extend even further alo the Eyre Highway to Eucla.

Superconducting motor: A superco ducting electric motor, producin 3250hp at 200rpm, has been develop by International Research & Develo ment Co Ltd., (IRD) of Newcastle-o Tyne, England. It will be used in a ne oil-fired power station to drive a coolin water pump.

The IRD motor is basically a simp homopolar machine, but new principle permit higher voltages to be used tha with previous motors of this type. Th field winding uses 5.25-tons c niobium/tantalum/copper composite su perconductor and is coupled with closed circuit helium refrigerator. ❖

EA CROSSWORD

ACROSS

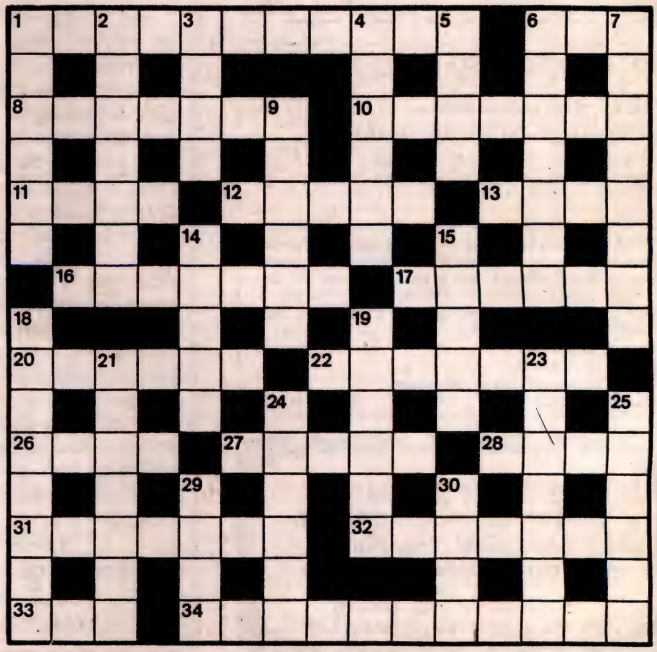
1. Type of light tube. (11)
6. A gate term. (3)
8. Again indicate proportions or values. (7)
10. Repeat a fitting process in circuit building. (7)
11. Said of distant space. (4)
12. Figurative representation of related data. (5)
13. Group of three. (4)
16. Bands of colour. (7)
17. Said of tetravalent state of element 92. (6)
20. Opposite to affirm. (6)
22. The ---- lamp burned acetylene. (7)
26. Initials of the international agency of atomic energy. (1,1,1,1)
27. Size of screw. (5)
28. Respected brand of hi-fi music systems. (4)
31. Transmit in a faulty manner. (7)
32. Tubes carrying cables, etc. (7)
33. Acronym for disk operating system. (3)
34. Said of objects emitting light in subincandescent state. (11)

SOLUTION FOR APRIL 1994

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DOWN

1. Units of electric capacitance. (6)
2. Not scanned by radar, etc. (7)
3. Obtain and transfer data from a store. (4)
4. A satellite of Jupiter. (6)
5. Igor ----, co-discoverer of the Cerenkov effect. (4)
6. Subatomic particle. (7)
7. Operate contrary to previous action. (8)
9. Archimedean exclamation! (6)
14. Heinrich ----, helper to Hermann Helmholtz. (5)
15. Item of testing equipment. (5)
18. Having full illumination. (8)
19. Coupled for simultaneous operation. (6)
21. Lubricates. (7)
23. Quartz is such a substance. (7)
24. This is initially in RAM. (6)
25. Massive force? Possibly! (6)
29. Region in mobile telephone network. (4)
30. Operates functionally. (4)



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APPLE UNVEILS FIRST MACS USING POWER PC RISC PROCESSOR CHIP

'SMART CHARGER' FOR SEALED CELLS USES A MICRO TO CONTROL CHARGING CURRENT



RUGGED NEW 'TEKMETERS' FROM TEKTRONIX FEATURE AUTORANGING 5MHZ DSO CHANNELS, 'DYNAMIC DISPLAY DSP' FOR FAST UPDATING

NEWS HIGHLIGHTS

SIMPLIFIED VCR PROGRAMMING

Philips Consumer Products has launched in Australia a device known as 'G-Code', which is designed to simplify programming of consumer videocassette recorders. Developed in the USA by Gemstar Corporation and marketed there since November 1990 as the 'VCR+', the unit is now also widely used in the UK, Canada, France, Germany, Japan, Korea and New Zealand. It is manufactured in China.

Operation of the user's VCR by the G-Code device is quite independent of the recorder's own inbuilt timer, and therefore not affected by power interruptions prior to the ti of recording. Once set up to suit the user's VCR make a model, the G-Code unit is programmed simply by keying a single multi-digit code number for each TV programme it desired to record. The unit then turns the VCR on and off record this programme, using the normal IR remote sensor a control circuitry.



The multi-digit code numbers keyed into the G-Code u to program it for any desired program are randomised using Gemstar proprietary algorithm, and the company supplies t codes required to licensed magazines and newspapers, for pu lication and use by G-Code owners. In Australia, the magazi *TV Week* is currently the only publication licensed to publi the numbers, so for the present at least owners will need buy this magazine each week in order to have access to t codes to program their units.

Operating for approximately 12 months from four AAA-siz alkaline cells, the G-Code unit is compatible with 90 differe brands of VCR and is readily 'taught' the specific model i volved. IR transmitting LEDs in each corner of the case, an also underneath, allow it to control the VCR from almost an position near it. The unit carries an RRP of $129.

Philips Consumer Products is the exclusive distributor of th G-Code unit in Australia, and has set up a telephone 'hot lin to assist users with any problems.

QLD ELECTRONICS EXPO & CONFERENCE

The Queensland Electronics Development Association (QEDA) is holding its annual Trade Exhibition and Conference at the Exhibition Building, RNA Showgrounds, Brisbane on May 4th (10am - 8pm) and 5th (10am - 5pm).

This year the show is being enhanced by a series of seminars. The Australia Electronics Development Centre will hold a conference with the theme of 'The Future of the Electronics Industry in Queensland'. In addition there will be feature displays from high-tech manufacturers in Queensland, and displays of new technology such as virtual reality.

Product areas on display at the show include test and measuring instruments, components, cables and connectors, soldering and desoldering equipment, tools and hardware, power conditioners and optical fibre products. Tertiary education bodies will also be providing information on the currently available courses.

More information is available from QEDA, PO Box 1065, Fortitude Valley, Qld 4006; phone (07) 839 1705, or fax (07) 832 4912.

LUCKY WINNERS OF THE HP DSO'S

During the period of October 1993 - January 1994, new and renewing subscribers to *Electronics Australia* were given the opportunity to win one of two superb Hewlett-Packard HP54601A four-channel Digital Sampling Oscilloscopes, which feature 100MHz bandwidth plus the 'look and feel' of a conventional analog instrument. Complete with the optional HP54658A Fast Fourier Transform/Measurement Storage modules, each instrument was valued at $6173 — giving a total prize value of over $12,000.

By sheer coincidence, the lucky winners of these instruments were both Queenslanders: Mr J. Lennon, of Loganholme, and Mr G. Demaine of Southport. Both readers have now received their prizes, together with our congratulations. We trust that by now they will putting their HP54601A's to good use.

INTEL OPENS FAB PLANT IN IRELAND

Microprocessor industry leader Int has opened its newest and most moder chip fabrication facility in Leixlip Ireland (a suburb of Dublin). Known a Fab 10, the plant is Intel's largest, an this year will produce millions of Pen tium and IntelDX4 processor chips.

"Adding Fab 10's production to th other three Intel factories building Pen tium processors will pump millions o units into the marketplace this year, an continue to drive Pentium processor based PCs down to very attractive prices", said Craig Barrett, Intel execu tive vice president and chief operating officer. "Over the course of the year, we plan to double the amount of computing power people can buy at key given PC price points."

Intel has invested US$750 million to build and equip the new plant, as part of the company's US$7 billion, five year capital expansion program. Construction began in December 1990.

At the recent IEEE Solid State Circuits Conference in San Francisco, Intel demonstrated and released details of an

a-fast version of its Pentium chip. new version runs at 150MHz, over ce the speed of the current 66MHz test Pentium.

The new 150MHz Pentium uses Intel's micron process technology, and uses r-layer metal technology which contributes to performance by reducing die ea, clock skew and voltage. It is a CMOS device superscalar design mprising 3.3 million transistors, runs 3.3 volts and dissipates only 4W of wer at 100MHz. It has a MIPS rating 250.

USTRALIAN RADIO ISTORY PROJECT

Once Upon A Wireless Limited is a n-profit company formed by the ustralian radio broadcasting industry, part of a project to record the history our commercial radio industry. It has oncentrated on conducting recorded terviews with people who have orked in the industry and who were sponsible for its birth and develop- ent, to capture their reminiscences and ersonal anecdotes.

To date some 45 pioneers have been terviewed by a team of volunteers, and he recordings lodged for preservation at he National Film and Sound Archive in anberra to serve as a research source or teaching institutions and other inter- sted people.

The Company would appreciate any ssistance, either financially or other- vise, available from people interested in his worthwhile oral history project. It is n the Register of Cultural Organisa- ions, and is able to offer tax deduction tatus for any financial donation over $2.

Further information is available from Brendan Horgan, a Director and Com- any Secretary, Once Upon A Wireless td, 28 Patrick Street, Willoughby, NSW 2068; phone (02) 417 7240, or fax (02) 417 7258.

C OBVIATES NEED FOR SCREWDRIVERS

Sanyo Electric in Japan has developed an LSI 'TV signal processor' chip which when built into a TV receiver can automatically make adjustments to some 15 different performance parameters, using an inbuilt digital interface, non-volatile memory and D/A converters. Receivers incorporating the new LA7610 device can thus be automatically set up on the production line, without any of the traditional manual adjustments using screwdrivers or other tools.

On the production line a high definition TV camera monitors the picture on the receiver's screen, and a computer then analyses this image and determines which adjustments need to be made. The appropriate instructions are then fed to the LA7610 chip inside each set, via its serial interface, and the chip is then able to optimise receiver performance. Information gathered by the camera and computer system can also be used to fine-tune component values and tolerance, and to develop production statistics.

Parameters which can be adjusted by the LA7610 include detected video and audio signal level, luminance and chrominance channel frequency response, Y signal delay time, white balance, horizontal scan frequency and drive level (pulse duty cycle), and horizontal position (phasing). The chip also handles the usual controls required for user adjustment, including brightness, contrast, colour hue and saturation, sharpness, video/audio switching and stereo volume.

The LA7610 chip is said to contain approximately 11,000 transistors, and includes some 46 D/A converters and other digital circuitry as well as the usual analog circuitry required for TV signal processing from IF input to stereo audio and RGB colour drive signal outputs. Its

APPLE UNVEILS POWER MACINTOSH



Apple Computer has unveiled what it claims is the 'wave of the future' in computing: Power Macintosh, a new generation of Macintosh personal computers which puts the advantages of the PowerPC microprocessor into desktop personal computers for the first time.

The PowerPC family of RISC microprocessors, developed jointly by Apple, IBM and Motorola are intended to create the foundation for the future of personal computers. The PowerPC streamlines the internal workings of the computer, offering significant performance increases and new capabilities, while preserving compatibility with existing software and peripherals.

"The alliance of Apple, IBM and Motorola has produced not just a new RISC architecture, but a new level of performance for personal computers" said Apple Computer Australia marketing director David Rigg.

"PowerPC is a mainstream standard backed by major vendors, with a scalable architecture which will be used in all Macintosh systems. Up to now, RISC technology has been restricted to systems for high end users. PowerPC is the first to harness the latent power of RISC technology for personal and business computing applications, and Apple Computer is the first manufacturer making RISC available as a desktop personal computer with Power Macintosh," Rigg said.

Over time, Apple plans to move its entire Macintosh product line to RISC technology, while ensuring compatibility with existing Macintosh hardware and software. Power Macintosh offers capabilities such as speech recognition, text-to-speech and telephony without the need for extra hardware in the computer.

The transition from Macintosh to Power Macintosh will be transparent. Power Macintosh uses Macintosh System 7, and has the same user interface as today's Macintosh. These new models look, act and feel like a Macintosh, so current users require no retraining. The thousands of applications already available for the Macintosh also run on Power Macintosh.

Applications specifically written for PowerPC systems will run two to four times faster than the same applications running on today's Motorola 68040 and Intel 80486 systems. The speed of common computer tasks such as recalculating spreadsheets and drawing graphics is significantly enhanced.

Prices for the six new Power Macintosh models range from $3995 for a 6100/60 with 8MB of RAM and 150MB HDD, to $10,995 for an 8100/80 with 16MB of RAM and a 1GB HDD.

line technology for fabricating mixed analog/digital circuitry with a high level of integration. Field servicing and adjustment of a receiver using the LA7610 can be performed using a microcomputer to access and reprogram the chip's non-volatile memory.

ULYSSES REACHES UNEXPLORED REGIONS

NASA's Ulysses spacecraft — on its way to explore the polar regions of the sun — has become the first spacecraft to reach further south than the most southerly dip of the sun's magnetic equator. In this previously unexplored region, Ulysses observed that the fast moving stream of charged particles, called the solar wind, is twice as fast, but less dense, than near the sun's equator.

Measurements from Ulysses's solar wind plasma experiment showed wind speeds of about two million miles per hours (800 kilometres per second) in this previously uncharted region of space, twice the speed at which the solar wind is known to flow in lower latitudes.

The sun's magnetic equator is tilted and also characterised by a sheet of current extending into space. The current sheet rotates with the sun and has folds like the skirt of a whirling ballerina. Ulysses is now south of the folds of this current sheet.

"This change in speed coincided with the spacecraft's passage south of a sheet of electrical current," said Dr Edward J. Smith, NASA project scientist on the joint NASA-European Space Agency (ESA) mission. "This current sheet separates the solar wind that originates in the northern solar hemisphere from that originating in the southern hemisphere."

Ulysses is measuring the magnetic fields and waves and ionised gas flowing from the sun, particle radiation, radio waves, x-rays and gamma rays and dust in its highly inclined elliptical five year orbit around the sun. It is now about 45° south solar latitude and will reach over 80° south latitude for the first time late this year, and a maximum northerly latitude in 1995.

SERG'S 30TH ANNUAL CONVENTION

South Australia's South East Radio Group (SERG) is holding its 30th annual amateur radio convention, over the weekend of June 11-12, 1994. The Group claims that this makes the convention the longest continuously-run event of this type in Australia.

Particular emphasis this year will be placed on the Australian Fox Hunting Championships, and on the 'Home Brew' Competition. For the past few years the focus on Home Brew has been increasing significantly, due to prizes donated by an anonymous supporter. However the number of entries has not as yet increased to match, and the Group is inviting more people to submit their home built equipment. To encourage beginners there are three separate categories, ranging from No to Expert.

Further information is available f the Convention Coordinator, SERG, Box 1103, Mount Gambier, SA 529

UNSW HELPS INDIA WITH SOLAR ENERGY

The University of NSW was selec by the Ministry of Health and Fam Welfare as the one non-Indian organi tion to participate in a recent seminar India exploring the use of solar ener

As a result of the seminar, a collabo tive agreement will be signed betwe the Indian Health Services Consultat Corporation and UNSW Unisearch L The agreement will draw on the exp tise of Solarch, the Centre for Photov taic Devices and Systems and oth UNSW solar energy specialists.

The involvement of UNSW has gro out of an Indian community heal project that was funded by AIDAB (t Australian International Developme Assistance Bureau) and managed by t Unisearch Professional Educati (IPACE) in association with UNSW School of Community Medicine.

Links between UNSW and India ha also been assisted by the long collabor tion between CEL, India's Centr Electronics Laboratory at Bangalore, ar UNSW's Centre for Photovolta Devices and Systems.

For many years, CEL has been th largest photovoltaic cell manufactur in the developing world, using techno ogy developed at UNSW. CEL will soc be producing higher efficiency burie contact photovoltaic cells, als developed at UNSW.

AWARD FOR WESAT STATIO

Australian technology designed t keep meteorological satellites in geost tionary orbit has won a Federal Gover ment sponsored technology productivit award. Bureau of Meteorology engineer say the new weather satellite ground sta tion at Crib Point outside Melbourn operates at around one fifth the cost o the equipment it replaced.

The Secretary of the Department o the Environment, Sport and Territories Mr Stuart Hamilton, received a Govern ment Technology Productivity Silve Award on behalf of the Bureau at a func tion in Canberra. The award recognises productivity gains achieved by govern ments through computer and com munications technology.

