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Volume 54, No.12

December 1992

AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE — ESTABLISHED IN 1922

Almost a filmless SMPTE

This year's 'down under' Convention of the Society of Motion Picture and Television Engineers was held at Sydney's Darling Harbour, and Barrie Smith reports that he could find only one solitary cinema projector representing film technology. But digital video was very much in evidence, as he explains in his story starting on page 10.

A most unusual fault...

One of our Serviceman's stories this month involves a set with this rather weird and colourful fault. Can you guess the cause? (see page 46)

On the cover

On the recent NASA/ESA 'tethered satellite' mission STS-46, commander Loren Shriver found time to try eating chocolate M&M's in the Shuttle's zero gravity (see page 26). Also shown is our hi-tech Christmas tree project, whose description starts on page 58. (Photo by Kevin Ling)

Video and Audio

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Projects and Technical

Professional Electronics

Columns and Comments

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180 Bourke Road, Alexandria, NSW 2015
P.O. Box 199, Alexandria 2015
Fax number: (02) 353 0613
Reader Services: Phone (02) 353 0620
Subscriptions enquiries: phone (02) 353 9944
Book Shop enquiries: phone (02) 353 9944
INTERSTATE ADVERTISING OFFICES
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Fax: (862) 890 4811, Adrian Batten.
ELECTRONICS AUSTRALIA is published by Federal Publishing Company, 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.

Typeset and printed by Hannanprint, 140 Bourke Road, Alexandria, NSW for Federal Publishing Company.
Distributed by Newsagents Direct Distribution Pty Ltd, 150 Bourke Road, Alexandria, NSW 2015. (02) 353 9911.
The Australian Publication emblem on the front cover of this magazine is there to proudly signify that the editorial content in this publication is largely produced and edited in Australia, and that most of the advertisements herein are the products and services available within Australia.
ISSN 1036-0212
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LETTERS TO THE EDITOR

SW receiver?

After seeing numerous kits associated with amateur radio I decided to get interested in it by building a shortwave radio. I then looked back through previous issues of *EA* and found a radio which was suitable, published in November 1980.

I am enquiring as to whether *Electronics Australia* has a shortwave radio on the design boards? Or if not, could you tell me where you could buy the parts needed for the 1980 radio, because the transistor BF494 isn't available and Watkin Wynne, the supplier of the coil formers, the Denco IF transformer, the Jabel handspan knob, and the Rolan single gang variable capacitors, have seemingly closed down.

Could all the coils be switched so they wouldn't have to be swapped around, such as in the design published in April 1980? And could you incorporate a meter for distinguishing incoming signals.

Colin Irwin,
West Chatswood, NSW

Comment: As you've discovered, Colin, many of the parts used in earlier designs are no longer available which makes a shortwave receiver not as easy as it used to be. But we'll see what can be done.

Moffat and GST - 1

Let me say at the outset that like Tom Moffat I am not a political party person; I try to vote for the people I feel may in some way advantage the country (not an easy task).

I must applaud Tom for bringing to readers' notice the amount of government paperwork that will be heaped on us self-employed small businesses, if a goods and services tax is introduced.

Unfortunately many of the thousands of people that will be affected have no idea just what will be required of them, and I suggest that a majority think it will not affect them.

I cannot understand any political party fighting an election with a tax package as their flagship, particularly as some of their other ideas seem quite good, but they must know something I do not.

No doubt it will help unemployment because hundreds more tax inspectors will be needed all over Australia, to check that the thousands who spend their Sunday afternoon writing up their week's work, are not cheating on the system. What will probably happen with the unscrupulous contractor, will be that the goods bought to carry out a job will have the tax paid at the time of purchase and this amount will simply be added to the service charge and the customer will pay the 15% twice. As the customer has effectively paid the tax the contractor will not need to fill out forms to reclaim the initial 15% paid on the goods at purchase time.

No doubt the government will not object if this occurs, and the hapless customer will not know they are paying GST twice.

I enjoy Tom Moffat's columns and he might be interested to know I have written this without the help of icons (I haven't got any).

Derek Logan,
Lenah Valley, Tas.

Moffat and GST - 2

Tom Moffat's absurd attack on the Coalition's Goods and Services Tax (GST) proposals (*EA* August 1992) brings a whole new meaning to his 'Madhouse' column.

Mr Moffat has no understanding whatsoever of the GST and it is regrettable, owing to a lack of basic homework, that he has chosen to mislead his readers. Small businesses will not be overburdened with paperwork in meeting the GST's reporting requirements. The whole scheme is blindingly simple and straightforward.

If any of *EA*'s readers wish to be reliably informed as to the effects of the GST on small businesses, they might write to me at: PO Box 486, Sale Vic. 3850. Hopefully, Mr Moffat's request for further information might be first in the mailbag.

Peter McGauran, MP,
Shadow Minister for Science
and Technology,
Sale, Vic.

Noise cancellation?

A reader for over twenty years, I wonder about something I read in a motoring magazine: Noise cancellation circuits to make a car quieter.

If I got it right a microphone picked up cabin noise, somehow phase-reversed it and put the resulting waveforms through a speaker.

My neighbour's teenagers spend a lot of time on drums and amplified guitars, which at times can be very frustrating. Wouldn't it be nice to do a project on these lines? Please consider. Kind regards and thanks for a great magazine.

Chris Gronlund,
Carlingford, NSW.

Comment: You have the basic idea right, Chris, but it isn't as easy as it sounds — especially in a larger volume than a car's interior. We'll try to look into it when time allows, but don't expect anything next month!

Spice for Amigas

I am a Dutchman visiting Australia, and happened to come across your publication 'PC based Circuit Simulators', which I found to be very instructive.

The possession of such a program must be the dream of every electronics amateur. The prices quoted are rather prohibitive for a hobbyist, however.

May I also draw your attention to the fact that those readers in possession of the more advanced Amiga computers, provided they have one megabyte of memory, may obtain the program ASPICE from the Fred Fish library for free (it's in the public domain). When I try to recall from memory it is disk #278, but you should check that. There may be an update on a later disk.

This program is the Amiga version of SPICE.

John W de Vries,
Melville, WA.

Comment: Thanks for the information, John.

Hifi speakers

I am currently in the process of building my own home speakers. I have a very fussy ear when it comes to music, so I want these speakers to sound good. For the speakers to sound good, I realise that you must use quality components and that is why I'm writing to you. I would be very grateful if you could provide me with names and contact numbers of companies who sell good quality drivers and/or cross-over units. By good quality, I also refer to good value-for-money.

I look forward to your reply and congratulate you on the continued quality of your magazine.

Chris Ripoll,
Macquarie Fields, NSW.

Comment: We can really recommend the Seas system described in the August issue, Chris, and also the VAF systems described in November. But don't forget that for the best results, the enclosure must be correctly matched to both the driver and the cross-overs. ❖

EDITORIAL VIEWPOINT

Pay TV: the battle for control continues...

As I sit down to write this leader, the logical topic is Pay TV — and the ongoing debate about when we might eventually get it, whether it'll use analog or digital technology, how many channels there will be, what the involvement of the ABC is going to be, and so on. The papers have been full of it, in the last couple of weeks, with rumours of deals being cut behind the scenes and all kinds of people and organisations battling for control over as much of the future medium as they can.

I guess it's understandable that the existing media moguls are interested in getting as big a slice of the Pay TV cake as they can, because as a new and undoubtedly very flexible medium it has the potential to make a lot of money — at least in the longer term — and some of this will inevitably be at the expense of existing media. As well as competing with free-to-air TV, in terms of viewer attention, there's also the strong possibility that Pay TV may eventually supplant it (especially that which relies on public funding). No doubt that's why the ABC and its supporters are taking such a keen interest in the debate.

What I find rather harder to understand is the apparently pivotal role of the Federal Government in all this. I can see that the Government has a responsibility to its citizens, to ensure that the technologies used are standardised and meet the appropriate technical performance standards — so everyone knows where they stand, and people can invest in equipment with confidence that it will have a reasonable working lifetime. Hence the need for the Department of Transport and Communications to be involved in decisions about the kind of technology to be used.

But once this responsibility is met, what is the justification for the Government then assuming the right to decide how many of the available transponders and channels are going to be used, and who will get the licences to use them? It's not as if we're talking about a limited public resource; there's room for quite a few satellites up there, quite apart from other delivery systems like optical fibre cables, local-area microwave broadcasting and possibly even twisted-pair wires, once digital video compression systems are fully perfected. In any case most of these delivery systems are now privately owned, at least in theory — and ownership of something normally implies the right to use it.

The Government *seems* to be justifying these actions in terms of the need to ensure economic viability. But this in turn seems to be based on assuming that while the people who will be investing in the new medium are supposedly incapable of making their investment decisions wisely, Australia's politicians and bureaucrats in contrast *are* gifted with the wisdom to make the decisions for them. History doesn't suggest that this is a valid assumption...

Recently the daily media reported Mr Rupert Murdoch as saying that he too couldn't understand why Pay TV needed to be regulated at all. "I think they could just get out of the way and let everyone get at it", he is quoted. I imagine that there are very few subjects on which Mr Murdoch and I would agree (not that that would worry him, I'm sure); but on this occasion I think he's right.