The Turn Around Ranging Station (TARS) blends into bushland nea



ATUG 94, the 11th Telecommunications and Data Networking Exhibition, will be held in Melbourne at the Royal Exhibition Building from 3rd to 5th May. The exhibition is open from 9am to 6pm on Tuesday and Thursday, and from 9am to 7pm on Wednesday; admission is free to business people. A major feature planned is the ATUG Interop network, to allow demonstrations of data networking.

stern Port Bay, 75km from the ctromagnetic interference of Melrne. Each day it will automatically d signals which contribute to a ee station radio ranging system, asuring the precise position of a stationary satellite in orbit 36,500km r the equator. About four times a r, the location data are used to direct llite boosters which are fired to cort the orbit.

The award is for the $700,000 station ich will serve China's first geostationy meteorological satellite, Feng-Yun 2. sister station is about to open to place the outdated equipment which rves the Japanese geostationary teorological satellite GMS4.

The Director of Meteorology, Dr John lman, says the satellite ground station a significant Australian contribution to e World Meteorological Organisation's orld Weather Watch. Under this system untries like Australia receive daily eather satellite data without having to vest directly in the $300M-plus cost of unching a meteorological satellite.

The new TARS is safer, cheaper, more liable and more efficient than existing cilities. Featuring Australian innovaons in microwave technology, it was ilt under tender contract by MITEC ustralia of Brisbane and Sencon Enronmental Systems of Melbourne, to esigns by John Beard and Michael enny of the Bureau of Meteorology's atellite Section.

IDEO SYSTEM FOR LUMINIUM PLANT

Thomas Electronics of Australia ecently installed a video distribution ystem (VDS) at Comalco Aluminium's lant in Yennora, NSW. The VDS rovides a high quality video signal to ıe coil operator's position from the ıill's process control computer, located ome 75m away. The coil operator's ork requires him to see what is physially happening on the coil machine, hile being able to view the computer isplay of the overall operation of the olling mill.

The VDS from Thomas Electronics eplaced a previous system which was ourced from overseas. The latter proved nsuitable as it was badly affected by the lectrical and magnetic environment of he plant.

Mr Nenad Pavic, Control Systems Engineer at Comalco was delighted with he results of the new VDS. "Our old system was unreadable, while the new one is crystal clear," he said.

Thomas Electronics' video distribution systems are being used to drive analog signals from two or more outlets, called slave units, from a master computer. A standard VDS supports up to 12 slave units; with the addition of an external power supply. This can be increased to 20 units. The systems were designed and manufactured in Australia.

NEWS BRIEFS

- ***Independent Information Technology Training*** is running a Network Cabling Design course at Sydney and Melbourne. The dates are Sydney (1994) August 10-12, Melbourne May 23-25 and November 16-18. For details phone (02) 252 2844, fax 247 1048.
- Hayes Microcomputer Products has opened an office in Sydney under the name of ***Hayes Microcomputer Products (Australia)***. They can be contacted on (02) 959 2340.
- AMES Agency, suppliers of specialised tools to the electronics industry has appointed Perth based ***RQR Products*** as its sole agent in Western Australia. The phone number is (09) 227 5645.
- ***The 19th Australian Conference on Optical Fibre Technology (ACOFT)*** will be held in Melbourne, December 4-7 (1994). Closing date for submission of papers is August 26, 1994. For further information, contact Conference Secretary, IREE Head Office, PO Box 79, Edgecliff 2027; phone (02) 327 4822.
- ***The 11th Telecommunications and Data Networking Exhibition*** will be held on May 3-5 (1994) at the Royal Exhibition Building, Melbourne. For more information, phone (03) 429 6088.

MAXIM BUYS TEK'S IC PLANT

Tektronix, Inc. and Maxim Integrated Products, Inc. have announced that Maxim is to acquire Tektronix' Integrated Circuits Operation (ICO). In addition the two companies have reached an understanding to form a joint venture for the operation of Tektronix' Hybrid Circuits Operation (HCO).

The ICO transaction would involve the purchase of assets and facilities for an undisclosed amount of cash and a long term agreement for Maxim to supply components to Tektronix. Maxim would also continue to supply integrated circuit products to existing Tektronix customers. The hybrid circuit joint venture also would supply products to Tektronix, as well as Maxim and other customers.

Upon completion of the transactions, Tektronix ICO and HCO employees would be offered employment with the new operations, to be based in the current Beaverton, Oregon location.

POWER TECH ACHIEVES AS3901

Melbourne power electronics manufacturer was recently accredited by the Standards Australia Association (SAA) to Australian Standard 3901, as a Quality Endorsed Company. Power Tech's accreditation to AS3901, equivalent to the International standard ISO9001, recognises the company as a quality approved manufacturer of the highest order, encompassing its systems and management from design of the product, product documentation, vendor selection and auditing, through to manufacture, testing and despatch.

Power Tech's Managing Director Mr Peter McLoughlin says he is committed to his company's sound Quality Assurance and environmentally sound practices. Mr McLoughlin added that achieving AS3901 would assist Power Tech in supporting its major OEM clients, and opening more opportunities for export. ❖



CAMNET, a 'telepresence' system developed by British Telephone Laboratories, allows experts to see problems at one end of a telephone line and give advise for their solution. Until now, it's only been available where telephone lines reach — but now ETL has developed a satellite link for the system as well.

First Australian 'hands on' report:

New handheld DMM/DSO from Tek

Tektronix, best known for its high-end oscilloscopes, has released the first models in a new range attractively priced, handheld 'TekTool' instruments. The new TekMeters combine a 3-3/4 digit tru RMS reading digital multimeter with either a single or two-channel sampling scope, all in a compa and easy to use handheld package. And Tek seems to have designed these first models primarily f an often-forgotten group of users: industrial electronics technicians.

by JIM ROWE

In the 'good old days', people working in industrial electronics didn't need too many instruments; you could often get by with little more than a good multimeter. But in modern industry with its programmable logic controllers, microprocessors and microcontrollers, variable-speed AC drives, data loggers, D/A and A/D converters, LANs and so on, those days are well and truly gone. At the very least you also need a calibrated oscilloscope, and preferably one with single-shot and storage facilities — like a DSO (digital storage oscilloscope).

Unfortunately traditional cathode-ray tube scopes are relatively big and bulky, and not really very convenient for lugging around an industrial plant. No doubt that's why in recent years firms like Leader Instruments and Philips/Fluke have developed compact hand-held DMM/DSO instruments with liquid crystal display (LCD) panels. There's no doubt that this type of instrument is going to play an increasingly important role in any kind of electronics field work, in the future.

The latest of the established test equipment makers to address this area is Oregon-based Tektronix, which has just released a trio of instruments — announced as the first models in an ongoing family of new, relatively low priced and compact 'TekTools' intended for use in the field rather than Tek's traditional marketing area, the R&D lab. Called TekMeters, to emphasise their down-to-earth emphasis, the new THM550, THM560 and THM565 are also being promoted in Tek's advertising as 'the newest tool of the trades'.



All three models look very simila and combine a 3-3/4 digit true-RM reading DMM with a DSO sharing th same 120 x 60mm super twisted LC panel (but not the same input jacks The lowest-cost model 550 provide only a single-channel scope, while th two other models provide two channel the 565 has other features as well, in cluding an event clock, electrolumines cent backlit display, extended memor and motor test facility.

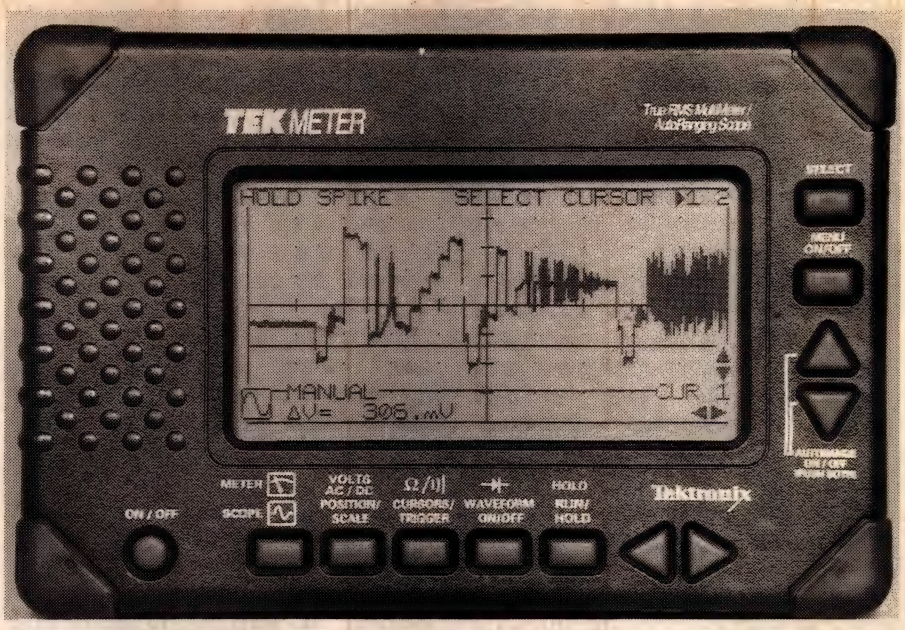
Unlike the Philips/Fluke 'Scope Meters', which have vertical 'portrait shape rather like a enlarged version of standard handhel DMM, the Tek Meters have horizontal 'land scape' format an measure 211mm wid by 141mm high b 43mm. The case i moulded in tough im pact-resistant black plastic, and is fitted with clip- on rubber shock absorption pads on each corner. The overall weight is only 1kg, 40% less than the ScopeMeters, and the case also has a pattern of dimples moulded into the surface at one end to allow you to hold it securely using one hand (your left one — sorry about that, left-handed users).

All inputs to the in-

ents are on the 'top' of the case, our colour-coded banana jacks. e are all recessed and shrouded, for mum safety. From the left the jacks e 560 and 565 are labelled DMM COM (black), CH1 (yellow) and (blue); fairly obviously the first are used for DMM operation, and ast three for DSO operation. These els come with four matching ur-coded test leads with integral le-point prods, with spring-loaded adaptors; presumably the 550 es with only three of these leads.
wer for the instrument comes from AA' size cells, which fit into a com- ment in the rear. With alkaline cells battery life is about five hours, but a f rechargeable NiCads with charger ailable as an option.

a DMM

ne DMM side of the TekMeters cer- y qualifies for the description '3-3/4 ts', as on most ranges the full-scale ling is 4000 (3999). The exceptions the top DC voltage range, which ls to 850, and the top AC voltage ge which has an upper limit of 600. main readout is via 12mm-high ts on the high-contrast LCD panel, h a secondary 32-segment 'bar ph' analog scale underneath. Smaller ts and letters (3.5mm high) are used indication of units, derived quan- s, etc.
he basic DMM measurement ctions provided are DCV, ACV, istance/continuity and diode test. rrent and power measurements are sible using optional clamp-on cur- t probes. All three models also pro- le 'maths' functions such as nimum, maximum and max - min cal- ation, and also the ability to both old' a reading and compare current dings with it (ΔHold).
here are five DC volts ranges, with R values spanning from 400mV to OV and resolutions from 0.1mV to . Rated accuracy is +/-(0.5% of read- g + 5 counts), with a 50/60Hz rejec- n of better than 60dB. For AC volts ere are also five ranges, with FSR lues from 400mV up to 600V and the me resolutions as before. Here the ed true-RMS accuracy is +/-(2% of ading + 5 counts), for a 50Hz or 60Hz newave or a non-sinewave signal with crest factor of less than three.
For resistance there are six ranges, ith FSR values in decade multiples om 400 ohms (resolution 0.1 ohm) to OM (resolution 10k). Rated accuracy or the five lower ranges is +/-(0.5% of ading + 2 counts) with the highest



A close up of the THM565 TekMeter in DSO mode, displaying the VITS lines in a received TV signal. The LCD screen has high readability.

range derated to +/-(2% of reading + 5 counts). The continuity function displays a 'closed switch' graphic when the measured resistance is less than 50 ohms, and also produces an audible tone (which can be disabled if you wish). The final 'diode test' function can be used to display a diode's voltage drop on a 0 - 2V scale, and thus allows both the diode action and forward resistance to be tested.

The DMM side of the instrument has auto ranging, but this can easily be over-ridden for manual range control if you wish.

The DSO side

Pressing a single function key changes the TekMeter to its alternative 'personality' as a DSO. Here almost the complete 256 x 128 pixel LCD becomes a 250 x 120 pixel bit-mapped scope screen, with 10 x 8 major graticule divisions and various legends added along the top and bottom.

Each channel of the 560 and 565, and of course the single channel in the case of the 550, uses an 8-bit digitiser operating at up to 25MSps (megasamples per second). The record length (i.e., sample memory) is 256 samples, just slightly longer than the display width. Tektronix apparently designed a special proprietary ASICchip to follow the digitisers, based on the technology its engineers developed for the high-end TDS scopes. The digitisers in the two-channel models operate simultaneously and provide a basic DC accuracy of +/-(3.5% + 2 pixels) over the temperature range 19 - 27°C.

Each vertical channel has six sensitivity ranges, spanning from 5mV to 500V per division in decade steps. The basic analog bandwidth is DC - 5MHz, but the top end is derated to 1MHz for the 5mV, 5V, 50V and 500V/div ranges. Maximum input voltage is +/-(600V RMS + 6kV surge). Input impedance is 1M in parallel with 10pF, and there's a choice of either AC or DC input coupling as well as 'normal' or 'inverted' display.

The timebase has some 26 ranges, spanning in 1/2/5 steps from 200ns per division down to a s-l-o-w 60s/div. There are a variety of triggering modes, including 'Auto level' (which is the default mode in AutoRange operation) and 'Auto', plus manual and single shot. Both DC and AC trigger coupling are available along with positive or negative slope selection, and the trigger sensitivity is adjustable over a wide range. Spike detection circuitry allows the capture of spikes down to 40ns wide, at all sweep speeds.

A feature of the DSO section of the TekMeters is 'dynamic display DSP', which provides up to 100 effective on-screen waveform updates per second, for an 'analog like' display.

There are two basic DSO operating modes, labelled 'Autorange' and 'Manual'. In Autorange mode, which is the default, the instrument automatically sets the vertical and timebase ranges and positions, to provide a stable display of between 30% and 60% of full scale. This is provided that it can be done with ranges of 50mV/div and 100ms/div, or above.

Handheld DMM/DSO from Tek

The autoranging occurs every 500ms if the signal amplitude or period is changing.

The DSO switches into the alternative Manual mode automatically if you adjust any of the controls which alter the waveform display.

There are actually two other modes, both more specialised and specifically designed for industrial electronics users. 'Line Test' allows you to monitor the AC power line voltage, and check for variations in amplitude and frequency as well as triggering on spikes, notches and so on. 'Motor Test' is alternatively designed to trigger on PWM signals, of the type used in variable AC motor drives.

The DSO section of the TekMeters is provided with memory facilities for storage of measurement setups, waveforms and complete screens. The 550 and 560 models can store up to four setups, four waveforms and a single screen, while the 565 can store up to eight of each.

Like the DMM section, the DSO section also provides various maths and derived measurement options. For example you can have it measure maximum, minimum and peak-to-peak volts, as well as the frequency and period of periodic signals.

You can also measure the voltage difference between two moveable horizontal cursors, and the time difference between vertical cursors. With the two-channel models there's also the ability to display either the sum or the difference between the two channel signals.

When one of the optional current probes is used you can also obtain a calculation of the real power in a circuit (with current on CH1 and voltage on CH2), or the harmonic derating factor (THDF) for power transformers (peak current/1.414 x I_{RMS}, with current on CH1). These functions would again be very useful in industrial electronics.

Simple controls

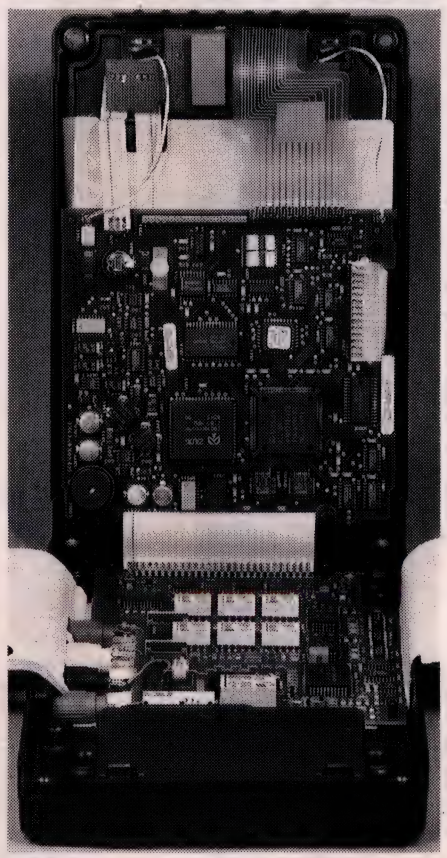
Operation of the TekMeters is simplified by the use of a menu-driven approach, involving very few actual controls. There are only 12 control buttons in all, one of which is the On/Off power switch at the lower left of the display.