Why *not* just let anyone who wants to lease a transponder and offer programs to subscribers 'give it a go'? That way, it seems to me, Pay TV's subscribers are much more likely to get genuine freedom of choice.

Best wishes for the Christmas and New Year season, from all of us here at *EA*.

Jim Rowe

Satellite TV technology:

NEW LNB'S, PAL DBS RECEIVER FROM AV-COMM

Local satellite TV reception equipment supplier AV-COMM has expanded its range recently, with two interesting new low-noise block downconverters and a new 'top of the range' receiver for fortuitous PAL reception — featuring extended tuning range, selectable half-transponder operation and dynamic noise reduction.

by JIM ROWE

When I reviewed a low cost Ku-band satellite TV reception system from AV-COMM earlier this year (see the stories in the July issue), I was most impressed with the quality of 'fortuitous' PAL reception it delivered from the current 12W A-series Aussat/Optus transponders.

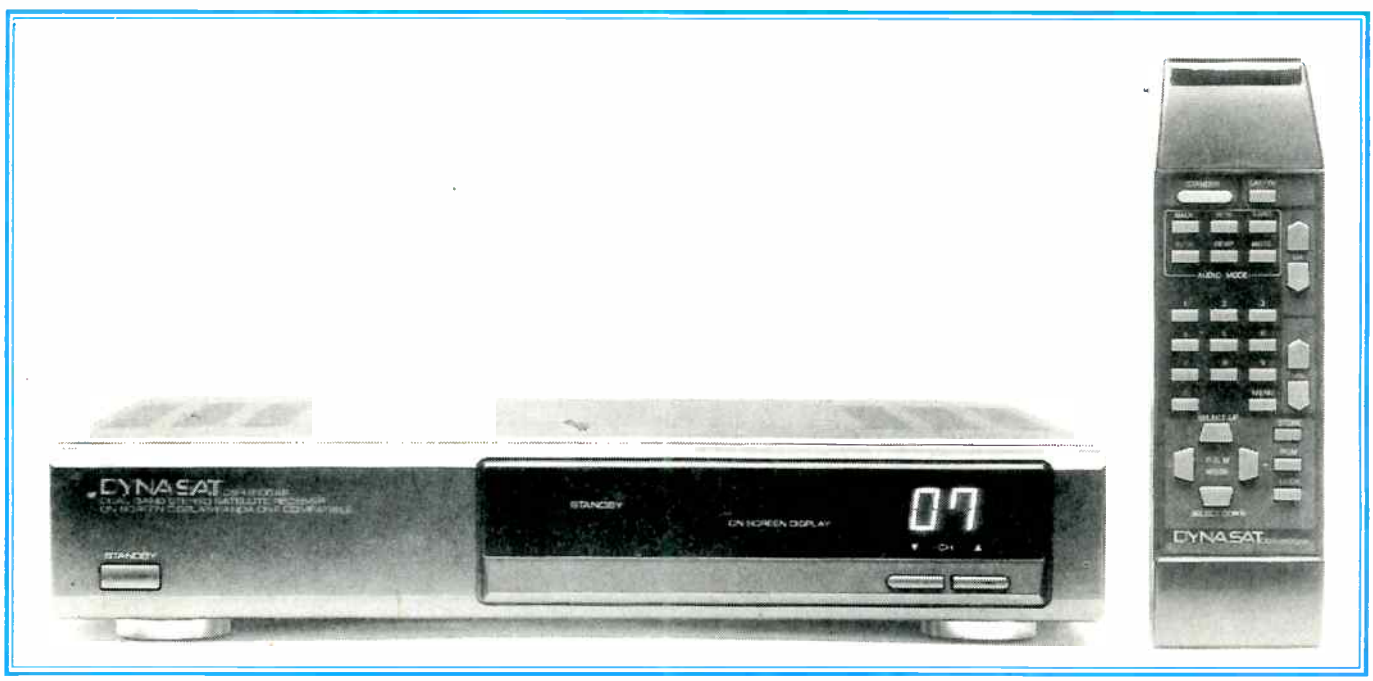
However like most such 'domestic' systems, even those costing considerably more, it had something of a problem with reception of the 'SCPC' (single channel per carrier) radio signals that are also radiated by the satellites: the signals don't stay fixed in frequency, but appear to 'wander' slowly along the band.

There's no mystery about the cause of this wandering: it's frequency drift in the local oscillator inside the LNB unit, at the focal point of the receiving dish. As well as providing 'masthead' RF amplification of the very weak incoming Ku-band signals at 12.25 - 12.75GHz, the LNB also converts them down to a 'first IF' in the range 950 - 1450MHz, to travel down the cable to your satellite receiver (which is really a 'tuneable IF').

In order to perform the downconversion, the LNB has to have a local oscillator at 11.3GHz, located right inside the LNB itself. And as the LNB is up at the dish focus and exposed to a very wide range in temperatures, stabilising the frequency of this local oscillator is quite a challenge — especially as in low-cost LNB's for domestic reception, the oscillator is essentially just a free-running type based on a tuned microstrip line.

By using very careful design, LNB makers have been able to provide this kind of oscillator with a stability of within +/-2.5MHz, over the full temperature range. Which is really quite an achievement, when you think about it; 2.5MHz drift at 11.3GHz is only .022%, or about 220 parts per million.

This order of stability has turned out to be fine for TV reception, because until now at least this has used wideband FM (30MHz p-p deviation) for the



The Dynasat DSR 9105AP satellite receiver is AV-COMM's new top-of-the-line model, featuring half-transponder operation.

video, with the sound on subcarriers. Satellite receivers have had to be provided with AFC, in any case, to cope with the deliberate 'dispersion wobble' of the signals, and this has meant that they can easily cope with the relatively modest drift of the LNB oscillator.

So there hasn't been a problem with TV reception; it's only when you try to receive the SCPC *radio* signals that the LNB drift really makes itself evident.

Needless to say, AV-COMM's founder and Technical Director Garry Cratt has been well aware of this, and when I was writing the July stories, he advised me that he was expecting before long a new type of LNB which would hopefully solve the problem: one with a local oscillator stabilised via a phase-locked loop (PLL). I mentioned this in the review article, and said that I hoped to be able to try one out when they arrived.

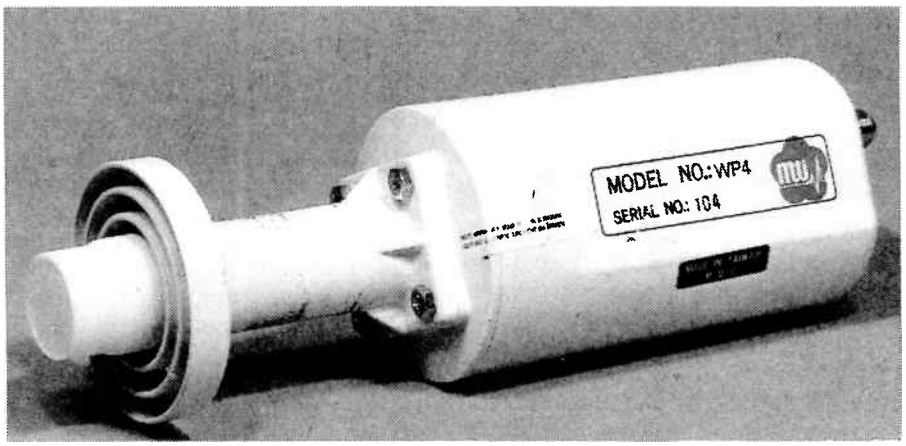
Well, the new PLL-stabilised LNB units did indeed arrive soon after that, and I have been able to try one out for a couple of months. I gather that they are the first low cost PLL-stabilised LNB's produced for domestic satellite reception, so it's quite a feather in Garry Cratt's cap that he has been able to source them for use in Australia.

And the performance is very impressive, especially in terms of frequency stability. The data sheet specifies a drift figure of +/-275kHz maximum, but the sample I received turned out to be significantly better: between about 4°C (in the wee hours at night) and 28 - 30°C at mid-day, it varied by no more than around 60kHz.

That's only .0005%, or 5 parts per million — an improvement of over 40 times, compared with a standard LNB. Obviously the crystal oscillator used as the PLL's reference must be very well designed, to achieve this order of stability.

Needless to say, the improvement in receiving SCPC radio signals is quite dramatic. Each SCPC signal is very nearly fixed on the 950 - 1450MHz IF band, as it should be. The only thing you find now is that if you listen to such a signal for an extended time, you occasionally need to adjust the tuning by one 20kHz or 25kHz increment, to maintain optimum reception.

But is there any penalty for this improvement in stability — has any other aspect of the performance been sacrificed? Not that I can see. The noise figure of the unit I tried had been measured at better than 1.05dB over the full 12.25 - 12.75GHz band, with a gain of 57dB +/-1dB and an image rejection of 55dB.



And here is the dual-polarity LNB, complete with its feed horn assembly.

This means it is well and truly up with the best of the current 'ultra low noise' standard LNB's, although I don't have the factilities to confirm these measurements.