Then directly under the display there are five rectangular buttons — a Meter/Scope button, and four other which are used for selecting various functions in both Meter and Scope mode. Simple colour coding makes it very easy to select the right button in either mode.

Near the lower right-hand corner of the display are two pairs of triangular buttons, one pair for right-left selection and the other for up-down selection. These are used for manual selection of timebase and vertical range settings, respectively, and also for X and Y positioning. The function of these buttons at any time is made clear by legends in the adjacent corner of the display.

Finally, on the upper right-hand side of the display are two further rectangular buttons which are used mainly for things like activating various on-screen menues, and selection of items from them. On the whole, then, the TekMeters are designed to be quite user-friendly, and do not require any previous experience with DSO's.

Optional extras for the TekMeters include a more elaborate set of probes, with silicone insulated leads and multi-way jaws; an RS-232C communica interface, for connecting the instru to a serial printer or computer; a N battery pack with charger; a choi three different clamp-on current pr and either a soft 'hands free' c pouch or a rugged transport case.



A look inside the TekMeter case. The analog input circuitry is on the board mounted in the case rear, in the lower part of the picture. Note the fold-out shielding strips.

Trying one out

Tektronix Australia very ki loaned us one of the very first TekM THM565's into Australia, so tha could conduct a 'hands on' trial on behalf. We found it a most interes instrument, and certainly one tha very easy to use in both the DMM DSO modes of operation.

The LCD panel provides a clear, contrast display in a wide range of li ing conditions, and the instrume light weight and compact form mak very convenient for making meas ments in many physical situatio (There's even a threaded 1/4" socke the rear, for attaching it to a stand photographic tripod.)

We checked its accuracy in DM mode against a newly calibrated 6 digit Yokogawa 7562 system DMM, a it turned in figures that were well wit the quoted specs. DC voltage readi were within 0.1%, AC voltage readi within 1.2% and resistance readi within 0.3%.

Similarly we checked the time a frequency calibration in DSO mo against our TV-derived reference, a also the vertical calibration against 7562. In both cases the TekMeter a peared to be accurate to well within effective working resolution of 0.5% time and 1% for amplitude. T measured vertical channel frequen response on the 500mV/div range w 5MHz (-3dB), with rise and fall times about 50ns.

Tektronix invited us to open up t sample 565 TekMeter to examine t construction, and we did so — once found an Allen key which would ma with the four socket-head assemb screws, located under the rubber corn protectors.

Inside we found a very nicely-mad assembly of two surface-mount PCB' linked with semi-flexible ribbon. Th analog circuit board is mounted insid the rear of the case, encased i fold-over shielding foil, while th digital circuit board is mounted insid the case front behind the LCD panel an control buttons.

The instrument appears to be contro led with a Zilog Z180 processor runnin at 25MHz, with what looks to be 1M of ROM firmware and a 256Kb stati

M. The DMM front end appears to based on a Maxim chip, while each nnel of the DSO front end has one of 's proprietary digitiser chips in a ll quad package. DSO range chang- is via subminiature SMT relays. All an elegant design and one that uld prove very reliable.

mmary

n the whole we really liked the M565, although we did have a few nor niggles. One was the apparently w response to control button press- , in DSO mode; sometimes there's te a pause before the instrument ms to respond.

We also noticed that the on-screen e measurements use a capital 'S' to present seconds, instead of the lower- se 's' as specified in the SI standard. e capital 'S' should strictly only be ed for the unit of conductance, the emens, although it's also commonly ed nowadays to represent 'samples' in gital systems.

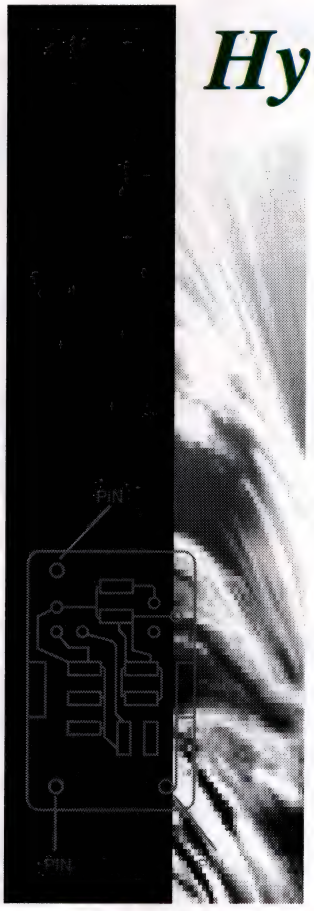
Finally, we were a little disap- inted to find that the TekMeters use rouded and recessed banana jacks r all inputs, making it a little dif- cult to use shielded input leads for w-level measurements. However e appreciate that this has probably en done deliberately with this first io of instruments, to ensure maxi- um safety when they're being sed for testing in high voltage in- ustrial circuitry.

Perhaps the answer to this one will be at Tek will hopefully be releasing her models soon, with input connec- rs more suitable for audio, video and ther 'low level electronics' applica- ons. I understand that other models *are* ndeed coming...

On the positive side, the current Tek- Meters are compact, rugged and very onvenient in use. With a performance nore than sufficient for industrial lectronics applications, they should be ery popular for anyone in this field who needs a really portable 'universal ester' DMM/DSO combination, and especially for people who as yet may have dismissed a DSO as 'too complex for me'.

Quoted prices for the new TekMeters are $1395 for the single-channel THM550, $1595 for the dual channel THM560 and $1995 for the enhanced dual channel THM565.

Further information is available from the Test & Measuring Products division of Tektronix Australia, at 80 Waterloo Road, North Ryde 2113; phone (02) 888 7066. ❖



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READER INFO NO. 19

Product review:

Statpower's 'smart' charger for 12V lead-acid batteries

Featuring switchmode power conversion circuitry and a microprocessor controlled charging cyc the 'Truecharge 10' is designed to recharge modern wet or gelled-electrolyte batteries in the ran of 25 to 200 amp-hours. It's compact, lightweight, can deliver a 10A charge current, and offers so very elaborate protection features.

by ROB EVANS

There was a time when the process of choosing a lead-acid battery charger really only involved selecting a unit with an appropriate power rating for your intended application — and perhaps being tempted by relatively sophisticated extras such as an output current meter or maybe an overload cutout device. There were only simple units available, and no one worried too much about pandering to battery characteristics.

Of course, these somewhat crude and bulky chargers are still with us today and probably will be for some years to come, since there's no doubt that they perform their intended role of recharging lead-acid batteries — albeit in a rather 'boots and all' fashion. With the advent of the new high-performance sealed lead-acid (SLA) batteries though, there is a need for a more sophisticated charger which will promote the service life of these comparatively fussy and often expensive devices.

The main problem with simple chargers is their tendency to over-charge the battery when it's left connected for an extended period, as is often the case. In this situation, the battery will begin to suffer a drop in electrolyte purity as the cells are forced above their so-called 'gassing voltage', where the electrolyte begins to break down into hydrogen and oxygen gases, thereby causing the cells to effectively 'dry out' over time.

Simple chargers tend to have a high off-load output voltage (that is, poor regulation), and will keep pumping current into the battery even when it's fully charged.

A charger with better voltage regulation is not really the answer either, as according to battery literature, the initial charging period as the cells rise to the gassing voltage will only restore around 75% of their charge. After that point, the charger really needs to supply the remaining charge at a much lower current, so as to avoid cell damage due to gassing. It therefore should switch into some form of current limited mode.

To further complicate the situation, circumstances often require a battery to be left permanently connected to a charger, so that the charge is continually 'topped up' and the battery is at full strength when it's called on — this is mostly known as a 'float' charge. While the charging current will be quite low in this situation however, the extended periods involved mean that the cells should be held well below (rather than near) their gassing voltage, to avoid any progressive deterioration of the electrolyte. In terms of a full charge cycle then, the charger must finally change to yet another mode where a reasonable charging current is available, but the terminal voltage is somewhat lower.

So the characteristics of a charger which is effectively and efficiently able to deal with the current breed of high performance lead-acid batteries are by no means simple, and go way beyond those of the ubiquitous 'car' battery charger.

And as you've no doubt gathered, Statpower's Truecharge 10 satisfies all of the above criteria, plus more...

The Truecharge 10

The first, and probably most noticeable aspect of this charger is that despite its healthy 10A maximum charge current rating, the circuitry is housed in a surprisingly small case (200 x 170 x 70mm, including mounting flanges), and the complete unit weighs in at only 1.6kg. This is no doubt thanks to the use of h frequency (around 80kHz) switchm techniques, to convert the 240V mains power into the low-voltage levels required.

As with computer power supplies an increasing number of other pov conversion devices, the switchmode cuitry allows the use of a very small lightweight 'inverter' transformer, wh in conjunction with modern switchi FET devices delivers the final DC out in a very efficient manner — around 9 in this unit.

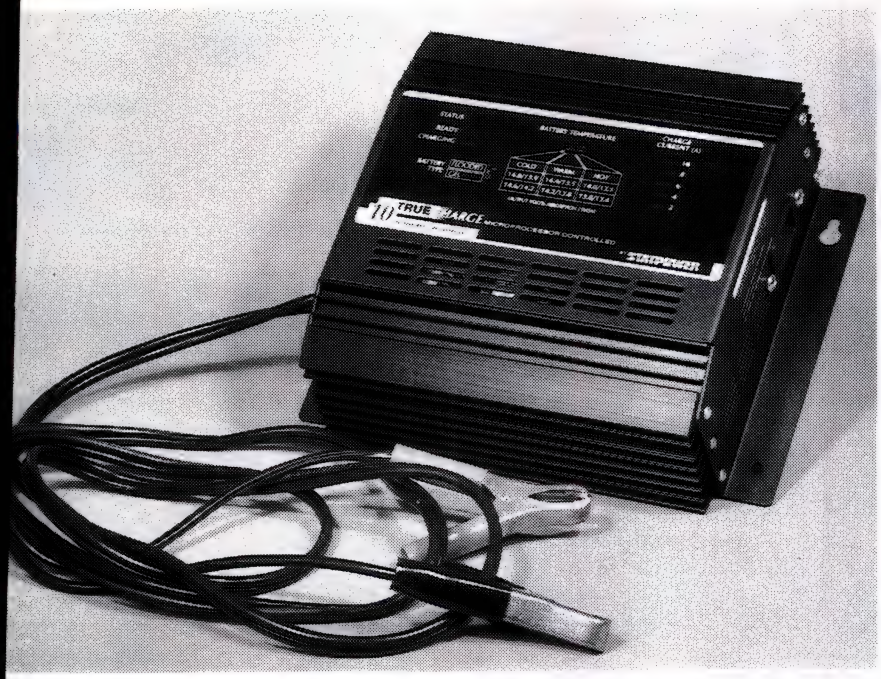
This system offers the further a vantage of *direct* control over the outp current and voltage, by simply varyi the pulse width modulation (PW process within the converter stage itse thereby maintaining a high efficien over the charger's full operating range. a more conventional but much less ef cient circuit, some form of 'smart' line regulator would be driven from a norm (50Hz) transformer-based DC supply.

So before any of the Truecharge 1 'intelligent' charging modes are co sidered, the unit appears to offer a co siderable advantage over more trad tional chargers, simply by the use of switchmode power conversion stage.

In practical terms this means that it small, light, quiet (none of the usu 100Hz 'hum' and 'buzz'), and delivers fully filtered DC output rather tha 100Hz pulses (which would have a lowe RMS value, and less charging effect).

Physically, the charger has a blac anodised case with the increasingl familiar integrated heatsinks at either sid to provide cooling for the internal switch ing MOSFETs.

It also has a top (as opposed to front control panel which has a five-stage LE



tput current meter, 'ready' and harging' status indicators, and switches set both the type of battery being arged and its current temperature.

The battery type switch is used to lect between those with 'flooded' (wet) 'gel' cells, while the temperature selec- allows you to choose between 'cold', varm' and 'hot' conditions, where varm' covers the normal range of 10°C 27°C. These switch settings ultimately fect the unit's charging characteristics, redefining the expected cell gassing oltage — which not surprisingly, is dif- rent for each cell type and will alter ith temperature.

When AC power is applied to the ruecharge 10, the unit first limits the vailable output current to around just 5mA, which both provides short rcuit protection and greatly reduces ie possibility of sparks occurring s a battery is connected. This is an nportant consideration, as batteries an produce highly-flammable ydrogen, and in a marine environment xplosive fumes can build up within a oat's engine compartment.

After a battery has been connected, he unit then checks the terminal voltage nd will only proceed to its full-current harging mode if the battery level is be- ween 5V and 13V. The idea here is that f the voltage is above 13V the battery eeds little more than a float or trickle harge, and a terminal voltage of less han 5V means that the battery is com- pletely exhausted.

In the latter case, the battery is supplied with a very low charging current (around 25mA) so as to avoid cell damage. Then if the battery is in a serviceable condition (no damaged cells), the terminal voltage will eventually rise to above the 5V threshold and full charging current can be applied.

Once these initial conditions have been satisfied and the Truecharge 10 has moved into its 'bulk' (full-current) charging mode, the unit then delivers its maximum current until the battery's terminal voltage reaches the cell gassing level, as defined by the front panel switches — say, 14.4V.

At this point the battery has received most of its charge, and the charger then transfers to what Statpower refer to as the 'absorption charge' mode. In this state, the charger holds the terminal voltage near the battery's gassing voltage while the charging current is steadily decreased. Then when the current has dropped to less than about one amp, the battery is considered fully charged and the front panel 'ready' indicator is activated — the unit then moves on to its final 'float charge' mode.

The Truecharge 10 then drops the terminal voltage to well below the selected gassing voltage (say, 13.5V) to prevent any chance of electrolyte loss or drying, and will remain in this mode unless the battery voltage drops below 12.5V or 21 days has elapsed. In this way, the charger will respond to a depleted battery charge through some short-term load, and force the battery through a periodic charge cycle so as to maintain the condition of the cells. A full charge cycle will also occur if either the battery or the AC mains is removed for more than about 30 seconds, by the way.

Besides its sophisticated charging sequences, the Truecharge 10 also offers a range of features which should make it suitable for just about any environment or installation.

As we've come to expect from switchmode power conversion circuits, the unit can cope with a large variation in the AC input voltage, dissipates little heat thanks to its high efficiency, and includes the usual high temperature shut-down feature. And as a nice touch, the charger's DC output is fully isolated, which ensures that there will no electrolysis problems when charging batteries on a boat.

In practice

When it came to trying out the Truecharge 10, we found that the unit met its specifications with ease and performed without fault. The most impressive aspect of the test was noting how the charger's internal microprocessor would sense the conditions at the unit's output, and change the output current capability and voltage level to suit. Whether there was a flat battery connected, a charged battery connected, an output short circuit, or no load present, the circuit always appeared to take the appropriate action.

The end result of this 'smart' circuitry is that the Truecharge 10 is very much an *automatic* charger, in every sense. You can connect a battery which might be in any sort of charge state or condition, and safely assume that the charger will apply the correct type of charge cycle, and not damage either itself or the battery.

So as you've probably gathered, we're quite impressed with Statpower's Truecharge 10. It's ideally suited to the latest high-performance deep-cycle SLA batteries, in the gel or wet cell format, and it will also do the best possible charging job of charging a standard (unsealed) wet-electrolyte automotive battery. It's electrically well protected, appears to be very rugged, and offers a compact size and efficiency that wouldn't really be possible with more conventional chargers.

Statpower's battery charger range also includes the larger Truecharge 20 and Truecharge 40, which are rate at 20A and 40A respectively, and offer the same level of sophistication as the Truecharge 10. Not surprisingly the Truecharge units are considerably more expensive than the simple and far less effective automotive type chargers.

The Truecharge models 10, 20 and 40 are priced at $670.34, $968.00 and $1243.88 respectively (including sales tax), and are available from Bainbridge Marine Pty Ltd, at 3/16 Veronica Street, Capalaba, Qld 4157; phone (07) 245 2033. ❖

Solid State Update

KEEPING YOU INFORMED ON THE LATEST DEVELOPMENTS IN SEMICONDUCTOR TECHNOLOGY

High density PLDs are fast

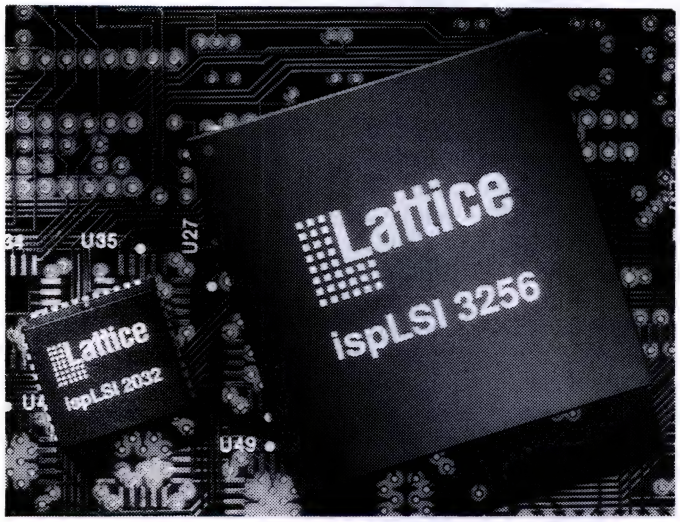
Zatek Components has announced two new families of high performance, high density programmable logic devices (HDPLD) from Lattice Semiconductor Corporation, the pLSI/ispLI 2000 and the pLSI/ispLSI 3000.

The pLSI and ispLSI 2000 family features system speeds up to 135MHz, allowing it to support 66MHz microprocessors, including the Intel Pentium. The pLSI and ispLSI 3000 family has a dedicated IEEE 1149.1 Boundary Scan capability and device densities up to 14,000 gates. The pLSI and ispLSI 2000 family suits speed-critical applications such as address decoders, small state-machines, processor bus interfaces, counter/timers and glue logic.

These devices are offered in a variety of packages including 44 and 84-pin PLCC, 44 and 100-pin QFP (for PCMCIA designs) and 128-pin PQFP.

The pLSI and ispLSI 3000 family offers system performance up to 110MHz, densities from 8000 to 14,000 gates, and IEEE1149.1 Boundary Scan test capability.

These devices will suit high performance, complex operations such as cache controllers, compression encoders, encryption/decryption and graphics functions. The 3000 devices are offered in a variety of packages including 128, 160 and 208-pin QFP, and 167-pin PGA.



For further information circle 276 on the reader service coupon or contact Zatek, PO Box 397, West Ryde 21 phone (02) 874 0122, fax (02) 874 617

16-bit 4Mb SRAM

Toshiba has announced its 4Mb SRA with a 16-bit structure. Mass product is scheduled to start in June, with an pected cost of US$180 per unit.

The TC554161 devices have a 25 word x 16-bit structure. They have 85ns access time and standby power co sumption of 6uA at 5V.

The new 4Mb SRAMs are expected be used in PDA, personal organise portable homes, point-of-sale equipme and other information equipment.

Operation noise is reduced using fo pairs of power supply pins. Since t basic design is a 256 x 16-bit structur there are 16 I/O pins. Such a high p count requires a high current, whic generates noise. Assigning four I/O pi to each pair of power supply pins reduc this noise.

With a 16-bit CPU operating wi software that uses 8-bit data transfe the SRAMs enhance operation b dividing its 16-bit signal into 8-bit signa and assigning read/write commands t each one.

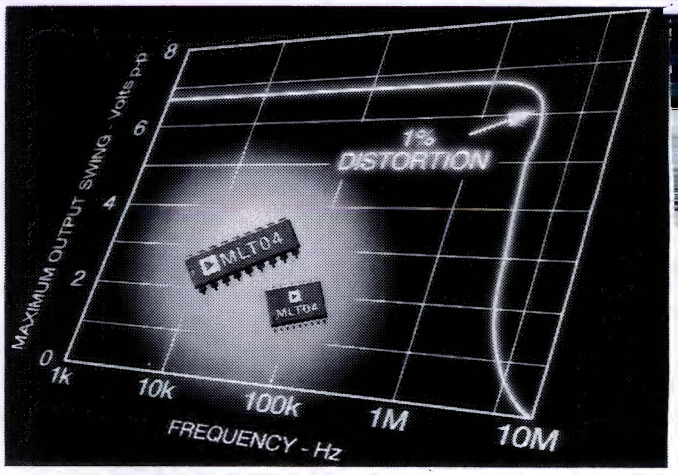
For further information circle 290 o the reader service coupon or contac Toshiba Australia, PO Box 350, Nort Ryde 2113; phone (02) 887 3322.

Four channel, four quadrant multiplier

Analog Devices' MLT04 is the industry's first monolithic four channel, four quadrant analog multiplier, designed for space constrained multichannel applications. For example, in high resolution CRT display systems, the 8MHz (small-signal bandwidth) MLT04 can generate polynomials for geometry correction.

The device can perform analog power calculations and multiplication. It can determine squares and square roots, and provide gain control and signal correlation. Packaged in an 18-pin DIP or SOIC, the MLT04 includes a stable 1.23V bandgap reference and individual output amplifiers. Each channel of the MLT04 accepts +/-2.5V inputs and delivers a normalised voltage output implementing a factory calibrated transfer function of W = (X x Y)/2.5V. With +/-5V supplies, typical power dissipation is only 150mW.

Nonlinearity error is typically 0.2%, with 0.005%/°C drift of total error over temperature. Slew rate and settling time are 53V/us and 1us respectively. The MLT04's Gilbert cell configuration and current feedback output amplifiers allow a +/-6V p-p minimum signal swing capability at 1MHz. Other applications of this device include voltage-controlled amplification, variable active filtering, 'zipper' noise-free audio level adjustment, and low frequency signal modulation.



For further information circle 271 on the reader service coupon or contact NSD Australia, Locked Bag 9, Box Hill 3128; phone (03) 890 0970.

Hz op-amps rated for 3V

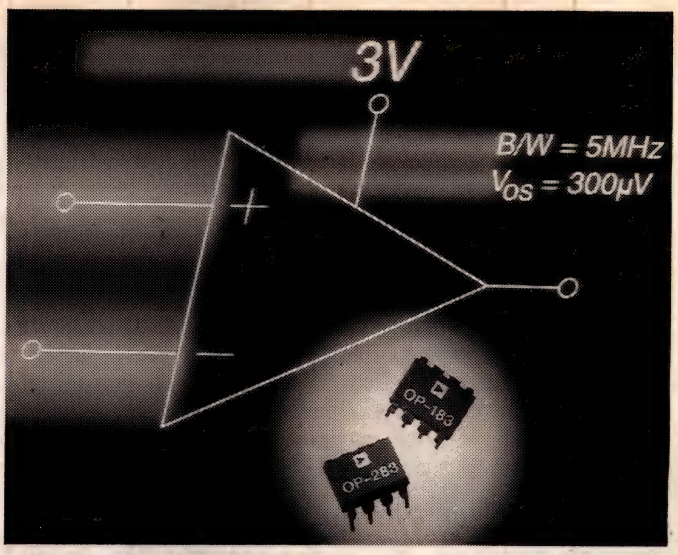
vo new 5MHz op-amps from Analog Devices feature +5V or +/-15V supply operation. The single channel 183 and its dual counterpart, the OP-283, offer guaranparameters.

r example, the devices guarantee maximum DC ifications such as 1mV input offset voltage (typically V), +/-50nA offset current, and 600nA input bias current cally 350nA).

sing a single +3V supply, the OP-183 and OP-283 will mmodate input swings from 0V to +1.5V and provide V/mV large signal voltage gain with 104dB common-e rejection. When operating from +5V or +/-15V sups, the op-amps offer wider input voltage spans with roved large signal voltage gain (1000V/mV at +/-15V).

he OP-183 and OP-283 require 1.5mA of supply current amplifier. They achieve 50kHz full power bandwidth, at 10V/us, and settle full scale signals to within 0.01% in s. Both devices are specified from -40° to +85°C and are sed in 8-lead plastic DIPs and SO-8 packages.

or futher information circle 273 on the reader service coupon or contact NSD Australia, Locked Bag 9, Box Hill 3128; phone (03) 890 0970.



EXFETs have w on-resistance

nternational Rectifier has introduced cost effective low on-resistance XFET power MOSFETs.

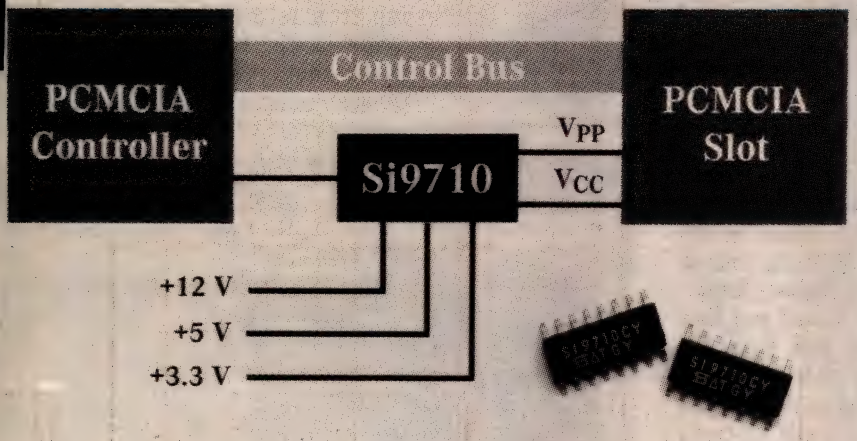
he 30V IRL2203 and 50V IRL3705 hannel devices are housed in the TO- package and feature an Rds(on) of 10 12 milliohms respectively. Both devices can operate from a 5V gate drive as well as the standard 10V.

The IRL3705 is rated at 50V over the full operating temperature range, making it particularly suitable for automotive applications, where a breakdown voltage at temperatures down to -40° is important.

Both devices offer the designer a reduction in component count or size in comparison with devices with higher on-resistance. This is particularly true when designs require paralleled MOSFETs. As an example, 12 IRLZ44s can be replaced by only seven IRL3705s, or, if the 30V rating is adequate, six IRL2203s.

The IRL2203 will find applications in synchronous rectifiers in 5V power supplies as well as DC-AC inverters, 12V battery UPS systems and other five to 12V applications. The IRL3705 is suited to automotive applications and certain DC-DC converters where only the 30V breakdown voltage of the IRL2203 is insufficient.

For further information circle 274 on the reader service coupon or contact NSD Australia, Locked Bag 9, Box Hill 3128; phone (03) 890 0970. ❖



CMCIA power witching ICs

The first device in a new series of 's for PCMCIA (Personal Computer, emory Card Industry Association) wer switching has been released Siliconix.

The Si9710CY, a monolithic PCMCIA wer interface switch has on-resistance low as 150 milliohms. Compliant with CMCIA standards, the device switches ther 3.3V or 5V to the Vcc pin in the mputer's PCMCIA slot.

Depending on the control inputs, it will switch 3V, 5V or 12V to the flash memory program voltage pin. The Si9710CY requires no external MOSFETs and reduces component count by eliminating seven power discrete and associated drivers. The device features ESD protection and a small outline, surface mount package.

For further information circle 272 on the reader service coupon or contact IRH Components, 1-5 Carter Street, Lidcombe NSW 2141; phone (02) 364 1766, fax (02) 647 1545.

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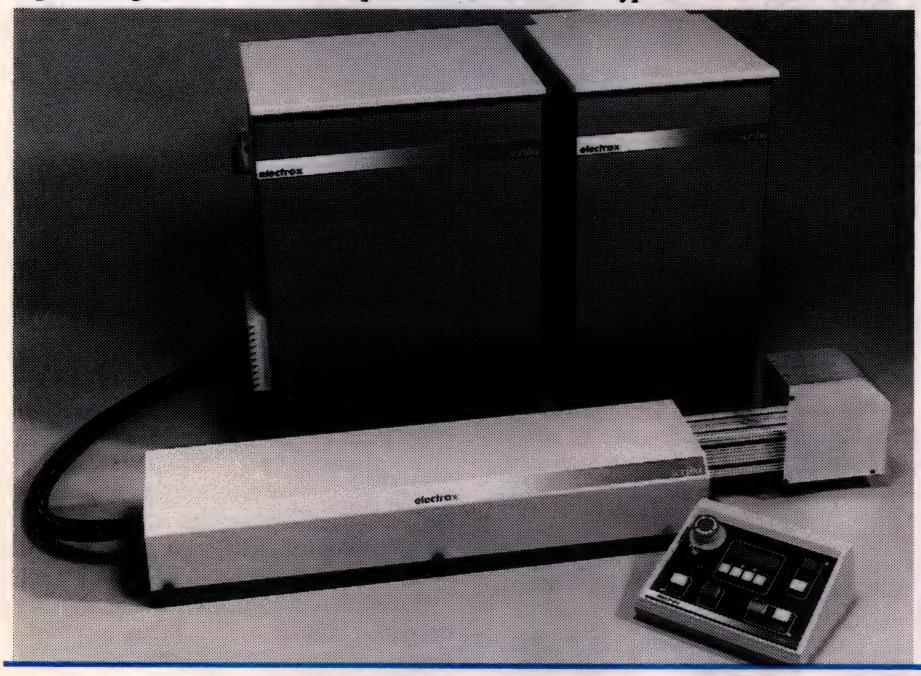
READER INFO NO. 20

NEW PRODUCTS

Laser marker

Electrox, distributed in Australia by Spectra-Physics, has manufactured laser marking systems for a number of years. Its latest development, called Scriba, is capable of marking a variety of materials, reproducing both text and complex images. The company designs and manufactures most of the critical components used in the marker, including the Nd:YAG laser, the controller, the laser power supply, the RF driver and the software.

The main enclosure can be either floor or bench mounted and is small enough to fit under a typical office desk. A remote head and operator control pen facilitate simple integration with a range of work areas. The software ca supplied for either Macintosh or IBM computers. The computer use generate the marking program is needed to operate the machine once relevant information is downloaded. simple work allows text to be ma without a computer. For goods requi serialisation, numbers can be increme from the pendant. As well, a stan IBM keyboard can be plugged in to pendant to facilitate the entry of large phanumeric strings.



For further information circle 242 the header service coupon or cont Spectra-Physics, 25 Research Dri Croydon 3136; phone (03) 761 5200 free call 008 805 696.

Compact, quiet UHF PLO's

Miteq of New York has recen released its LP series of phase-locked cillators, which use a low phase no coaxial resonator design for output f quencies from 800MHz to 2.2GHz, lo ing to a reference input from 50 500MHz. The high Q resonator provi phase noise performance equivalent capacity designs in a low weight, comp

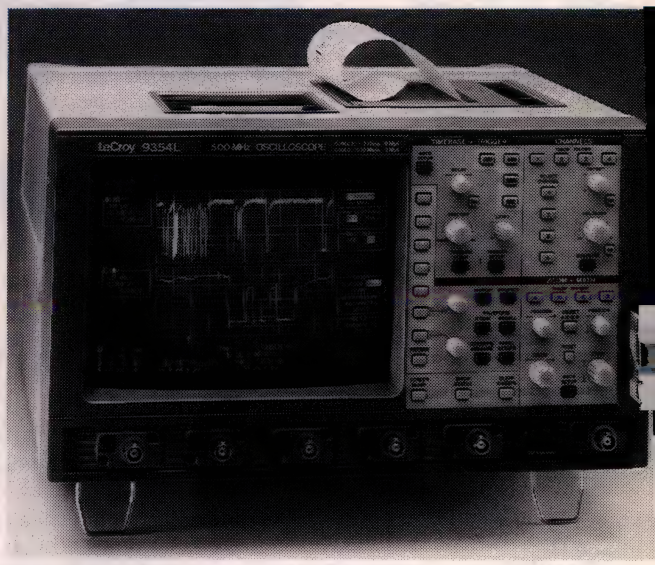
Digital storage oscilloscopes

Lecroy USA has announced a family of high performance DSOs. The 9350 family includes six new DSOs, aimed at different applications. All instruments feature 500MHz analog bandwidth, together with 500MS/s (megasamples/sec) single-shot A/D conversion per channel. Both two channel and four channel versions are available and each comes with three different memory sizes, ranging from 25KB per channel for the base version to 2MB per channel for the 'L' version.

The ADC and memory of individual channels can be combined, to further enhance performance. This allows up to 2GS/s digitising with up to eight megabytes of memory on one channel. All instruments offer a full feature set, including smart trigger, pass/fail testing, waveform processing and extensive interfacing.

The 9354L is the flagship of the family. It offers four channels of simultaneous sampling at 500MS/sec, with two megabytes of memory per channel. This memory can be combined to provide one channel with eight megabytes. Due to its high speed processing, the scope is capable of performing waveform maths and processing (including FFT) on whole eight megabyte records. Typical applications for such long memory acquisition include telecommunications, LAN, RADAR, HDTV and magnetic media research and development.

The heart of the 9354 family is a state of the art eight bit 500MS/s flash ADC. Both two and four channel versions have one dedicated ADC per channel, enabling simultaneous sam pling at 500MS/s on all channels.