However during my testing it did give really good 'fortuitous' PAL TV reception from the 12W transponders on satellite A1, with very little visible noise even on saturated reds and yellows. On one or two even more fortuitous occasions it also gave truly superb reception when the A1/T8 30W transponder was carrying PAL material.

In short, then, I can report that the new PLL-LNB is not only excellent for SCPC radio reception, but also a very nice performer indeed for fortuitous PAL TV reception. It would make an ideal LNB for the satellite enthusiast keen to listen to the SCPC signals as well as viewing the TV.

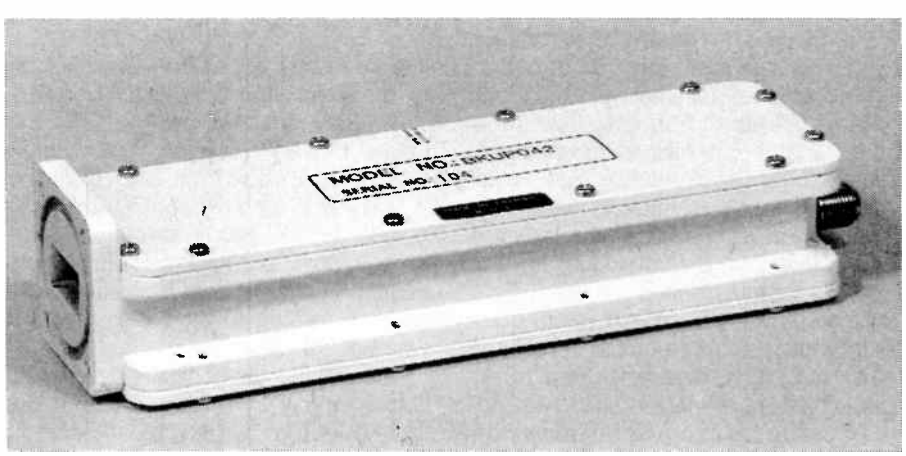
LNB number 2

As it happens, AV-COMM is now also stocking *another* new and interesting type of LNB, apart from the PLL-LNB. This is one of the new *dual polarity* LNB's, which respond to both vertical and horizontal polarisation and don't require the use of a polar rotator.

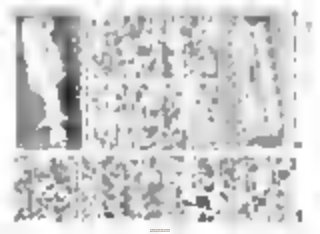
I mentioned this type of LNB in the July articles also, but in case you've forgotten here's a quick recap. To pack as many transponder channels as possible into each satellite, both vertical and horizontal polarisation are used — with the transponders alternating between the two, so that adjacent transponders have the opposite polarisation to minimise interference. This means that the receiving system and LNB must be capable of responding to signals of either polarisation, as required.

Early satellite receiving systems used mechanical actuators, to rotate the LNB and feed horn physically by 90° while maintaining them accurately at the dish focus.

More recently, ferrite 'polar rotator' units have been used, which twist or 'skew' the polarisation of the incoming signals themselves, by using the Faraday rotation effect. An adjustable DC current is passed through a small piece of ferrite in the waveguide between the feed horn and the LNB's pickup probe, to control the degree of skewing.



Here is the new phase-locked loop LNB, which is a little longer than the standard type.



New receiver from AV-COMM

Although ferrite polar rotators allow quite precise adjustment of the skew, like the older mechanical rotators they still require additional conductors in the cable between your receiver and LNB. The receiver also has to provide programmable levels of drive current, adding to receiver complexity.

A further disadvantage is that there is inevitably a small loss of the incoming Ku-band signals, as they pass through the rotator's ferrite material. The loss is only a fraction of a dB (typically 0.2dB), but even a tiny loss at this point in the system degrades performance noticeably, when you're trying to receive such weak signals.

Because of these disadvantages, there has been a trend in the last year or so towards a different system again: the dual-polarity LNB.

Instead of having a rectangular input waveguide with a single 'antenna' probe near the end, coupled to a single RF stage, a dual-polarity LNB has a *circular* waveguide capable of supporting signal waves of either polarisation. It also has *two* antenna probes, spaced radially 90° apart; so that when the whole assembly is orientated correctly, one probe can respond to the vertically polarised signals and the other to those that are horizontally polarised.

To allow convenient selection between the two, the LNB circuitry is made to respond to changes in its DC supply voltage — fed up the IF cable from the receiver in 'phantom' fashion.

Thus a supply voltage of +18V causes the LNB to operate from one probe, while changing the supply to +13V makes it switch to the other probe. Many of the latest satellite receivers have been provided with the facility of switching the LNB supply voltage between these two levels, to control this type of LNB.

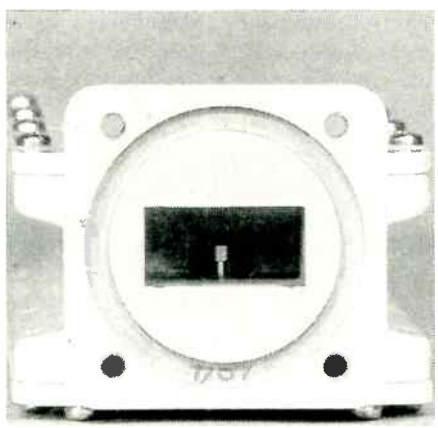
The potential advantages of this kind of dual-polarity LNB are simpler cabling, a less complex receiver, better overall noise performance and easier setting up. So I was understandably very interested in trying out a sample, when Garry told me recently that he had received samples.

When the sample arrived, it was complete with matching circular feed horn. This made it very easy to fit it to the 1.8m test dish, in place of the PLL-LNB and existing feed horn/ferrite rotator assembly.

And since the dish had already been set up for one of the A-series satellites, it was relatively easy to find the correct orientation for the new LNB; all that I had to do was program the receiver for a particular transponder, with the correct DC voltage coming up the cable, and then rotate the LNB in the focus clamp assembly until the meter on the AGC line indicated maximum signal strength.

And the results? I have to say that there was a *very significant* improvement in picture noise, even compared with the 1.0dB noise figure PLL-LNB. So much so that even on highly saturated reds, there were almost no 'sparklies' at all even with light cloud — and again with fortuitous PAL signals from 12W transponders on A1.

Since the sample dual-polarity LNB has nominally the same 1.0dB noise figure as the PLL-LNB and the previous 'standard' LNB I tried, I can only assume that this improvement is largely due to the removal of the polar rotator



Ever seen an antenna for 12.5GHz before? Well, now you have: it's the tiny little probe visible in the centre of the waveguide, in this view of the input to the PLL-LNB.

and its insertion loss. But whatever the reason, there's no doubting the benefits.

If you're after the best possible fortuitous PAL TV reception, then, with the least possible noise for a given dish size, it looks as if the new AV-COMM dual-polarity 1.0dB LNB is currently the way to go. Garry does have a 1.4dB version as well, by the way, but it would be well worth stretching to the 1.0dB model if your budget allows.

And talking about budgets, I should note here AV-COMM's current prices for the various LNBs. The new PLL-LNB (1.0dB) is $470, while the 1.4dB version of the dual-polarity model is $325 and the 1.0dB version is $475.

For comparison, the 'standard' LNB models are priced at $225 for the 1.4dB version, $349 for the 1.0dB version and $369 for the ultra-low noise 0.8dB version. These prices are all inclusive of sales tax.

Incidentally Garry tells me that because of the excellent performance of the new dual-polarity LNB, he's incorporating it into his $995 complete receiving system for Aussat fortuitous PAL reception.

By the time you read this, this system will be supplied with a 1.6m dish and one of the new LNB's, in place of the original configuration.

New receiver

The third new item in the AV-COMM range is a new 'top of the line' PAL satellite receiver, the Dynasat DSR 9105AP. This is a compact but very powerful unit which offers 100 programmable channels, and is equipped for 'half transponder' reduced bandwidth reception so that it can be used for C-band operation as well as Ku-band.

At this stage I haven't seen one of the new receivers in the flesh, but from the information sent by Garry Cratt it looks quite impressive. Features include increased tuning coverage (from 950MHz to 1750MHz), a very flexible IR remote control with on-screen function display, full PLL synthesised tuning, dynamic noise reduction, decoder output switching and scan mode.

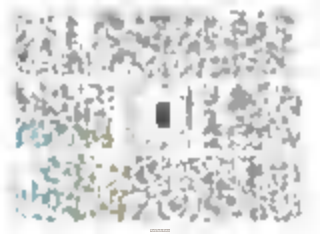
The DSR 9105AP has discrete video and audio outputs using both RCA and SCART connectors, and also provides a tuneable UHF remodulated output for feeding to a standard TV receiver. It even generates a test signal for tuning the receiver, like many VCRs.

The receiver supports both mechanical and ferrite polar rotators, as well as voltage switching dual-polarity LNB's. It also has AFC capable of tracking LNB drift of several megahertz.

So all in all, it seems like a most impressive receiver, and one that should be of considerable interest to anyone interested in reception of Intelsat and other C-band signals, as well as those on Aussat's Ku-band satellites.

The quoted price of the Dynasat DSR 9105AP receiver is only $595, which sounds very reasonable considering its features and capabilities.