For further information circle 241 on the reader servic coupon or contact Scientific Devices, 2 Jacks Road, South Oak leigh 3167; phone (03) 579 3622, fax (03) 579 0971.

age. The coaxial resonator design of- excellent stability with low suscep- ity to vibration and a low power umption. Other features include an nal high stability crystal reference in same package outline or with a 1 - Hz input reference as a dual loop gn. The standard temperature range is C to +70°C.

r further information circle 243 on reader service coupon or contact tronic Development Sales, PO Box Lane Cove 2066; phone (02) 418 , fax (02) 418 6550.

tical sources d power meters

Vandel & Goltermann has added some test instruments for installation and ntenance of fibre-optic based net- ks. The new optical LED sources and er meters meet the special require- nts of datacom and LAN networks. se instruments are easy to operate, ke reliable measurements and can pt to more than 20 different types of ical connectors. They also have a ged housing to protect their sensitive asurement components against shock, and water.

The LED source is available in two ver- ns: OLS-8 for 850nm and OLS-10 for 0nm. These devices provide a stable output power level across a wide temperature range. The OLP-10 optical power meter measures power and attenuation in the wavelength range from 800 to 1600nm. This device is suited to measurements in the optical windows at 850nm and 1300nm due to the use of a large area germanium photodiode (fibres up to 100/140 micrometre). Calibrated wavelengths of 820nm, 850nm, 1300/1310nm and 1500nm Identification of fibres is simplified as the output signal can be modulated for automatic recognition by the power meter.

For further information circle 246 on the reader service coupon or contact Wandel & Goltermann, 42 Clarendon Street, South Melbourne 3205; phone ox (03) 690 6750.



Hand held cable tester

The Microtest Pentascanner is a hand-held cable certification and diagnostic system for 'Category 5' cable systems and provides a complete solution for professional cable installers, service providers and network managers.

The Pentascanner incorporates a backlit display and graphical user interface, arrow keys and descriptive menu options which guide the operator through installing, certifying, or troubleshooting cable runs. The instrument will test and certify a range of networks, including; Token ring, ARCNET, ISDN, Apple talk, Fast Ethernet (both proposals) and ATM51. Cable types accommodated include co-ax, UTP (Cat1-5) and STP/ScTP.

Tests carried out include NEXT, attenuation, resistance, impedance, noise and capacitance measurements. A TDR is incorporated to measure cable length and provision is made for wire mapping. An autotest function is provided which allows the network under test to be checked out with the stroke of a single key. Up to 500 reports can be stored in memory, for later downloading to a PC or printer, through an RS232 interface.

For further information circle 245 on the reader service coupon or contact Tech-Rentals, PO Box 621, Ringwood 3134; phone (03) 879 2266. ◆

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Herman Nacinovich, ETI review "It's a Breeze" Jan. 1990.

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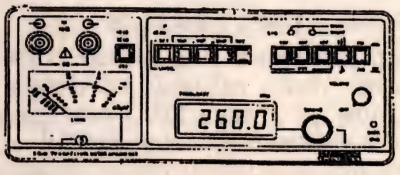
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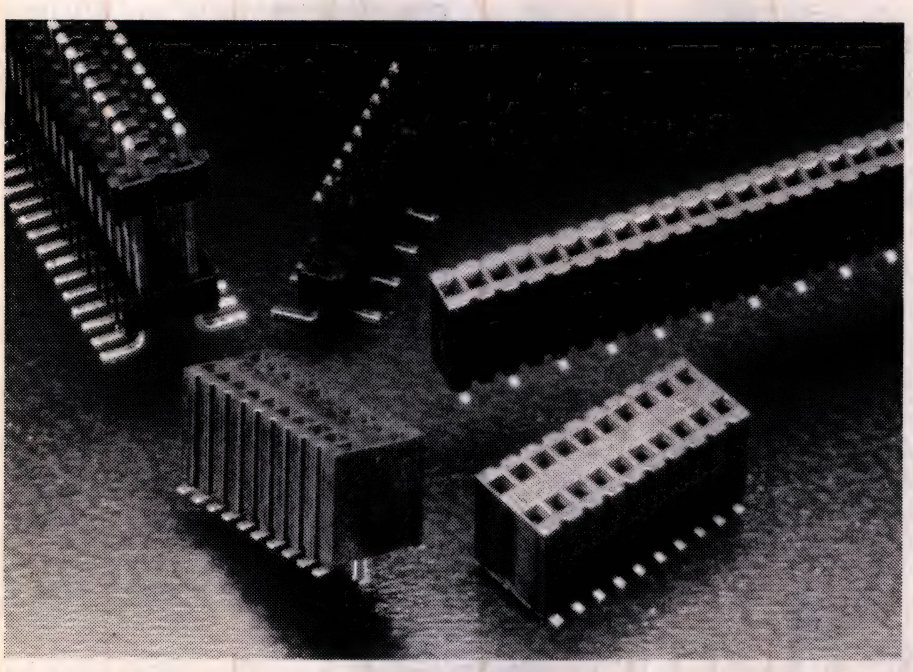
Skandia

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READER INFO NO. 22

Special Feature:

The latest in SMT and soldering products



Surface mount sockets and headers

A new micro surface mount socket (RSM series) on 1.27 x 2.54mm (.050 x .100") pitch is now available from Samtec. These sockets feature a low profile of 5.97mm and are available in both single and double row design. These socket strips are ideal for board stacking with surface mount headers and are suitable for 'pass-through' applications. Locking clips, pick-and-place pads, polarised positions and tape-and-reel packaging are standard options.

Standard 1.27 x 2.54mm pitch headers (HTMS series) in through-hole and face mount versions for mated hei down to 9.78mm are also available. edge mount option is also available this terminal strip.

Board stacking headers (HDW series) achieve from 11.82mm 19.81mm mated heights with the R series socket strip.

For further information circle 2 on the reader service coupon contact NSD Australia, Locked Bag Box Hill 3128; phone (03) 890 09 fax 899 5191.

Low cost rework station

The newly released Baltimo Rework Station VT-420, marketed RQR Products has been designed hobbyists and professionals electronics. The product is manufa tured in Perth, and has a much low price than equivalent imported rewo stations.

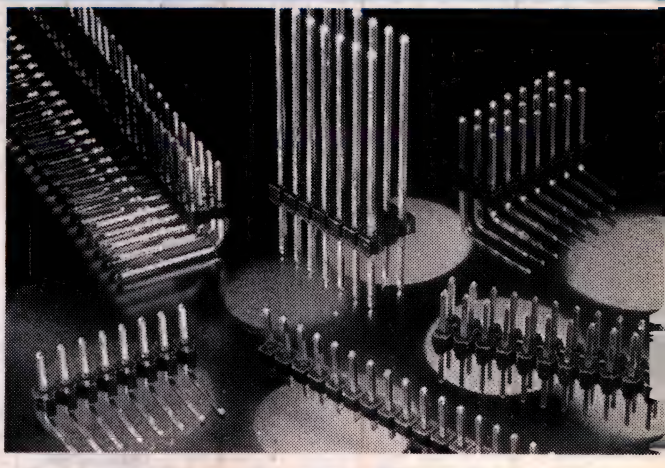
The VT-420 features a closed-lo temperature control system that mai tains a constant temperature at the ti and can be used to repair or mainta any type of PCB. The constant temper ture means the smallest pads can

0.64mm square post headers

Samtec's 0.64mm square post headers (TSW series) are available in single, double and triple row designs with one to fifty pins per row on 2.54mm (0.1") row spacing. Options include high temperature insulators (HTSW series), right angled designs, locking leads and plating variations including gold, tin, two types of selective gold and palladium nickel.

Twenty six standard pin styles are offered, and Samtec's 0.64mm square post strips can be changed to provide custom post heights for specific needs. These strips (MTSW series) can be supplied in small to large quantities with the same delivery as standard 0.64mm square post strips.

For board stacking applications, additional insulators can be added to the pins 9DW, EW and ZW series) to achieve any desired board spacing from 13.59mm to 49.15mm when mated with Samtec socket strips. Other specialty square post headers are also available including surface mount, low profile, shrouded and friction lock insulators and IDC cable header strips.



For further information circle 201 on the reader servic coupon or contact NSD Australia, Locked Bag 9, Box Hil 3128; phone (03) 890 0970, fax (03) 899 5191.

dered without the risk of lifting the rom the board.
e unit has less than three ohms ance in extractor to ground operaand a stable operating temperature dless of input voltage variations. system comes with base station, piece, solder collect tube, twist baflross and resin filters, acorn filter iner and vacuum hose. There are wo extractor bits, an Allen key and ing probes.
r further information circle 206 on reader service coupon or contact Products, 217 Beaufort Street, 6000; phone (09) 227 5645.

T component removal

K Industries has released their SMT ork station, model SA-2981-VV ch powers two specialised hand es simultaneously. One hand can ove PLCC, SOIC and discrete comnts. The other can be used for very soldering, gull-wing lead touch-up QFP removal.
he station has a footprint measuring x 100mm. Its wide ranging abilities make it suited to production s, engineering labs, rework and ser- areas.
or further information circle 204 on the reader service coupon or contact Electronic Development Sales, PO Box 822, Lane Cove 2066; phone (02) 418 6999, fax (02) 418 6550.

SPDT RF video switch

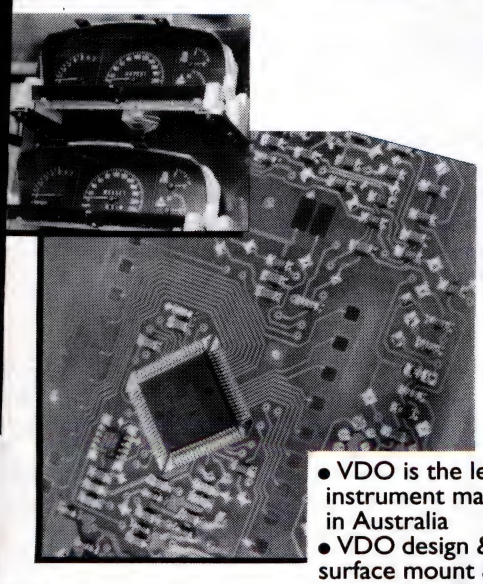
Siliconix has released a new low on-resistance video switch in its DG64X series. The DG643, a dual single-pole double throw analog switch, offers a typical on-resistance of eight ohms and an on-state capacitance of 10pF. The new switch has a -3dB bandwidth of 500MHz, which reduces group delay and preserves rise and fall times when switching digital signals.

Because of its low on-resistance, the DG643 is suited for use in cellular communications systems. Its 75mA current capability makes it useful in laboratory test equipment and industrial applications.

The device is suited to any application requiring a low cost RF video switch and is available in both a standard 16-pin DIL package or as a surface mount device.

For further information circle 210 on the reader service coupon or contact IRH Components, 1 - 5 Carter Street, Lidcombe 2141; phone (02) 364 1766, fax (02) 647 1545. ❖

VDO Instruments Australia

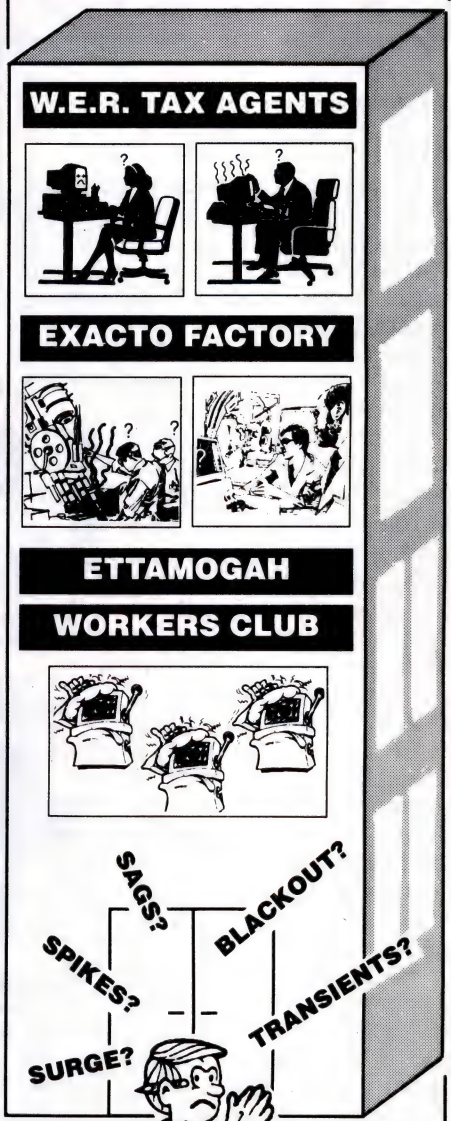


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POWER PROBLEMS?



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READER INFO NO. 24

Silicon Valley NEWSLETTER



First shot aimed at telecom market

As expected, the Clinton Administration is implementing trade sanctions against Japan for failing to live up to its obligations under a trade agreement aimed at opening its cellular telephone market to Motorola.

Since 1989, the US and Japan have signed three trade agreements to allow Motorola to compete in the 155 mile Tokyo-to-Nagoya corridor, where 60 million people live and work. Today Motorola still only has a 1.2% share of that market because Japan has allegedly failed to live up to promises to make its system compatible with Motorola's cellular phones. By comparison, in the much smaller Osaka area, where there is compatibility, Motorola has a 49% share of the market. Motorola estimates that the lock-out in the Tokyo-Nagoya market is costing the company some US$300 million in annual sales.

The Clinton announcement came less than a week after the trade summit failed to resolve key issues in disputes over the telecommunications, semiconductors, auto parts, and several other specific markets which the US wants Japan to open to foreign competition. In Motorola's case, Japan has refused to accept a Clinton Administration demand that sales of US telecommunications equipment to Japan increases at least 20% over the next five years.

In announcing the intended sanctions, US Trade Representative Mickey Kantor refused to specify which products would be targeted. He said the list of products involved would be published within a month.

This move was designed to give Japan several weeks to avoid getting into a trade war with the US by reconsidering its position and working out a compromise. It is expected that the initial US sanctions will total about US$250 million.

Sculley resigns, sues Spectrum for US$10M

After less than four months on the job, John Sculley announced his resignation from Spectrum Computer less than a week after assuring the outside world he was totally committed to working at Spectrum. Sculley immediately filed a US$10 million lawsuit against Spectrum, claiming he had been conned into taking the job as part of a scheme to artificially boost the price of Spectrum's stock.

In the court papers filed on Sculley's behalf, the former Apple chief executive says he was misled by Spectrum founder and president Peter Casserta. Before joining Spectrum, Sculley claims he had repeatedly asked Casserta whether there were any 'significant fact' or problems with Spectrum that he should be aware of. Sculley now claims he was never told about a host of problems, including a Securities & Exchange Commission investigation, questionable accoun practices, and other problems.

In a separate statement Sculley Casserta withheld the information cause he was very anxious to cash i the inevitable increase in Spectru stock on Wall Street if he was abl bring Sculley on board. It has been timated that Spectrum officers ea more than US$13 million f stock options in the week after Scu joined the firm.

An associate of Sculley quoted as saying that "John conned by a master. It is fai say that he is bitterly dis pointed."

Three days after Sculley f his lawsuit, Spectrum Infor tion Technologies roared b with a $300 million laws against Sculley. In the s Spectrum says Sculley breac his contract with Spectrum a also defaulted on his fiduci responsibilities. The suit a accuses Sculley of mismana ment and theft of trade secr

Finally, the suit claims Sc ley had been trying to lea Spectrum since December. fact, according to Spectru Sculley all but stopped worki for Spectrum as early December and he refused promote the company bef potential customers.



At the recent Consumer Electronics Show in Las Vegas, wireless communications specialist RadioMail provided some 100 journalists with adaptors which allowed them to file their news stories via RadioMail's wireless network. Pictured here is RadioMail president Bill Hipp (right), demonstrating how a message can be sent from his HP OmniBook to the Apple PowerBook held by marketing assistant Tom Crawford.

H-P makes brighter LEDs for autos

Hewlett-Packard has announced t development of a family of LED lam which will be able to provide aut mobiles with brighter brake lights a make it easier to observe traffic ligh during the day time. The new LEDs a four times brighter than any LEDs on t market. They will be available in amb and red/orange. H-P said the new LE will be available on the market with the next six months.

The first automobiles expected to us the new lamps will be in the 199 model year. Although they co more than traditional incandescer light bulbs, the H-P LEDs use much le

er and can be expected to last the me of the vehicle.

the US, LED lamps are already in about one million cars, primarily e third, high centre brake light.

-P product manager Mike Dunn said company has already begun showing new LEDs to major auto makers in US, Europe and Japan. In addition, n said his company expects the Ds to be used in cellular phones, traf- signals, and other applications where ht daylight conditions make it icult to see traditional lights.

unn said the market for auto- ive LEDs is currently worth ut US$100 million. With the ressive move into the brake t area, he said those sales will ly expand to more than US$1 ion by the end of the decade.

companies line behind Oracle

Oracle has announced an al- nce with 21 firms which have dged to develop data super- hway hardware, software and vices built around the soft- re and multimedia servers acle has developed for the tentially huge new market. nong those that have jumped the Oracle bandwagon is pple Computer, which will velop EZ-TV — a TV-top x which will allow users to eract with the superhighway using a acintosh-like interface.

With the announcement in Los An- les, Oracle is trying to outmanoeuvre icrosoft, which has also set its sights the software end of the data super- ghway. A week previously, Microsoft nounced plans to market a TV-top in- face box or license the technology, in- ding a Windows-like software inter- ce to interested companies. Microsoft, wever, has not announced any com- nies willing to support its approach.

Oracle's announcement was originally heduled for mid-January, but the ent was cancelled after the Los An- les earthquake damaged the CBS udios from which the launch was to ave been broadcast.

Oracle president Larry Ellison said he elieves the data superhighway will radi- ally alter life in the 21st century. "In 20 ears, our world will be so transformed y this highway, that people will scarce- y be able to remember what life was ke before it. We won't just talk shop on he highway, we'll live on it." Ellison opes Oracle's software and related technologies will run the data highway from end to end, starting with the powerful media servers to the TV-top interface boxes.

Ellison said the endorsement by the 21 companies will make Oracle the world's leading information management company, a step ahead of rival Microsoft where Bill Gates recently stated that he doesn't believe the interactive television market will develop as rapidly as some expect.

Silicon Graphics loses its founder chairman

James Clark, the former Stanford professor who founded Silicon Graphics as part of his vision of a world of 'visual computing', unexpectedly announced his resignation as chairman of the Mountain View company. The move was effective March 1.

Clark said his decision was based on his desire to start a new company, one that will focus on developing software products for the next generation of 'interactive digital living room information and entertainment devices'. Such devices will be developed as society enters the age of information superhighways in which consumers and businesses will enjoy hundreds, if not thousands, of channels with interactive media.

Privately, Clark has talked for several years about his fascination with the opportunities to be created by the data superhighway.

Apple launches $750 digital camera

Apple Computer has introduced its long awaited digital colour still photography camera, which stores images in memory circuits and allows users to download the pictures into their Macintosh or IBM PC computers. Apple also announced it had reached its goal of shipping one million CD-ROM drives in 1993.

The QuickTake 100 camera was introduced at the MacWorld show in Tokyo. It will retail for US$745 and will be aimed mostly at business users and high end consumers.

The point-and-shoot camera was scheduled to go on sale in March for Macintosh computers. A PC version will become available in June. PC users will have to purchase a US$98 cable and software kit to enable them to hook the QuickTake camera to their PCs.

"Digital photography has arrived. The QuickTake 100 will bring an exciting new visual dimension to many different software categories, especially creative applications that have been limited to traditional ways to capture and work with images," said Harry Wilker, vice president of publishing at Broderbund Software.

The flat hand-held camera sports an automatic focus feature for objects further away than four feet, and its flash also adjusts to the distance of the centre object in the picture. Loading individual pictures into their computer takes only a few seconds.

Users are able to manipulate the image by cropping it, rotating or positioning it at angles up to 60°. They can then import the pictures into word-processing, spreadsheet, database or other documents.

The QuickTake 100 weighs just 450grams. A small LCD display in the back features simple icons to monitor functions such as flash, battery, picture count, selected resolution, and self timer. Images can be taken in two sizes, 320 x 240 and 640 x 480 pixels. The camera can store up to 32 standard or eight high resolution pictures.

To load images into their desktop or portable computers, users simply plug a cable into the back of the camera and their computer and run the installed QuickTake software. The software offers 'drag-and-drop' controls for copying images into any common publishing software application.

Apple said the camera will be most useful for business users such as insurance claims adjusters who can easily incorporate photographic images into their reports. Real estate agents and appraisers will be able to put pictures of homes in brochures or reports. Apple also believes a large number of consumers, particular children in wealthy, Macintosh equipped families will want to purchase the camera.

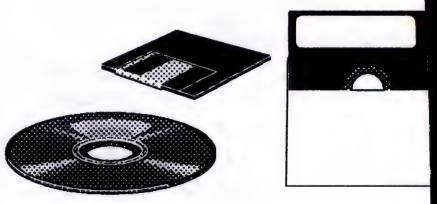
National cuts more

Despite its strong recovery in the past year, National Semiconductor announced it is continuing to restructure itself. As part of the latest program some 200 people will be laid off. The restructuring is concentrated in the communications business part of the company.

Company president Gilbert Amelio said he expects to continue to change National's organisation in his effort to make the company more efficient.

Since taking over from Charlie Sporck, National has eliminated more than 4000 jobs under Amelio. Currently the company employs 23,000 people worldwide with some 4800 at its headquarters in Santa Clara. ❖

SPOTLIGHT ON SOFTWARE



QmodemPro for Windows

Comms program *Qmodem* in its various forms has been around for some time, but not quite like this version. It features, among other things, support for a range of fax cards or modems able to support class 1 and class 2 fax protocols.

by PETER PHILLIPS

At a rough guess I'd say there are nearly as many communications programs in the world as there are wordprocessors, some of it quite hard to use. I believe that all computer software, particularly communications software, should be operable with little or no recourse to the manual. Let's face it — all we're doing is transferring data over a phone line, which should be easy.

Over the years I have grappled with many communications packages, trying to find one that is easy to use, intuitive and friendly. Prior to *QmodemPro for Windows* (QMW) I hadn't tried any other communications software that runs under Windows, although I've used the DOS version of QmodemPro along with a host of other DOS comms packages like Netcomm, Supercom and so on.

QMW needs Windows 3.1 installed in a '386 (or better) machine, and if you follow the defaults during installation, takes about 7MB of hard disk space. Installation is easy enough, and the program even determines what serial port is available for the modem. During installation you need to select the type of modem you have — and naturally, mine wasn't there.

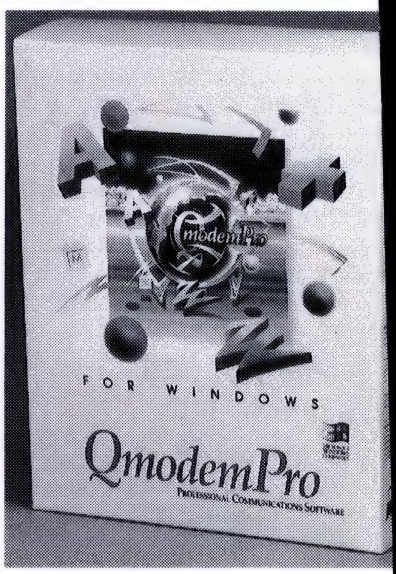
I'd expected this, as my Australian made modem is unlikely to be listed in software from the US. However, following the manual's advice I selected a generic modem, and eventually got on the air.

While doing all this, I found that the troubleshooting section of the manual gave very little help. In fact, the whole manual is based on the 'pie in the sky' notion that the user is a novice and that nothing goes wrong. Hmmph!

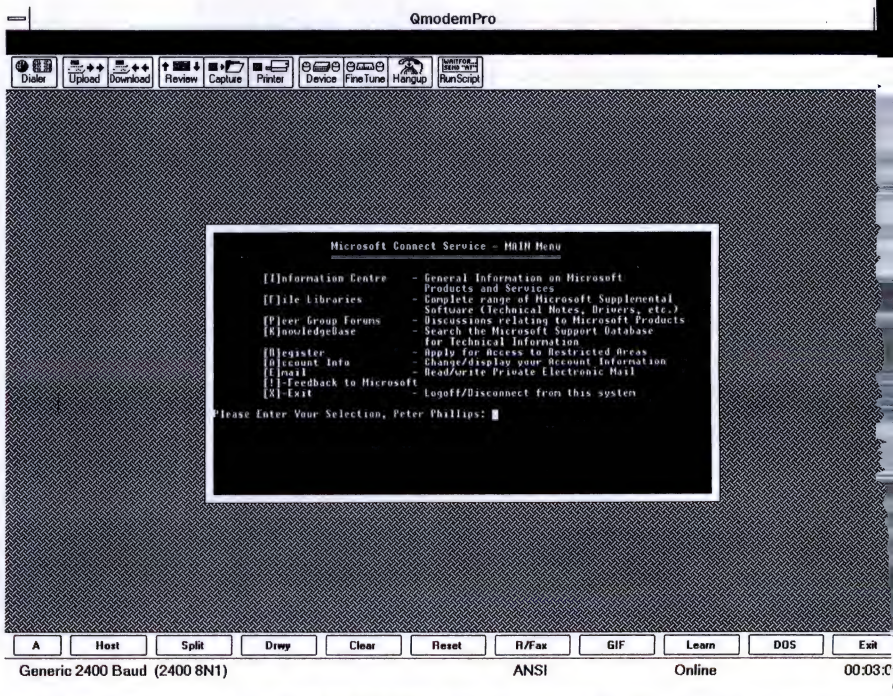
Once past this hiccup, I found the program itself quite excellent to use. I am very familiar with the Windows environment, and I was soon able to do things that usually take quite a bit of time to learn with most DOS communications programs. For instance, a basic need in a comms program is a phone list to autodial from; I very quickly got all this operational in QMW.

The phone list in QMW lets you enter up to five phone numbers for a particular service, so each number can be tried if the previous number doesn't answer.

You can also include your ID, password and other information to facilitate logging onto a bulletin board.



And getting on line is simply a matte double clicking on the phone num However, I don't understand why terminal screen only occupies ab 25% of the monitor screen. As a re text on the terminal is small and ra hard to read.



The QmodemPro for Windows screen looks like this when you are connected a bulletin board. Note the macro buttons on the bottom, and the rather sm terminal display.

vas disappointed that the program n't support videotext. This is a coming of most comms packages, te the fact that some banks still use service, including Westpac. How- it *can* emulate a large range of ter- ls, and supports all the usual file fer protocols such as various ver- s of XModem, YModem and Z- em as well as Kermit and (of se) ASCII.

MW has a host of unique features, uding support for sending and ving fax documents with a Class 1 Class 2 fax modem. You can send PCX and BMP graphics and also ude a cover page of your choice. eived faxes are selected from the ver as thumbnail sketches, which be viewed or printed at any time.

any types of modems are sup- ted, and file transfers include lities to view a GIF file during nload, and drag-and-drop of files n the Windows File Manager to the oad window.

erminal emulations include scrip graphics emulation, now be- ning popular on bulletin boards. This ulation lets you move around a bul- n board with a mouse. Up to 10 grammable macro buttons are lo- d at the bottom of the screen, which be used to invoke various functions he program.

n summary, this is perhaps the best mmunications package I've used. Be- se it runs under Windows, virtually printer can be used. Also you can eoretically) multi-task, with QMW nloading or uploading in the back- und while you do other things.

A shortcoming for me is that it esn't support videotext, probably cause this format is unique to stralia. I also think the manual tries be too patronisingly friendly, while ving out a lot of useful information. list of the Hayes commands would be eful, along with a larger troubleshoot- section.

The documentation includes a 235- ge guide for SLIQ (Script Language terface for QmodemPro) so you can ite scripts to automate QMW. The er guide has over 300 pages with any screen shots.

QModemPro for Windows comes om Mustang Software in the US id is distributed in Australia by anksia Technology.

The recommended retail price is 249, which gives you the right to use ut not own) the software for 25 years. he program should be available from ost software outlets. ❖

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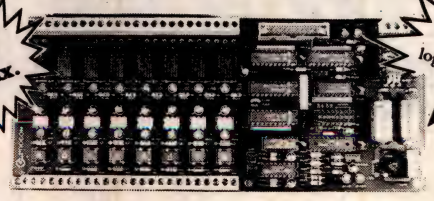
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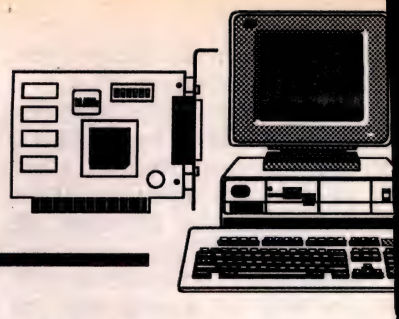
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READER INFO NO. 26

Computer News and New Products



Schneider notebook PC

Schneider's new FTX 417 notebook computer has been designed for engineers needing rapid access and control of PLC software, for programming, network management, reading and updating data, supervision and control of processes.

A novel feature of the FTX 417 is the injected magnesium alloy case, tested and reinforced to comply with IEC-65A for climatic, electromagnetic, safety and electrical standards. The alloy case is lightweight (only 3.2kg), yet is sufficiently rugged for an engineer to take anywhere in the industrial workplace.

To protect the unit against dust and spills, the keyboard is hermetically sealed and meets IP 50 specificat The computer also has an RS asynchronous communication por well as an RS232-C serial port.



It has 2MB (up to 8MB of R and a 40MB hard disk with a 1 access time.

For further information circle 163 the reader service coupon or con Schneider Australia, Regents Park tate, Princes Road East, Regents P 2143; phone (02) 743 7700.

Stepper motor controller card

Boston Technology has released low cost 'Complete Motor Systen based around the ESH 5000 se

Low cost Aust fax/modem

Banksia Technology has launched its new, competitively priced MyModem fax/modem. The device offers data and fax transmit and receive speeds up to 14,000bps, plus Windows-compatible software for a recommended retail price of $699. The full duplex, asynchronous MyModem features V.42 error correction and V.42bis data compression. It allows fax transmission to operate in background mode and has a broadcast fax capability. An auto detection feature distinguishes between faxes and data calls online.

MyModem comes bundled with the new Windows version of QuickLink II fax and communications software. This allows a user to transmit or receive a or data directly from any Windows plication. The user simply selects M Modem from a list of printers, and print preview feature then gives WYSIWYF (what you see is what y fax) view. The unit comes packag with manuals, a standard telephone cc nection cable and serial cable to conn to a PC.



The MyModem is manufactured a tested in Banksia's fully automated fa tory at Silverwater, on the western fri ges of Sydney. The plant emplo robotic equipment for its surface mou technology and its total quality manag ment accreditation ensures a consiste ly high standard of product. Banksia confident of exceeding is own 99.5 reliability target.

For further information circle 162 c the reader service coupon or conta Banksia Technology, 83 Languevil Road, Lane Cove 2066; phone (02) 41 6033, fax (02) 428 5460.

V32bis

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w cost stepping motor con- cards.
ESH 5000 series of cards are T/AT compatible and can control three independent stepper motor rs. Features incorporated include , direction and hold outputs for axis of motor control.
l step operation is standard, while tepping control is possible using ser-definable digital output line per axis). Pulse rates up to 00 steps per second are supported, ng the ESH 5000 series well suited crostepping applications.
dicated PCL240K Intelligent Step- Motor Controller chips (one per enable programmable velocity ling, including choice of direction. s may select from four program- modes and eight operating modes. nd down ramps can be programmed pendently, and all parameters are geable during motion.
ve digital input lines are provided imit switches. They are configured e used as two stop limits, two ac- ration limits, and one home limit.
l connections are made via a way D-connector. All inputs and uts are optically isolated to mini- e noise and to protect the card from voltages.

The ESH 5000 boards come with three software programs. One is a menu-driven motion profiling program designed to assist in the installation of a motion system by running the motors through their expected movements.

For further information circle 164 on the reader service coupon or contact Boston Technology, PO Box 1750, North Sydney 2059; phone (02) 955 4765, fax (02) 955 4468.

3V version of Intel 8051

Intel has released 3V versions of its MCS51 eight-bit microcontroller family. Equivalent in performance and peripheral integration levels to existing 5V 8051 microcontrollers, the new low voltage devices are targeted at energy efficient applications in portable computing, personal communicators, mobile telephones and communication devices.

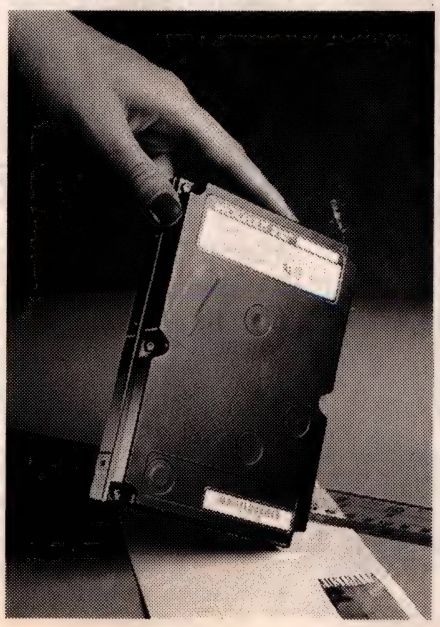
The new microcontrollers operate from 2.7 volts to 3.6 volts, at up to 20MHz maximum frequency for the commercial temperature range (0C to 70°C) or 16MHz for the extended temperature range (-40°C to +85°C). The new core design also has improved noise margins, thus lowering radio frequency interference generated noise levels.