Further information on the new LNB's and receiver, or indeed any of the satellite reception gear in their range, is available from AV-COMM, 70 Wanganella Street, Balgowlah 2093 (PO Box 225), or phone (02) 949 7417. ❖



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HORIZONS OF

Every two years, the US-based Society of Motion Picture and Television Engineers holds a 'Down Under' Convention in Australia. This year the fifth such Convention was held at Sydney's Darling Harbour, a change from the previous venue at the Sydney Showground. Here's a report from Barrie Smith, who found the technology itself most impressive — despite the fact that its presentation often left something to be desired...

by BARRIE SMITH

I have now attended all of five of the SMPTE's 'Down Under' Conventions, and while having few regrets about the move from the agricultural environs of the Sydney Showground, I suggest maybe a dash of 1990's high-tech would be welcome at future shows, by exhibitors and building supervisors alike.

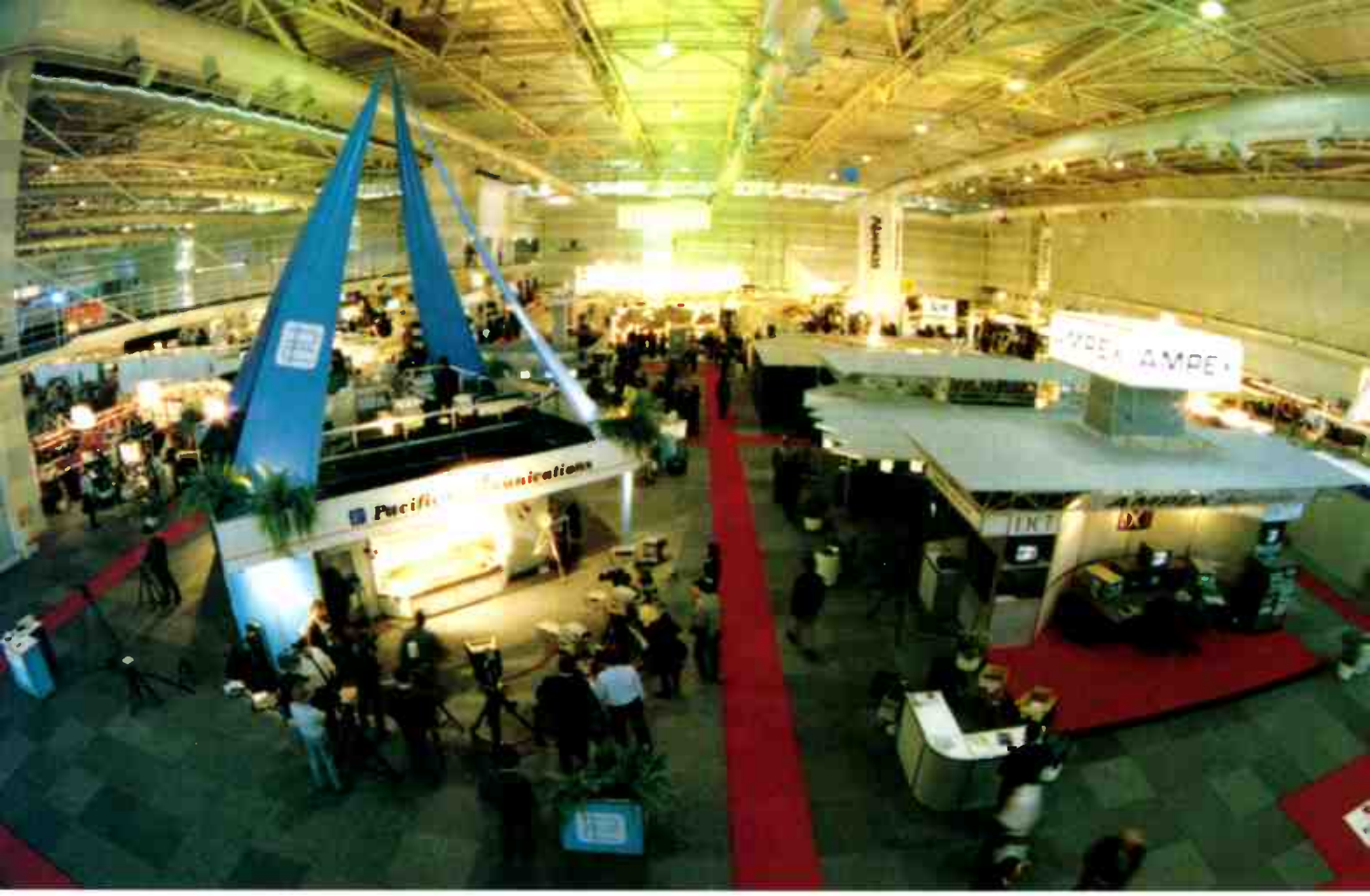
Why not get the exhibitions above eye level, for example? Only one or two had aerial aspirations — like the Sony stand — to give the eye a heavenwards lift. The foyer of the otherwise excellent presentation theatres could also do with a serious rewire, to remove unsightly and dangerous lines of taped-over phone and power lines across the carpets.

But with those gripes off my chest, on with the show. There were two halls, housing a large throng of exhibitors — from the very small, right up to the majors; over 80 exhibitors in total.

In terms of conference activity, more than 40 papers were presented by local and overseas representatives. The theme of the 1992 event was 'New Horizons for Creative Productions and Global Distribution'.

The technology shown and discussed covered the areas of film, video, audio, computers and communications. For an event that is now predominantly electronic in orientation, it was surprising to note that the most abundantly visible organisation was Eastman Kodak (13

HORIZONS OF



THE DIGITAL KIND

papers), belatedly followed by Sony (with three papers).

The 'New Horizons' theme was aptly chosen, as major changes in techniques and methods were revealed — with many companies entering new fields in an effort to compete in the race to tap lucrative dollars from the impending wild flurry of global activity in HDTV, satellite TV, the film to video interface, the computer to video interface, compression techniques — and digitisation.

Even the staging of the show owed much to 1990's technology: the event ran for four days, with only 72 hours allowed for setting up and another 21 for 'striking' the stands. Taking into account the daily rate for the lavish facilities, one exhibitor remarked to me that use of the Darling Harbour venue had been made economically feasible only through the use of cellular phones and the almighty fax!

Film under siege

The silver-based technology of motion picture film emulsions is under deadly attack. It was difficult to find any motion picture cameras on display — and the few on show were to be found on the stands of rental companies. Little was visible in the way of peripherals for film making, and only one screen showed a projected image — from a lumbering Cinemeccanica 35mm theatre projector, standing defiantly on the Greater Union stand.

Proving that video has a place even in the most traditional film environment, Sydney company Video Assist demonstrated what is virtually an 'off-line edit suite on wheels'. A video camera shares the image from the film camera's viewfinder. By use of frame stores and time code the 'assist' can deliver to the director or cameraman instant 'confidence' video replay of scenes for intricate frame matching trickery — such as the 'morphing' special effects currently seen on TV.

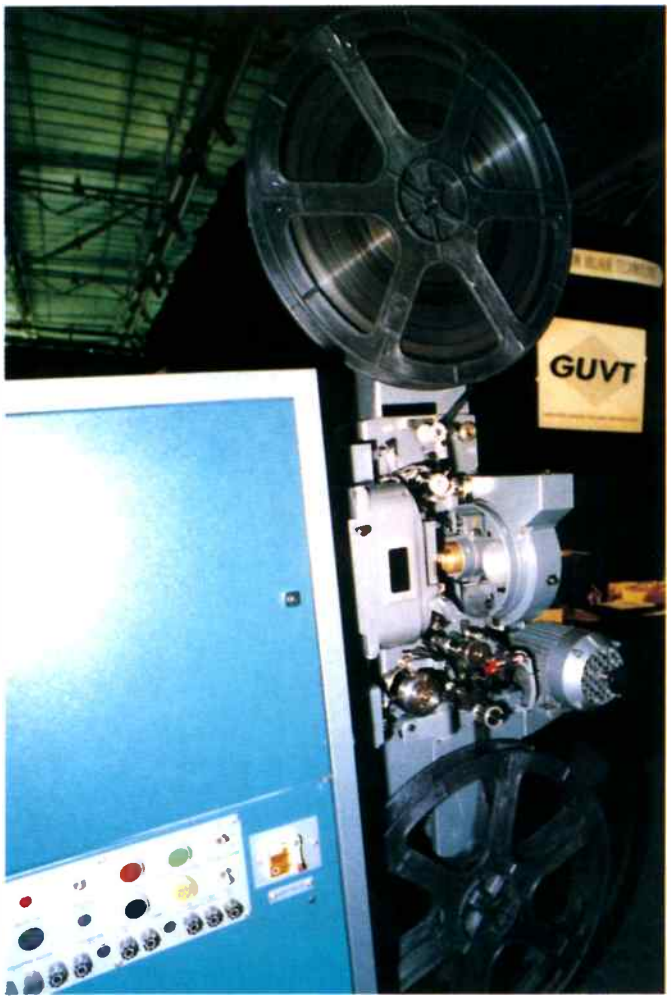
John Barry Group showed a 'budget' Steadicam — only $30,000! — to support lightweight cameras; the device provides steady action with viewing via a video monitor. Also on demonstration was the Optex Borescope (and periscope) lens for 35mm motion picture shooting — for screen-filling closeups, with the camera nearly a metre distant.