Other applications for the new 3V

B HDD is only 1" high

Micropolis Corporation has com- nced volume shipments of its new inch form factor high capacity es to Australian users.
he new Model 4110 Taurus drive a 3.5" disk drive of one gigabyte matted capacity, featuring what is imed as the industry's smallest m factor (one inch in vertical ght). It uses an enhanced SCSI-2 in- face and other technology improve- nts which make it suited to the new neration of powerful PCs, worksta- ns and super-servers.
Micropolis has incorporated a num- of technological enhancements in model 4110 Taurus drive which y claim greatly improves reliability d functionality.
Firstly, by using a 5400rpm spindle eed, access times are reduced. Seek ne is only 8.5ms, or 30% better than larger form factor Micropolis 1GB ive currently available.
Another breakthrough is in heat dis- pation and power consumption. icropolis' patented onboard manage- ent system reduces consumption to ss than 9W while seeking, meaning at more drives can be mounted in a small area like a tower. There is also a dramatic increase in reliability; in fact, Micropolis now offer a 66% increase in reliability to 500,000 hours MTBF.

For further information circle 161 on the reader information coupon or contact Micropolis Corporation, 201 Miller Street, North Sydney 2060; phone (02) 959 2326.



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READER INFO NO. 29

products include the input interface for pen-based computers, PDA/personal communicators, keyboard and peripherals control for green, laptop and notebook PCs. Intel is also targeting mobile communications, including cordless phones, cellular phones/systems and answering machines.

For further information circle 166 on the reader service coupon or contact Intel Australia, PO Box 1486, Dee Why 2099; phone (02) 975 3300.

Second generation Protel for Windows

Protel Technology has announced details of Advanced Schematic 2.0, Advanced PCB 2.0 and Advanced SB Route, its new electronic design applications for Windows. These products are the first of their second generation Windows EDA products.

Advanced Schematic, the fully hierarchical schematic design tool for Windows, now supports full forward annotation which allows engineers to easily pass design changes to routed PCBs in Advanced PCB.

The new version also provides head-up guided wiring of schematics, support for EEsof simulation products and improved support for SPICE and P-CAD PDIF netlists.

The new release of Advanced PCB is a 32-bit system with submicron resolution which now support full forward annotation of PCBs from Advanced Schematic and allows users to back-annotate component designators to f Advanced Schematic. Advanced also has expanded compatibility other PCB vendor files, incl PADS-2000, PADS-PCB, P-CA Tango products.

Protel's new Advanced SB Ro an extension of the Advanced PC tem and uses shape based r technology licensed from Coop Chyan Technology to route eve most dense fine pitch SMD b to 100% completion. Advance Route has submicron resolution uses a powerful gridless system rip-up/retry and push/shove ro techniques.

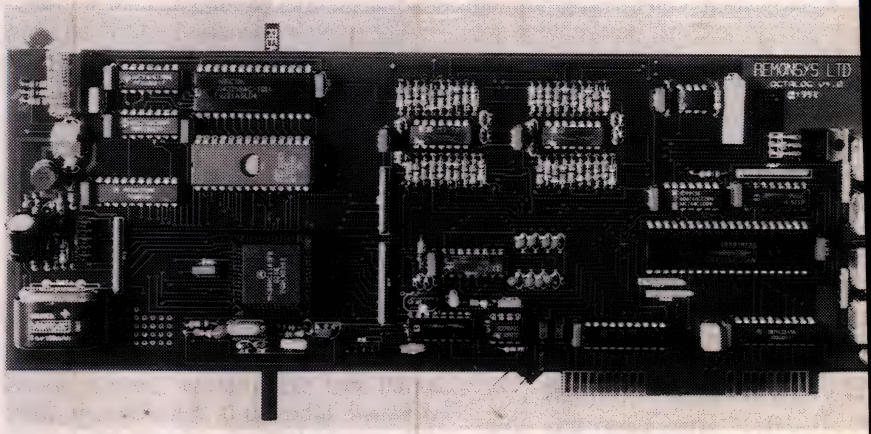
For further information circle 17 the reader service coupon or co Protel Technology, GPO Box Hobart 7001; phone (002) 73 0100.

Temperature logger for chill rooms

A PC card-mounted temperature data-logger which fits inside a desktop computer and uses thermistor temperature sensors is now available from Remonsys.

The system is suitable for monitoring chill rooms or investigating carcase cooling curves and other static applications. The OCTurion temperature data-logger is claimed to be the cheapest system available from a manufacturer in the United Kingdom. The system can take up to eight temperature sensors, plugged into sockets mounted on the edge of the OCTurion card, and eight digital inputs (ON/OFF) which can be used for monitoring such actions as door opening and closing.

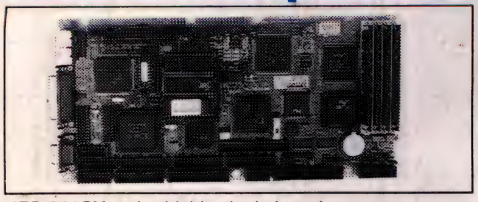
The card uses the PC's power to charge an onboard battery, allowing data-logging to continue over two weeks without the PC being switched on. The system is able to store a total of 16,000 temperature readings from the eight temperature sensors at user defined intervals, ranging from one minute up to 24 hours. OCTurion records temperatures to 0.1°C resolution and 0.2°C accuracy over the range -30 to +40°C.



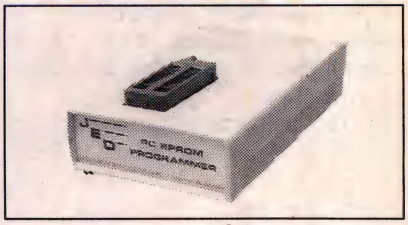
The software allows the user to view the temperatures of sensors with a sin key press. Data can be downloaded reports printed out to show tables graphs of results.

For further information circle on the reader service coupon contact W & B Instruments, 115 - Leicester Street, Carlton 3053; pho (03) 347 0866. ❖

Australian Computers & Peripherals from JED... Call for data sheets.



$125 PROM Eraser,complete with timer



The JED 386SX embeddable single board computer can run with IDE and floppy disks, or from on-board RAM and PROM disk. It has over 80 I/O lines for control tasks as well as standard PC I/O. Drawing only 4 watts, it runs off batteries and hides in sealed boxes in dusty or hot sites. It is priced at $999 (25 off) which includes 2 Mbytes of RAM.

$300 PC PROM Programmer.

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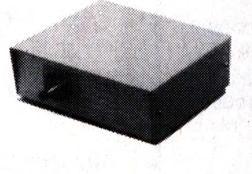
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DB25 socket terminations. Allows 1 computer to select between 4 printers or 4 computers to share 1 printer. **$49.95**

S36-ABCD

36 pin Centronics version of S25-ABCD **$54.95**

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SURGE PROTECTORS		
CAS-INLINE-SURGE	Inline Surge Protector	$25.95
CPEP1	Modem Protector	$60.95
POWER-BRD-PAC20	6 Way Power Board	$80.95
MISCELLANEOUS		
COPY-HOLDER	Desktop Copy Holder	$25.20
CPU-STAND	CPU Stand	$25.20
JOYSTICK-IBM	Joystick for PC 15 Pin	$39.95
MS001	3 Button Mouse 250dpi	$19.95
MOUSE-MAT	Computer Mouse Mat	$5.95
Disks		
DISC-DSDD-3	3.5" Double Density Discs	$10.50
DISC-DSHD-3	3.5" High Density Discs	$12.95
DISC-DSDD-5	5.25" Double Density Discs	$6.50
DISC-DSHD-5	5.25" High Density Discs	$10.50
FDC-1	5 1/4 Floppy Disc Clnr	$4.55
FDC-3	3 1/2 Floppy Disc Clnr	$6.75



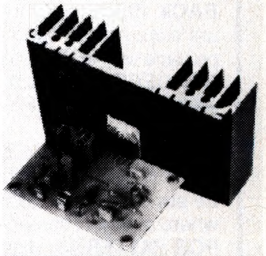
Super Fan Purchase

Now there's no excuse for overheating equipment. We have a limited quantity of high quality JAPANESE fans made by Matsushita Electric. The brand name is Panaflo and they are ultra-quiet, brushless, ball bearing types, model number FBP-08B12L. They run off 12Vdc, draw only 120mA and measure 80mm square by 32mm deep. You could pay around $25.00 for a fan made in Taiwan.

Still A Few Left **ONLY $15.00**

Sensational 50W Audio Amp on a Chip

Would you believe an audio amplifier on a single chip capable of 50W rms into 8Ω? Well the new LM3876T from National Semiconductor gives you all that and with a better spec than many discrete amplifier circuits! It runs off a ±35Vdc supply. Frequency response is from 15Hz to 110kHz ±1dB with <0.06% harmonic distortion (<0.002% typ!). The chip is described in Silicon Chip March 94 and there's full circuit details. LM3876T chip only **$11.65**



Interface Converters

How do you get your RS-232C equipment to communicate with other devices using the RS-422A interface?
Easy with our

RS-232C/RS-422A converter

RS422A uses balanced differential signals which allow communication over much greater distances – up to 1.2km (4000 feet) – at bit rates as high as 90k/sec. For multi-drop systems one driver will feed up to 10 receivers.
Uses Male DB25 connector for the RS-232C interface and a female DB25 for the RS422A. No handshake is required. Power from a plug-pack is only 200mA at 9Vdc.
$97.95
(optional plug pack $22.95)

RS-232C/RS-485 converter

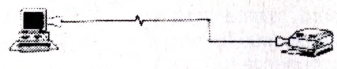
RS-485 is the enhanced version of RS-422A. It allows multiple drivers and receivers on a 2-wire system. Converter is similar to above. Will handle up to 32 drivers and receivers on any one 2-wire system! Each converter has one RS-485 driver and receiver. Power is by 9V plug-pack
$111.90 (optional plug pack $22.95)

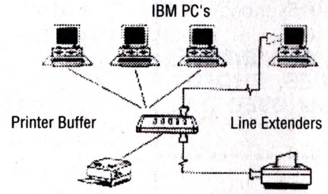
Netcomm Pocket Fax Modem

Turns your PC into a Fax machine as well as being a 1200/2400baud modem. No need to print items before faxing them. View faxes on screen or export them. Only print the faxes you need to and there's no need for special fax paper! Works in background and will redial till successful. Plus it's a full function modem featuring V22/V22bis etc. 9V battery operation. Only 32x100x75mm. FEW ONLY. Complete with software. **ONLY $295.00**

Parallel Line Extender

Extend the distance you can send data between device up to 360metres (1200ft) using simple 2 or 4 core telephone cable! Yes your printer can be that far away and there's no loss of speed! Requires no external power. Can be used with a parallel sharing device. Has excellent common mode noise immunity. And it's not much bigger than a DB25 connector. Plug into computer using Male DB25 connector and use RJ-11 connectors with normal telephone cable. Printer end has male 36 pin Centronics connector. Supplied with 15metres of cable. 3-6Vdc input socket in case your PC can't provide enough power. A great solution to distance problems with no loss of data transmission speed! Excellent value at **$115.95**





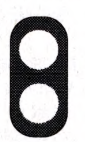
Enamelled Winding Wire

Wind your own using the ferrite cores alongside!

Metric	*B&S*	*Pack*	*Length*	*Roll*
0.2mm	32	25g	70m	$5.95
0.25mm	30	25g	50m	$5.95
0.4mm	26	25g	20m	$5.95
0.5mm	24	100g	36m	$8.65
0.63mm	22	100g	24m	$8.65
0.8mm	20	100g	18m	$8.65
1mm	18	100g	12m	$8.65
1.25mm	16	100g	8m	$8.65

FERRITES

Ferrite Beads		
FER-BN-(43)-202	Bead 2 Hole 0.525x0.295	$3.30
FER-BLN-(73)-201	Bead 2 Hole 0.227x0.160	$5.45
FER-FB-(43)-101	Bead 1 Hole 0.138 OD	$0.40
FER-FB-(43)-801	Bead 1 Hole 0.296 OD	$0.60
FER-FB-(43)-2401	Bead 1 Hole 0.380 OD	$0.75
FER-FB-(43)-5111	Bead 6 Hole 0.236 OD	$0.65
FER-FB-(43)-5621	Bead 1 Hole 0.562 OD	$4.60
FER-FB-(64)-101	Bead 1 Hole 0.138 OD	$0.40
FER-FB-(73)-101	Bead 1 Hole 0.138 OD	$0.40
FER-FB-(73)-801	Bead 1 Hole 0.138 OD	$0.60
FER-FB-(73)-2401	Bead 1 Hole 0.380 OD	$0.75
FER-FB-(75)-101	Bead 1 Hole 0.138 OD	$0.40
Ferrite Toroids		
FER-FT-23-(43)	Toroid .230 OD .120 ID	$2.90
FER-FT-23-(61)	Toroid .230 OD .120 ID	$2.90
FER-FT-37-(43)	Toroid .375 OD .187 ID	$2.00
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FER-FT-37-(75)	Toroid .375 OD .187 ID	$3.15
FER-FT-50-(43)	Toroid .500 OD .281 ID	$2.60
FER-FT-50-(61)	Toroid .500 OD .281 ID	$2.60
FER-FT-50-(68)	Toroid .500 OD .281 ID	$3.60
FER-FT-114-(61)	Toroid 1.142 OD .750 ID	$8.05
Iron Powder Toroids		
FER-T-25-(0)	Toroid .255 OD .120 ID	$2.05
FER-T-25-(6)	Toroid .255 OD .120 ID	$2.05
FER-T-37-(0)	Toroid .375 OD .205 ID	$2.60
FER-T-37-(2)	Toroid .375 OD .205 ID	$1.95
FER-T-37-(6)	Toroid .375 OD .205 ID	$1.95
FER-T-37-(12)	Toroid .375 OD .205 ID	$3.15
FER-T-50-(1)	Toroid .500 OD .303 ID	$3.15
FER-T-50-(2)	Toroid .500 OD .303 ID	$3.15
FER-T-50-(6)	Toroid .500 OD .303 ID	$2.35
FER-T-50-(10)	Toroid .500 OD .303 ID	$3.15
FER-T-50-(17)	Toroid .500 OD .303 ID	$3.15
FER-T-50-(26)	Toroid .500 OD .303 ID	$3.05
FER-T-68-(2)	Toroid .690 OD .370 ID	$3.60
FER-T-68-(6)	Toroid .690 OD .370 ID	$2.90
FER-T-106-(2)	Toroid 1.060 OD .570 ID	$9.60
FER-T-106-(6)	Toroid 1.060 OD .570 ID	$11.05
FER-T-130-(2)	Toroid 1.300 OD .780 ID	$11.05
FER-T-130-(26)	Toroid 1.300 OD .780 ID	$11.80
FER-T-157-(26)	Toroid 1.570 OD .950 ID	$11.45
FER-T-200-(2)	Toroid 2.000 OD 1.25 ID	$20.00
FER-T-200A-(2)	Toroid 2.000 OD 1.25 ID	$28.60





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9 Pin Female to Female	$5.45
9 Pin Male to Female	$5.45
9 Pin Male to Male	$5.45
9 to 15HDD	
9 Pin Female to 915F	$9.95
Gender Bender	$6.95
HDD 15 Plug to 9 Male	$6.95
9 to 25	
DB9 Skt to DB25 Plg	$4.95
DB9 Plg to DB25 Plg	$5.45
HDD15 to HDD15	
HDD15 Plug to Plug	$7.95
25 to 25	
25 to 25 M/M Bender	$7.95
25 to 25 F/F Bender	$7.95
Null Modem Adaptor	$13.95
36 to 36	
Centronics Female/Female cable	$47.90
Mini DIN 6 to DIN 5	
6 Pin Plug to 5 Pin Skt	$7.95
D Type to Modular	
D09 Plug to RJ45 Socket	$7.95
D25M to 4 Pin RJ Socket	$7.80
D25M to 6 Pin RJ Socket	$8.25
D25M to 8 Pin RJ Socket	$10.05

8.30am to 5.00pm Mon to Thurs. 8.00am to 4.30 Fri. Saturdays 8.00am to 4.00pm. Mail Orders add $5.00 min postal charges. Next day delivery in Sydney add $8.00.
All prices include Sales tax unless stated otherwise.
Tax exemption certificates accepted if the line value exceeds $10.00.