Editing systems to handle film in the electronic domain abounded. Greg Ropert of SMP (a 'bits and pieces' supplier) reported there has been an enormous change in the production industry: "The sprocket business, both in supplies and equipment, has fallen down to levels of film origination only. Anything in post production (meaning editing, etc) is now

THE DIGITAL KIND

Horizons of the Digital Kind

The John Barry Group was demonstrating this 'budget' Steadicam unit to support lightweight film and video cameras. It's priced at only $30,000!



There was little film technology on show, apart from this Italian cinema projector.

going electronic." He added that only organisations like the National Film Archive are still in need of traditional film hardware...

The investments being made in video by small and large companies are revealing. One cameraman-producer, Ed Payne from Mudgee, NSW operates a small video-making business with two Hi-8 cameras that total $20,000 in cost. But his capital outlay in terms of editors, TBC's (timebase correctors), mikes and sound gear would far exceed this. His product? Steam train videos, commissioned footage of stud horses and the odd local wedding.

At the other end, Quantel, the English company responsible for arguably the highest-end hardware for producing spectacular video effects for TV commercials, ran a display of its models which would have totalled millions.

The company's 'Henry' Concurrent Editor is claimed to be an entirely new concept in editing. Its random access disk-based store holds five minutes of video and is able to process, manipulate and interleave 42 levels of full broadcast quality vision in real time. Using the familiar pen and tablet interface, the operator is able to edit with intuitive control — the frames of vision are shown on the screen in the form of film clips; at the same time such tasks as superimposing, colour balancing and chroma keying can be performed.

'Henry' retains the image information within the digital domain during the entire process. The price? A cool $1.2 million — but three have already been sold in Australia.

But if you're still thinking of setting up a 'post' outfit to make big budget TV ads, the lashing out of big bucks doesn't stop there. Quantel Australia's MD Haydn Deere adds the caution that while the human interface with this level of 'machinery' is becoming simpler, operating it still calls for creative input to 'make it fly'. Creative talent in this area is scarce — and expensive.

Also intended to process vision within the digital environment is Ampex's DCT (Digital Component Technology) system. Based on a proven 19mm tape transport system which supports a full CCIR-601 (4:2:2) digital component video signal, the DCT is modular: it comprises a tape drive, switcher, computerised edit controller, ADO effects and an 'interconnect' which interfaces in/outputs to analog devices. The elements can be added as the need for sophistication in vision handling requirements grows.

The heart of the scheme is a new tape drive which has air-lubricated tape guides, with no pinch roller and delivering what is described as 'the gentlest tape handling in the world'. 525 line/60Hz or 625 line/50Hz formats are switchable. Four channels of 18-bit, 48kHz sampled audio can be recorded on the DCT tape.

Editing technology

Existing methods of editing are under challenge. On the way out are the 'linear' systems which depend on one or two VTR's dumping a compilation of scenes extracted in serial fashion, for recording on a further machine.

One step towards the new approach

The Ace Edit stand. In middle is Glyn Morris from Ace, while at right is Ed Payne from Mudgee — a cameraman-producer who operates a small video making business.

Quantel's 'Henry' Concurrent Editor is claimed to be an entirely new concept in editing. It's priced at $1.2 million...

was the compilation of an EDL (Edit Decision List) which the editor created as a list of scenes, with their 'in' and 'out' points. The EDL could be created via equipment no more sophisticated than the home VCR. Once compiled, this EDL could be fed as a bundle of numbers into the edit controller and its microprocessor — and the edit made without further human intervention.

Today, the catch phrase is 'non-linear', and the economic and everyday PC is being marshalled to handle the edit in a more casual and free-flowing fashion. (For 'non-linear' read *random access*.)

BTS (Broadcast Television Systems, a joint Philips/Bosch enterprise) showed their E-Clips unit. Unlike other editors, this is a hybrid between a linear and non-linear system.

You can stay with the screen, keyboard and mouse of your 486 PC and control the movements of the tape drives from a Windows-based display. Not only can you click on buttons marked 'Play' and 'View' to drive the tapes, but a single frame 'grab' from each scene can be stored in memory.

The E-Clips method doesn't retain 'active' video — only a single frame reference. As the operator explained to me: "Someone can sit there and shot list the 'go' takes, giving 'in' and 'out' frames. Then by using an option called Fast Edit you can call up your EDL".

E-Clips has a built in vision mixer, audio mixer and can interface with virtually any audio desk.

JVC showed a vast range of post production units. Some were intended for Betacam and the digital machines. The company also exhibited an S-VHS range, for programme making in that once amateur but growingly pro, format.

The latest generation machines have 9-pin serial control as standard, along with a slot-in TBC and time-code reader/generator board. Out of the TBC emerges YUV component signals or optional low/high band U-Matic. The company now claims 'first generation' quality right through to the fifth generation.

National Sales Manager of JVC Matthew Offord explained that the S format was fairly well accepted by broadcasters, but one of the things they *didn't* like was when the picture was slightly underscanned — revealing the head switcher information at the bottom. JVC have now included head switching masking, so if the picture is underscanned the data is concealed.

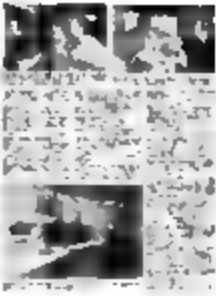
Another PC system on the JVC stand was 'EDDI', produced by Paltex of the USA. The company's Erle Jamgochiam confirmed that "EDDI works within MicroSoft Windows. Anyone familiar with MS Word or MS Excel already knows many of the operating routines".

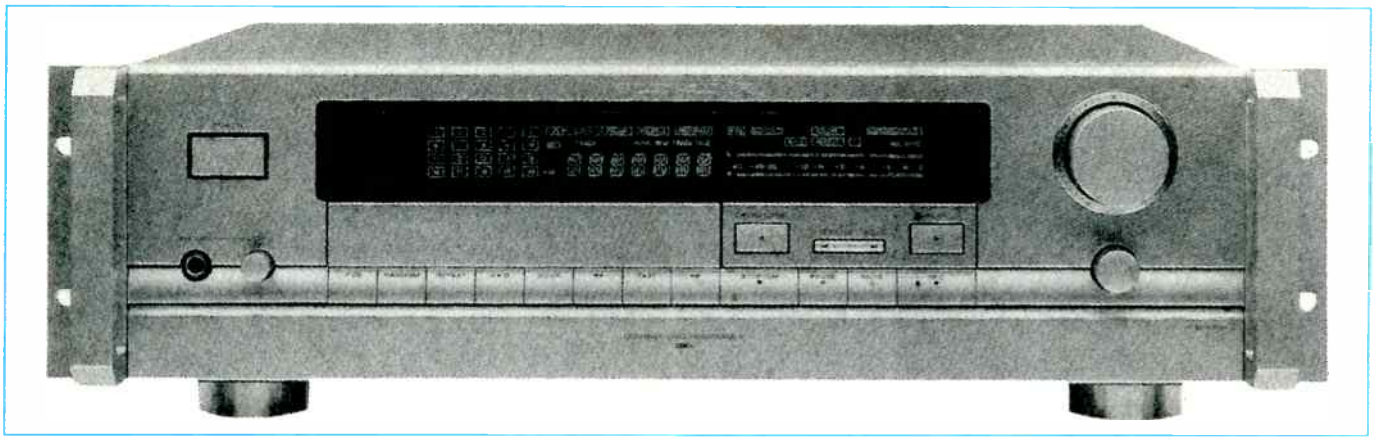
Users are free to 'task switch' between the tape editor, character generator, switcher and a number of other functions — all via the PC screen. The system also allows the user to capture still frames that represent shots on the source reel and build a data base. And the cost? There would be change out of $20,000, and this is including the PC.

A different approach to harnessing the increasingly humble PC was 'Shotbox' — a hardware/software package allowing the creative film/video maker to capture frames from tape and assemble that all-important storyboard before entering the edit suite. The package includes a 486 PC plus 250MB hard drive.

Another company showing editing systems was Ace Edit, with realistically

Ampex's DCT system, based on a proven 19mm tape transport system and supporting full CCIR-601 (4:2:2) component signal.





Marantz showed its CDR-1 Compact Disc Recorder, in the standard 16-bit format, sampling at 44.1kHz. It is able to produce masters for CD mass production.

priced modules working with all time code systems (SMPTE, RCTC, VITC) and interfacing with high end and low end replay/record units.

The US Matrox Studio showed its Power To Program complex, offering multilevel mix effects on up to five layers of video and graphics simultaneously. All processing is done in the digital domain (4:2:2).

Lightworks, from the UK, was on show. This hardware allows instant access to two hours of vision plus sound; 40 hours of material can be stored — on hard disk. Being an off-line system, Lightworks deals with component vision and can output to a video recorder for reference — and of course, produce the all-important EDL. To enable the video to be loaded onto a hard drive the pictures are compressed by a factor of between 50 and 150 times.

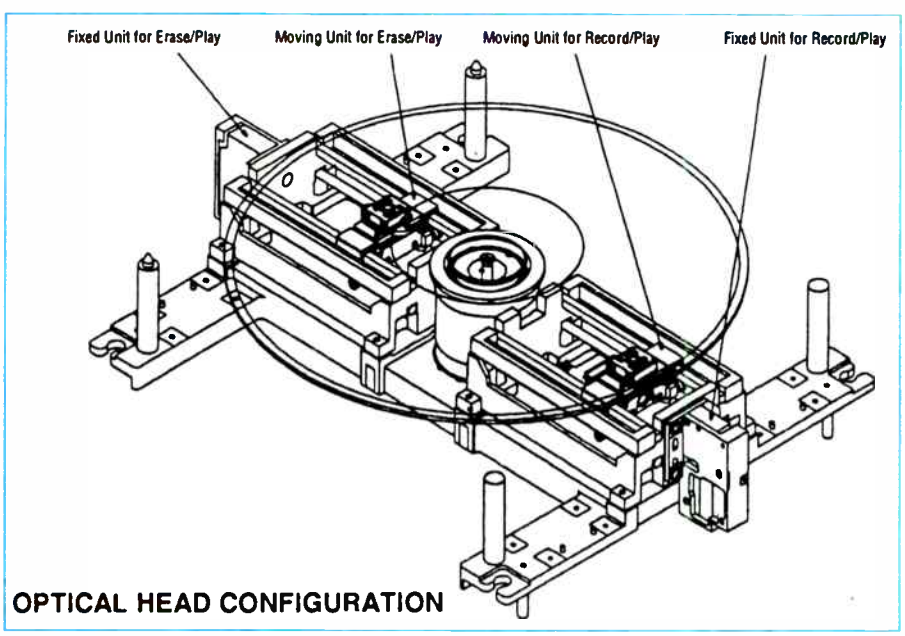
The audio side

Sydney company Fairlight showed its new Digital Audio Workstation, a 24-track console which uses colour graphics displays, 9-pin protocol, non-destructive recording and editing. Storage can be on hard drive, tape or rewriteable optical drives. At a sampling rate of 44.1kHz, a 1.2GB drive holds 200 track minutes.

Marantz showed their new, recordable Compact Disc machine, in full 16-bit standard, sampling at the standard rate of 44.1kHz. The recording process is sequential, so material can be recorded in different sessions. It can produce masters for CD mass production.

A rewriteable video disc recorder — Pioneer's PAL format VDR-V1000P was always well patronised by visitors. Claiming one million 'rewrites', the unit contains a full frame TBC, PCM audio and 32-minute, 48,000 still picture capacity.

Believing that digital was the way to go in the creation of a high quality field recorder for film production demands, the Swiss Nagra recorder employs its own helical head system to pack four 16-bit tracks plus time code onto a 1/4" (6.35mm) tape. This runs at 49.6mm/sec for two tracks, or 99.2mm/sec for four tracks. The machine is now on sale in Australia, at $33,000.



Pioneer's PAL format VDR-V1000P rewriteable video disc recorder has a capacity of 48,000 images per disc, and claims one million 'rewrites'.

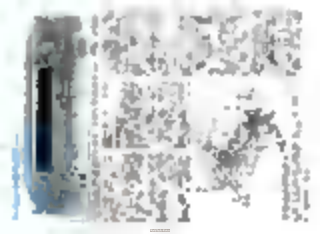
Cameras, cameras...

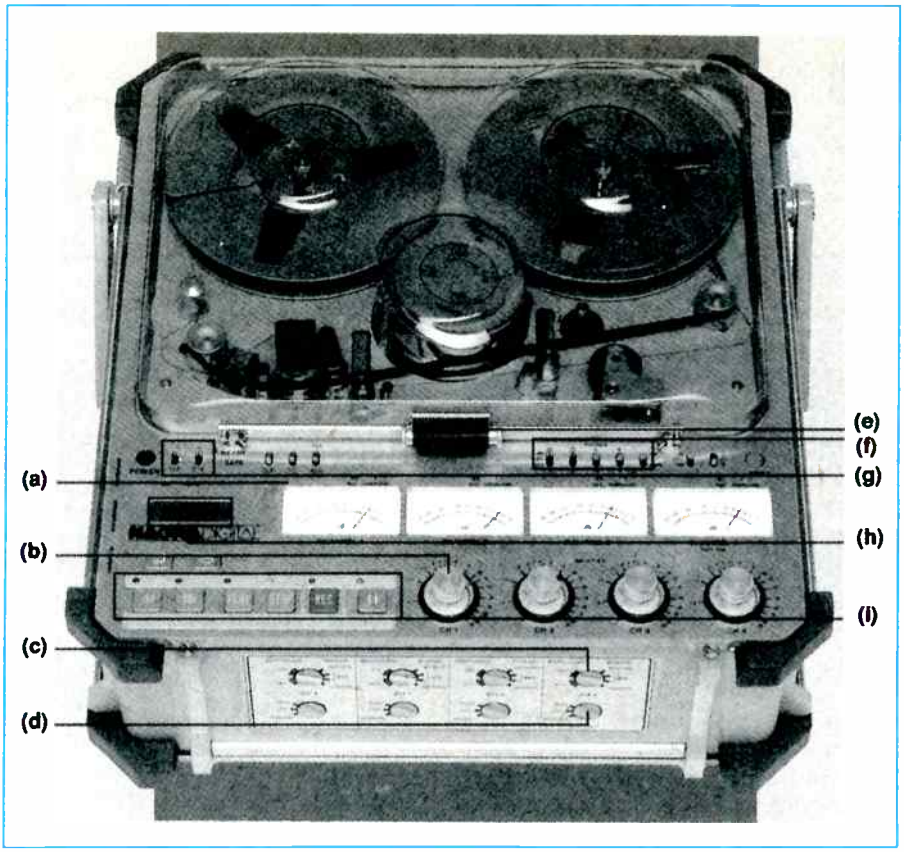
There were the usual video camera 'circuses', with serried rows of new models pointing at brightly and flatly lit mini studios bearing subject matter as varied — but inherently fairly static — as a model train (Ikegami), a painter's studio (BTS), a lone blonde with a set of weights (Panasonic) and Sony's lunar surface miniature.

GEC-Panasonic appear to have scored with their MII tape format in the 'enhanced' series, by targetting SP Betacam for lower-end pro customers. Current users are: Prime TV, Dandy Video Prods and Sports Colour which does the races in Melbourne and the MCG.

An interesting device stood alone and unwanted, amid a sea of editing desks. The unit was the GEC GPT Codec — for 'single handed' video conferencing.

The composite digital D3 format was given its initiation at Barcelona, with some 1200 separate D3 VTRs delivering high level pictures to the world. The component version is likely to be seen here late 1993. A complete edit suite was on working display at the company's stand.





The Swiss Nagra digital audio field recorder packs four 16-bit tracks plus time code onto a 1/4-inch (6.35mm) tape. Identified are the level indicators (a), level controls (b), direct amplifier controls (c), low cut filters (d), transparent cover (e), headphones switches (f), channel lockout switches (g) time code display (h), and finally the main function keys (i).

Sony showed an amazing array of equipment. Sony's Mike Steele surprised me by showing a simple assemble-edit unit in S-VHS. Said Steele: "It's obviously a bit of a change for us. We've really accepted that VHS is now the standard distribution format. This setup has been specifically designed for single generation recording. Various options are RS232, RS422 — the time code goes onto one of the audio tracks".

Much interest was being shown in the magneto-optical units and the new, lower cost laser video disc recorder — model LVR-4000P. The DIH-2000P Digital Information Handler and the Sony UP-7000P Multiscan printer were busy pumping out high quality dye sublimation prints, originally taken on the NTSC Mavica video still camera in Japan and received via modem.

Moored to the dockside was Digital Betacam — or at least a leisure cruiser packed to the gunwales with high definition monitors and a prototype VTR. The demo of the format was impressive; even taken to a 31st generation it was difficult to pick any loss or generation of artifacts.

Analog Betacam compatibility is promised in at least one digital VTR model. Ten heads are being retained to handle the information density — the trick is BRR, a 50% bit rate reduction.

Adjacent to Sony was a Fujinon lens stand, housing yet another model train. What attracted many were the high quality pictures captured by a mini colour camera strapped to one of the carriages. The camera? Sony. The lens was also by Sony.

The papers

It is always a challenge, and often educational as well, to sit in a darkened theatre and cope with speakers holding forth on subjects as esoteric as 'Automated Camera Measurements' and 'Accelerated Life Testing of Metal Particle Tape'. And this year, there were some rivetting ones.

Quantel has decided there's some business in transferring original film scenes to video, interpolating wild video effects digitally, then dumping the combined vision back to cinema quality film. (If you've seen *Terminator 2*, you'll know what I am referring to.) Their Domino system is due to be shipped later this year. The file sizes involved vary between 2.9MB and 11.8MB *per frame*.

One Sydney expert rather threw the Quantel speaker into a flurry, by asking about film steadiness and how it was being addressed in the digital domain. The answer given far from satisfied the inquisitor.