GEOFF WOOD ELECTRONICS

Geoff Wood Electronics Pty Ltd and Semtech

(inc in N S W)

229 Burns Bay Road, Lane Cove West
N S W 2066 (Corner Beatrice Street)

Telephone : (02) 428 4111 Fax : (02) 428 5198

WOOD FOR CHIPS...WOOD FOR CHIPS...WOOD FOR CHIPS...WOOD FOR CHIPS...WOOD FOR CHIPS...WOOD FOR CHIPS...WOOD FOR CHIPS...WOOD FOR CHIPS...WOOD FOR CHIPS...WOOD FOR CHIPS...WOOD

EA DIRECTORY OF SUPPLIERS

Which of our many advertisers are most likely to be able to sell you that special component, instrument, kit or tool? It's not always easy to decide, because they can't advertise all of their product lines each month. Also some are wholesalers and don't sell to the public. The table below is published as a special service to EA readers, as a guide to the main products sold by our retail advertisers. For address information see the advertisements in this or other recent issues.

Supplier	State	A	B	C	D	E	F	G
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Macservice	VIC						●	
RCS Radio	NSW			●				
Rod Irving Electronics	VIC	●	●	●	●	●	●	●
Scientific Devices	VIC						●	
TECS	VIC	●	●	●	●	●	●	●
Wagner Electronics	NSW		●		●	●	●	

KEY TO CODING:

A Kits and modules
B Tools
C PC boards and supplies
D Components
E IC chips and semiconductors
F Test and measuring instruments
G Reference books

Note that the above list is based on our understanding of the products sold by the firms concerned. If there are any errors or omissions, please let us know.

Electronics Australia Reader Services

SUBSCRIPTIONS: All subscription enquiries should be directed to: Subscriptions Department, Federal Publishing Co, PO Box 199, Alexandria 2015; phone (02) 353 9992.

BACK ISSUES: Available only until stocks are exhausted. Price A$7.50 which includes postage within Australia only. **OVERSEAS READERS SHOULD ADD A FURTHER A$2.50 FOR EVERY BACK ISSUE REQUIRED.**

PHOTOSTAT COPIES: When back issues are exhausted, photocopies of articles can be supplied. Price $7.50 per project or $15 where a project spreads over several issues.

PCB PATTERNS: High contrast, actual size transparencies for PCBs and front panels are available. Price is $5 for boards up to 100sq.cm, $10 for larger boards. Please specify negatives or positives.

PROJECT QUERIES: Advice on projects is limited to postal correspondence only and to projects less than five years old. Price $7.50. Please note that we cannot undertake special research or advise on project modifications.

Members of our technical staff are not available to discuss technical problems by telephone.

OTHER QUERIES: Technical queries outside the scope of 'Replies by Post', or submitted without fee, may be answered in the 'Information Centre' pages at the discretion of the Editor.

PAYMENT: Must be negotiable in Australia and payable to 'Electronics Australia'. Send cheque, money order or credit card number (American Express, Bankcard, Mastercard or Visa card), name and address (see form).

ADDRESS: Send all correspondence to: The Secretary, Electronics Australia, P.O. Box 199, Alexandria, NSW 2015; phone (02) 353 0620.

PLEASE NOTE THAT WE ARE UNABLE TO SUPPLY BACK ISSUES, PHOTOCOPIES OR PCB ARTWORK OVER THE COUNTER.

METHOD OF PAYMENT: (Please circle correct method).

Credit Card: Mastercard
Cheque: American Express
Money Order: Visa
Bankcard

Expiry Date: .....

Name:.....
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.....Postcode:.....

Back Issues:.....
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No.of issues required:.....$7.50=.....
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Total Payment Enclosed $ =========

Signature:.....
(Unsigned orders cannot be accepted).

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BIGGER LASER

We have a good, but LIMITED QUANTITY of same brand new red 5mW+ tubes, and some "As new" red 5mW+ laser heads that we have removed from new equipment. Tube dimensions (3mW+): 15mm diameter by 90mm long. Head dimensions: 45mm diameter by 380mm long. With each of the lasers we will include our 12V universal Laser power supply. BARGAIN AT:

$120

For the 3mW+ tube plus the 12V supply

$160

For the 5mW+ head plus the 12V supply

12V-2.5 WATT SOLAR PANELS

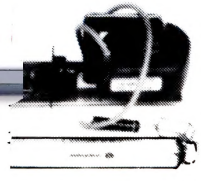
These amophorous glass solar panels only need terminating and weather proofing. We provide terminating clips and sheet of plain glass of the same size. The glass is glued to the rear of the panel with some silicone (not provided), and some silicone is also applied around the edge. To make the final product look very attractive some inexpensive plastic "L" angle could be glued to the edges with some silicone. Very easy to make. Dimensions: 305 x 178mm, Vo-c: 18-20V, Is-c: 450mA. BARGAIN PRICED.

$25 each

or 4 for $80

Each panel is provided with a sheet of clear glass of the same size, terminating clips, isolating diode and the instructions.

BUDGET LASER



A very economical Laser tube and 12V laser supply combination. The 12V switched mode power supply provides the tube with a constant current and will work from 10-15V, draws 0.5A at 12V. Very efficient! The tube supplied is used, tested and guaranteed 632.8nM (Red), power output 0.5-1mW. The tube-power supply kit combination for a total price of only:

$49

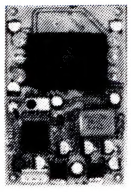
We can also supply new tubes with this kit: "Ring".

LASER POINTER

Improve and enhance all your presentations. Not a kit, but a complete commercial 5mW/670nM pen sized pointer at a SPECIAL PRICE of:

$120

CCD CAMERA



We now have good stocks of this incredible product. Monochrome CCD Camera which is totally assembled on a small PCB and includes an Auto Iris lens. It can work with illumination of as little as 0.1 Lux and it is IR responsive. Can be used in total darkness with Infra Red illumination. Overall dimensions of camera are 24 x 46 x 70mm and it weighs less than 40 grams! Can be connected to any standard monitor or the video input on a Video cassette recorder.

$239

PASSIVE NIGHT VIEWER



This is a completed commercial monocular hand held night viewer, that employs an image intensifier tube with a gain of 12,500 times. The viewer is of a USSR military standard, and will produce useful images in a very low ambient light. Has adjustable low light objective lens, adjustable eyepiece and is supplied with a carry case.

$399

★ SUPER SPECIAL ★ IR "TANK SET"

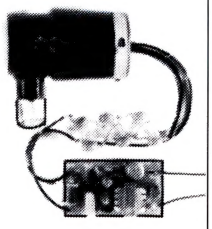


ON SPECIAL is a set of components that can be used to make a very responsive Infra Red night viewer. The matching lens tube and eyepiece sets were removed from working military quality tank viewers. We also supply a very small EHT power supply kit that enables the tube to be operated from a small 9V battery. The tube employed is probably the most sensitive IR responsive tube we ever supplied. The resultant viewer requires low level IR illumination. Basic instructions provided.

$120

For the tube, lens, eyepiece and the power supply kit. When ordering specify preference for a wide angle, or telescopic objective lens.

IMAGE INTENSIFIER TUBE AND SUPPLY

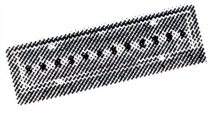


These are the key components needed for making a PASSIVE NIGHT VIEWER. The small prefocussed Russian image intensifier tube only requires a low current EHT power supply to make it operational, which we provide in kit form. Draws 20mA from a small 9V battery. With a suitable low light objective lens (not provided), the resultant viewer will produce useful pictures in sub-moonlight illumination and it can also be IR assisted. INCREDIBLE PRICE.

$150

For the Russian image intensifier tube and an EHT power supply kit! All that is needed to make a complete passive night viewer is a lens, an eyepiece, a 9V battery, a case and a switch. We can supply a matching lens and eyepiece: **$68 for the pair.**

LED DISPLAYS



National Semiconductor seven segment common cathode 12 digit multiplexed LED displays with 12 decimal points. Overall size is 60 x 18mm and pinout diagram is provided.

$2.50 each or 5 for $10

CRYSTAL OSCILLATOR MODULES



These small TTL Quartz Crystal Oscillators are hermetically sealed. Similar to units used in computers. Operate from 5v and draw approximately 30mA. TTL logic level clock output. Available in 4MHz, 4.032MHz, 5.0688MHz, 20MHz, 20.2752MHz, 24.74MHz, 40MHz and 50 MHz.

$7 each or 5 for $25

SOLID STATE "PELTIER EFFECT" COOLER-HEATER

These are the major parts needed to make a solid state thermoelectric cooler-heater. We can provide a large 12V-4.5A Peltier effect semiconductor, two thermal cut-out switches and a 12V DC fan for a total price of:

$45

We include a basic diagram – circuit showing how to make a small refrigerator-heater. The major additional items required will be an insulated container such as an old "Esky", two heatsinks and a small block of aluminium.

CAR ALARM

We have purchased a good but limited quantity of this well know brand Australian made car alarm. It has been made obsolete because it doesn't feature UHF remote control. But look at the features!! Voltage drop detection (wired directly or internal), pin switch detection for bonnet/boot, piezoelectric vibration detector, optional passive arming via ignition switch, ignition disable via master switch if passive arming is not used, may be wired to existing door pin switches to act as a switch-sensing last door arming alarm, 30 second exit delay, 7 second entry delay, flashing LED-intrusion indicator provided, flashes vehicle indicators when alarm is sounding; extra negative output to power second siren or pager, colour coded wiring siren provided, powerful 40 watt-125dB siren which employs a dynamic speaker. A sound that makes most car alarms sound like toys!! Priced at about 1/3 of their original price:

$48

With the car alarm package we will also include a circuit and notes on how to modify the entry-exit times, and how to make it UHF remote controlled: Our single channel UHF remote control is available: $17 for the transmitter, $34 for the receiver.

DYNAMIC MICROPHONE

Stage quality Unidirectional (Cardioid) 600 ohm dynamic microphone in a black metal housing. Has ON-OFF switch and cannon connector. Prewired lead and clip provided.

$39

C.O.B. SOUND GENERATOR MODULES

Stamp sized PCBs with an LSI sound generator IC that is surface mounted on them. Work from approximately 3V and have negligible standby current. Require a few external components to become complete sound generators: Typically 2 resistors, one capacitor, one transistor and a speaker.

Four Train Noises (Excellent for model railways): $4
Ambulance, Fire & Police Siren, plus Machine Gun: $2.50
16 Door Chime Tunes: $4
Classic Ding-Dong Door Chime: $3

X-Y LASER SCANNER KIT

You could spend thousands of dollars buying commercial X-Y scanners for laser beam deflection. This X-Y scanner compromises by employing two suitable DC motors to achieve good results. With normal levels the motors don't actually spin but simply vibrate around the set position.

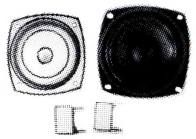
The PCB and components kit include rectification and filtering (power supply), audio preamplifiers, audio filtering, and two separate power amplifiers to drive the two deflection motors. The scanner is powered from a 16V AC-900mA plugpack.

In one of the modes of operation the scanner can produce a totally random two dimensional display which is dependent on the actual music picked up by the electret microphone. A second mode of operation enables the power amplifiers to be driven from external oscillators and/or pre-taped signals recorded on a stereo cassette recorder.

A short form kit of parts is available for the X-Y scanner. It includes a screened and solder masked PCB and all the on-board components, an electret microphone, two motors and two lightweight mirrors.

$44

SPEAKER GIVEAWAY



One 3" tweeter, one 4" woofer, a non polarized crossover capacitor, plus a diagram. $10 for the set.

2 sets (STEREO) for

$18

FIBRE OPTIC TUBES



These US made tubes are used but in excellent condition. Have 25/40mm diameter, fibre-optically coupled input and output windows. The 25mm tube has an overall diameter of 57mm and is 60mm long. The 40mm tube has an overall diameter of 80mm and is 92mm long. The gain of these is such that they would produce a good image in approximately half moon illumination when used with suitable "fast" lens, but they can also be IR assisted to see in total darkness. The superior resolution of these tubes would make them suitable for low light video preamplifiers, wild life observation and astronomical use. Each of the tubes is supplied with a 9V EHT power supply kit. INCREDIBLE PRICES:

$120 For the 25mm intensifier tube and supply

$190 For the 40mm intensifier tube and supply

Three of these tubes can be cascaded to make a very high gain image intensifier! We should have a kit and instructions available to make these. Approximately $270 for 25mm kit and $450 the three stage kit.

MEDIUM BRIGHTNESS LEDs

With a luminous output of approximately 7mCDs @ 20mA, these 5mm LEDs are more than 10 times brighter than ordinary LEDs. Available in GREEN, YELLOW and AMBER and priced below ordinary LED prices.

20¢ each, 10 for $1.80 or 100 for $15.

For any mix of colours.

OATLEY ELECTRONICS

PO Box 89, Oatley, NSW 2223

Telephone: (02) 579 4985 Fax: (02) 570 7910

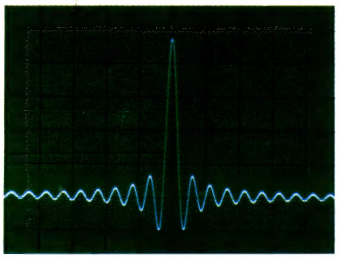
MAJOR CARDS ACCEPTED WITH PHONE AND FAX ORDERS

P & P ANYWHERE IN AUSTRALIA

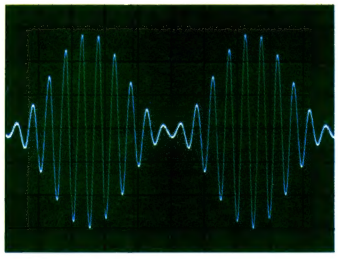
FOR MOST MIXED ORDERS: $2.50-$10

READER INFO NO. 2

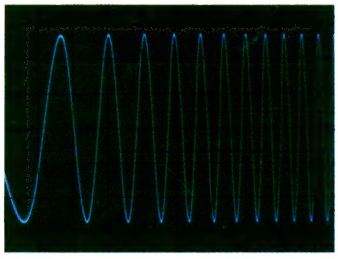
There are many areas where our function generator will surpass your expectations.



A built-in 12-bit, 40 MSample/sec, 16K deep arbitrary waveform generator easily handles your custom waveform needs.

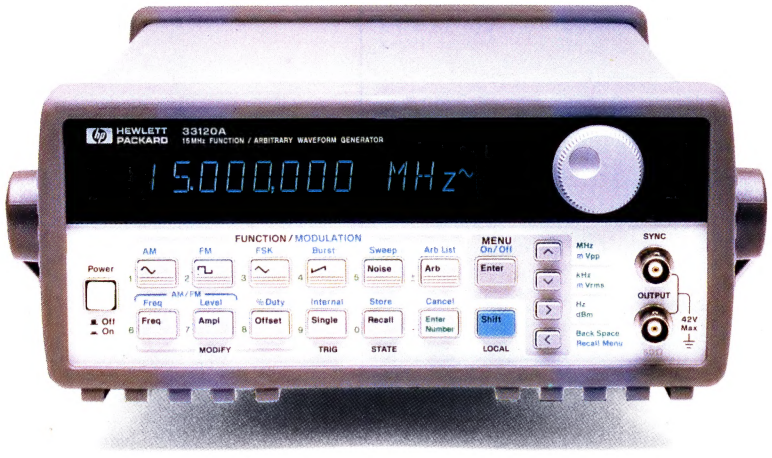


Internal AM, FM, FSK and burst modulation eliminate your need for a second modulation source.



Both linear and log sweeps are built in, making filter and amplifier testing quick and easy.

At a price that falls below them.



The HP 33120A 15 MHz synthesised function/arb generator: Within budget, without compromise.

In the world of function generators, price and performance have always been synonymous. So it's understandable you'd expect to pay more for the measure of confidence you get with a synthesised signal source that delivers stable, accurate signals test after test. Or, for the flexibility to generate complex waveforms with arbitrary waveform capability.

You'd probably also expect to pay a premium for the convenience of built-in sweep and modulation functions. And to have both HP-IB and RS-232 interfaces standard.

Fact is, you can always get high performance with the high price to match. Or, order the HP 33120A fully loaded function/arb generator and get something totally unexpected. A price you can afford.

Call HP to see how much function generator you can get for your money.

Discover just how easy it is to afford a fully loaded 15 MHz function/arb generator with synthesised signal source and arbitrary waveform capability. Once you hear the price, we think you'll agree it's the best deal of any function generator in its class.

In fact, you can learn more about the HP 33120A function/arb generator's custom waveform capability, signal accuracy, easy programmability and any other specifications you may need to make the right decision.

So call our Customer Information Centre on **13 1347** (Australia wide) and ask for extension **2902.**

A better way.

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