Back to back with Quantel's chat was a Kodak presentation, reminding everyone that the firm's high-resolution digital imaging workstation is still under way. In this scheme, film is digitally scanned and loaded into storage on a computer workstation, where image manipulation, colour enhancement and titling are performed in the digital domain. Following this stage the data is returned back to film — in high resolution format. Beta testing has already taken place in Los Angeles, and the product is expected to ship in 1993.

Hot topic

Compression is very much in the minds of engineers and manufacturers. Without its benefits, we are unlikely to enjoy HDTV and many other advanced vision technologies without heavy costs, in terms of dollars and equipment size.

What caught my own imagination in this context was an address by Roderick Snell, of Snell and Wilcox. Snell described work being done by the company in conjunction with the BBC, on Motion Compensation or Prediction. Akin to the animator's 'in-betweening' function when making a cartoon, the technology fills in missing frames in motion recreation.

Apparently the original intention was to harness the approach in the company's standards converters, but being 'more fun for the engineers', a swing was made to production of a *slomo* (slow motion) device. Startling tapes were shown of a fast moving basketball game, with the action slowed down on replay. There was little blurring, and an apparently complete series of frames. Even more impressive was a short sequence of a skidding racing car, slowed down to walking speed. Snell explained that the slowing factor was 30 times — i.e., 20 frames were 'predicted' and added into the slowed-down clip.

There was more, much more — and much of it showing the dependence on digital technology. In all, it was a very different SMPTE from previous years, and indicative of the way audiovisual technology is now advancing very rapidly.

Footnote: The papers presented at this year's SMPTE conference have been published in book form, and can be purchased for $55 plus postage from Expertise Events Pty Ltd, of Level 4, 22 Darley Road, Manly 2095. ❖

What's New in VIDEO and AUDIO

A-V receiver has Dolby Pro-Logic

Kenwood has released the KR-V7040 five channel surround sound audio/video receiver, offering both Dolby Pro-Logic and Dolby-3 stereo decoding to recreate the surround sound effects offered by today's Dolby encoded movie sound tracks.

The Pro-Logic decoder incorporated in the KR-V7040 'steers' the circuits to detect which channel is loudest at any moment, raise its volume, and momentarily reduce the volume of other channels. As a result, you can focus clearly and hear the sound of a car starting on the left of the screen, for example.

The KR-V7040 offers five channels (100 watts RMS in stereo mode — 65 watts front left, right and centre (surround mode) and 15 watts RMS rear left and right.

The bass, treble, centre and balance controls use regular knobs, while the main volume control is either motor-driven from the remote control or can be adjusted manually.

The AM/FM stereo tuner section offers 20 random pre-sets for either AM or FM stations, with pre-set scan and 10-key direct access tuning. A station name pre-set system (SNPS) allows the user to select up to four characters to label selected stations with their station call letters, for example 2NSB, 2JJJ, or 2CH.

The KR-V7040 provides two sets of video inputs/outputs for dubbing from VCRs, CTVs, etc. Additionally, the unit provides inputs for Phono, CD, tape in/out x 2, and video in/out x 2. For best sound quality from a compact disc source, a 'CD direct' key bypasses all the tone control circuitry. When used with other Kenwood compatible products such as CD player, tape deck and record player, an Auto mode feature will automatically play these units when the Play mode key is activiated.

The KR-V7040 has an RRP of $1099 and is covered by a three year parts and labour warranty. It is available at selected Kenwood A/V concept dealers.

VCR is 'easiest to program'

The new Amstrad UF22 video cassette recorder is claimed to combine features normally seen only on VCRs costing hundreds of dollars more — and also features what Amstrad describes as 'the simplest and easiest method of recording ever seen'.

Instead of a confusing maze of tiny buttons, the UF22's remote control uses just four large, colour-coded buttons.

Timed recording with the remote control is as simple as selecting the channel, selecting the time to start recording and pressing a button to send these instructions to the VCR.

Other features include two speeds, providing up to eight hours' recording on a standard E240 tape; 'satellite-TV-ready', with European SCART connectors for televisions, satellite Pay TV decoders and other VCRs, instead of just the usual RF output; centre deck design for minimal noise and distortion from other components; autotracking and autoplay; and a 'child resistant' clipped front panel design, to prevent the all-too-common destruction of front panels.

The Amstrad UF22 has a recommended retail price of $499.

DCC released overseas, here soon

Philips Consumer Electronics has officially launched its digital compact cassette (DCC) system in Japan, with the release there of the DCC900 player/recorder. The system has also been released in France, Germany, Holland and the UK, while the US release was planned for early November — after the expected passing of that country's Audio Home Recording Act.

According to Philips Australia, the Australian launch of DCC is planned for 'early in 1993'. The DCC900 will again be the first product released, with other products planned to follow during the year. These include a second hifi deck, a personal portable for headphone listening, a radio cassette unit, a 'mini' hifi system and a car stereo system.

DCC offers high quality digital recording and playback with direct track access, text information display and the serial copy management system (SCMS). DCC machines will also play existing analog compact cassette recordings.

Car radio with CD player

Those in the market for a complete new audio system for their car will be interested in Panasonic's CQ-DP37 radio/compact disc player (illustrated), just released.

Power output is 4 x 20W, while a new 'sound' feature allows the listeners to program their preference for bass and treble. The new unit incorporates a 32-times oversampling MASH one-bit digital-analog conversion system in the CD player.

Also just released is the CQ-DP42, a similar unit with even greater power output; 4 x 27W, plus a number of audio enhancements such as two preamp outputs for future expansion of the system.

A quick release bracket on Panasonic's receiver/compact disc players allows the extra security of being able to take the units out of the car for storage elsewhere.

DCC900 decks are currently being manufactured at Philips' factory in Sagamihara City, Japan, at a rate of 20,000 per month. The expected retail price in the USA is US$799.

Germany-based tape maker BASF is one of the many firms supporting the DCC system, and has already released its 'DCC-Maxima' back-coated chrome tape in DCC cassettes of both 60 and 90 minute capacity.

New hifi headphones

A new generation of hifi headphones has been released by Beyerdynamic of Germany. The new range comprises nine models, from the acclaimed DT911 audiophile system to the versatile DT211 lightweight model.

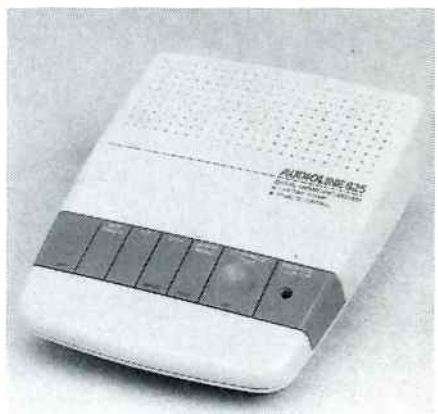
The new models benefit from new computer designed diaphragms, which provide extraordinary sonic accuracy; triple neodymium rare earth magnets for high efficiency and superior transient response; and Beyer's Bass-Reflex technology to reproduce the 'lowest frequencies imaginable'.

Beyer claims that virtually every design aspect has been re-evaluated and refined in the new phones. Improved headbands and replaceable velvet ear cushions assure pleasurable listening for long periods of time.

Connection cables for all headphones are fitted with a 6.5mm stereo jack plug with an adaptor for 3.5mm mini jack equipment. The top of the line models are supplied with coiled cables and gold plated connectors.

For further information circle 190 on the reader service coupon or contact Audio Insight, 5 Skyline Place, Frenchs Forest 2086; phone (02) 975 3011.

Tapeless answering machine



Audioline has recently launched the 825 tapeless answering machine, claimed to be the first of its kind in Australia.

The unit differs from traditional machines in using memory chips to record both incoming and outgoing messages. This ensures excellent message quality and a minimum of maintenance.

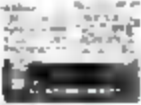
The model 825 has the capacity to store up to 30 incoming messages, which is sufficient for most home or small business needs. Additional features include a digital talking diary that automatically records the day and time of every message; a personal memo recording facility; call monitoring and powerfail protection.

A remote control feature allows the user to access messages and operate the answering system remotely.

The Audioline 825 measures just 14.2mm wide by 17.3mm deep and sells for the recommended retail price of $199.

Further information about Audioline's products and services is available by circling 181 on the reader service card, or by calling (008) 249 957 or (02) 674 6099.❖

Panasonic is offering a range of hi-tech consumer products as potential Christmas gifts for those who have escaped the effects of our recession. The KX-T4300BA cordless telephone has a built in answering machine, while the NV-S8A Palmcorder features auto-focus and 'artificial intelligence'. The SL-XP330 portable CD player (lower left) features a single-bit 'MASH' converter.



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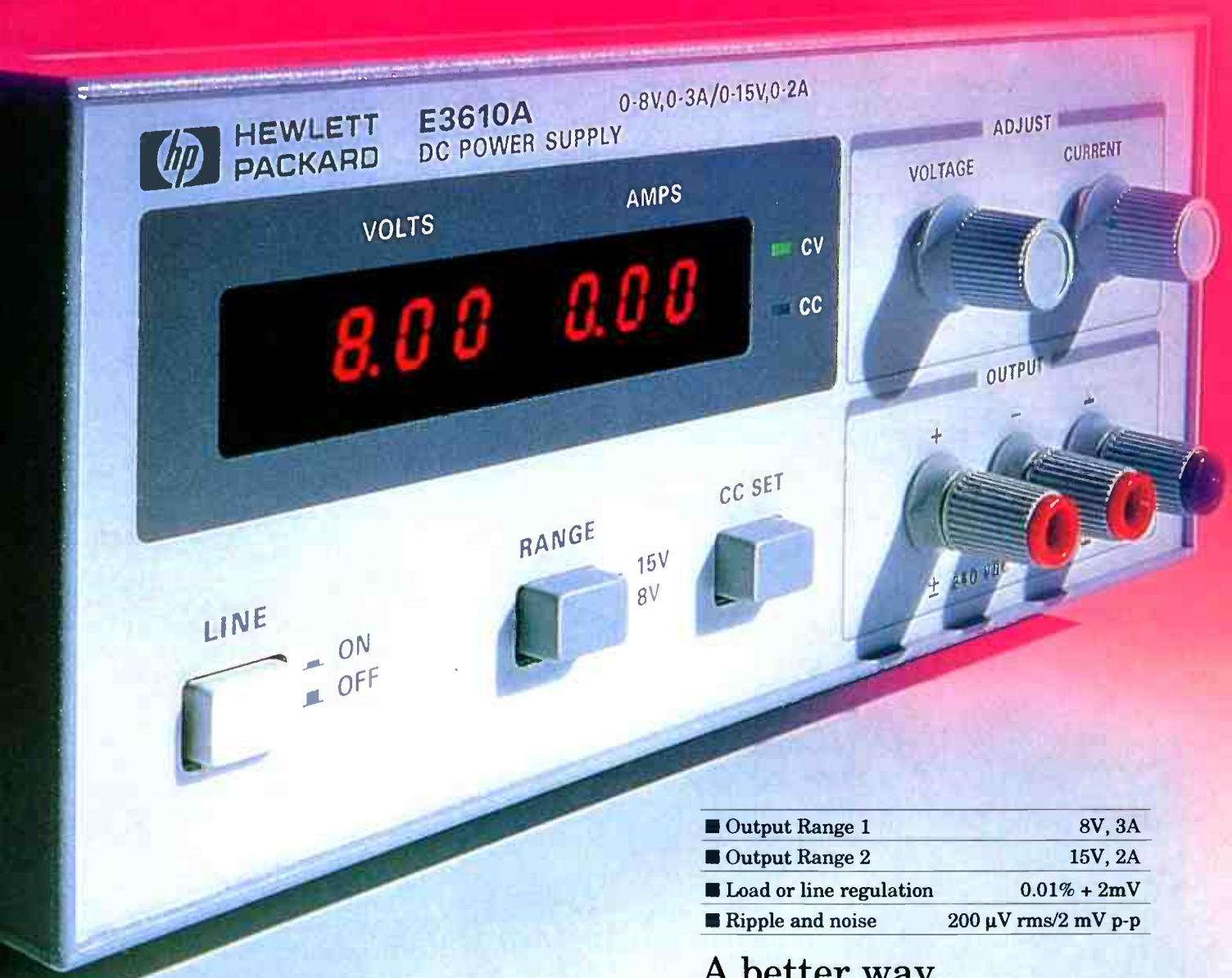

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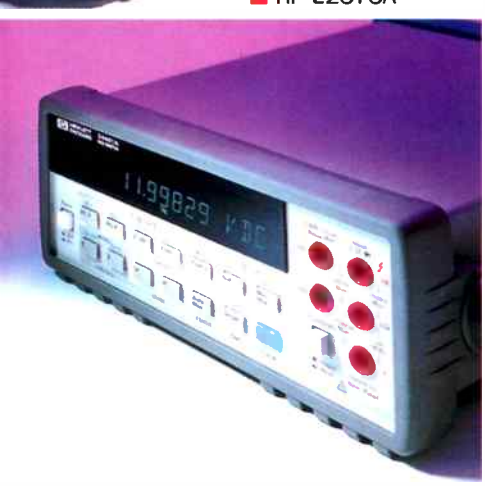

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Pioneer's PD-S901 CD Player with 'Legato Link' Conversion

This month, Louis Challis has been testing a new CD player which according to the maker achieves what is either impossible, or at least undesirable: reproducing signal components *above* the 22.5kHz limit imposed by Nyquist's sampling theorem. We believe you'll find the results of his tests very interesting, because even though the player's performance is very impressive, this may well be for quite a different reason...

When *EA*'s Editor asked me whether I would like to review Pioneer's latest CD player with 'Legato Link' conversion, I recalled that I had briefly discussed this product at the Winter CES last January, with the Technical Director of Pioneer USA. He had given me a brochure which claimed that the firm's Legato Link CD players are capable of reproducing signals that are higher than 20kHz. Even at the time I winced at the thought, as would anyone aware of the myriad problems which such extended bandwidth is likely to generate.

Of course I accepted the Editor's offer to test the new unit, but even as we discussed the planned review, I questioned the practicality and objectivity of the claim. Few people can hear sounds above 18kHz, and quite apart from that, most loudspeakers have difficulty in reproducing such high frequency sounds.

There are also numerous and important theoretical issues involved in Pioneer's claimed attempt to gain an extended frequency response, and resurrect 'lost data' which is above the critical 20kHz cutoff frequency of most CDs (and of course most CD players).

The main problem is simply this: during the digital recording process, all frequencies above 20kHz are *deliberately* filtered out in the recording chain, in order to avoid 'aliasing'.

Why? Well, all CD recorders use a 44.1kHz sampling frequency to sample the original electro-acoustic signal, and as a result frequencies spaced by equal increments on both sides of the 22.05kHz (i.e., half the sampling frequency) cannot be readily differentiated from each other during replay. In order to avoid that problem, the upper band of frequencies is deliberately filtered out.

Even those high frequencies that are in the lower band and which *approach* the half sampling frequency (22.05kHz), are at best only very rough approximations of the original sinewave (or similarly, very poor reproductions of harmonic related components of a lower fundamental frequency).

To filter out the unwanted and potentially disturbing frequencies above 20kHz, the

The PD-S901 player is a little unusual in that its 'stable platter mechanism' has a rotating turntable — onto which the CD is placed upside down, with its label underneath. The laser pick-up mechanism is actually above the drawer, and scans it from above. This is claimed to give even less wow and flutter than with the conventional arrangement.

original technique adopted by Sony, Philips and other manufacturers, circa 1982, was to incorporate quite severe filters — which although very effective in one respect, caused all sorts of other nasty audible effects during the decoding process. Accordingly a lot of heartache and extended research ensued, to solve the valid complaints of the purists, who rightly said that their new CD player 'wasn't a patch on their old record player'.

These thoughts, and many others were running through my head as I spoke to the Editor, and although I accepted the task as a challenge, it was partly because I realised that now at least I could generate the special software required for the testing. When I reviewed the Micromega Solo R CD recorder recently, DW Productions said they would be happy to make available one of these recorders to produce any special software, and I was delighted to accept this kind offer.

Background

Since 1982, when the first compact disc players became available on the consumer market, digital-to-analog (D/A) conversion has undergone a significant number of different modifications in order to improve their sound quality.

The first generation of CD players didn't sound as clean or as natural as they should have, as the anti-aliasing filters caused severe ringing on transients, and those characteristics were readily audible by anybody who had good hearing or musical training.

The player's control unit provides the ability to select tracks directly, by their index number.

The three most important developments affecting the D/A conversion process are claimed to have been:

a) Improvements in tolerances of conversion linearity, for digital to analog converters themselves.

b) Increased resolution, firstly by 18-bit and subsequently by means of 20-bit A/D converters, which have in turn been coupled with the adoption of eight-times oversampling to allow gentler output filtering.

c) Elimination of spurious noises (glitch noise, zero-crossing distortion), and more recently the development of one-bit converters which are even better than the conventional 20-bit converters.

Although D/A converters have unquestionably improved from each of these changes, there are still significant disparities between the output of the best CD players and the pre-recorded qualities of the original sound, before its digital encoding.

The waveforms of sounds produced by musical instruments are unlike the test sinewaves that we use for much of our test-

ing, as they are rich in harmonics and exhibit transient characteristics that are totally unlike those idealised sine waves.

As it happens, it is those nasty transients that really do upset most analog-to-digital, or digital-to-analog converters, and regrettably also give rise to the audible artifacts which have enraged so many hifi buffs (and readers of this magazine) over the last 10 years.

The problem manifests itself as significant *ringing*, both before and after the transient. And the sharper the transient, then the more disturbing the pre-transient and post-transient ringing becomes. Whilst such problems are generally unavoidable, they are nonetheless capable of being ameliorated, although not nearly as well as we would like.

The fundamental frequency of the ringing tends to be extremely high, and is a function of the transfer characteristics of the low-pass filter incorporated firstly in the original recorder, as well as within the CD player's D/A converter circuitry.

The phenomena can be actually measured in two different ways: either in terms of the transient response, or by an assessment of the frequency response characteristics of the D to A converter circuitry. However, since the fundamental sampling frequency used by all CD players is only 44.1kHz, all frequencies which are half that value (22.05kHz or higher), are automatically eliminated when the original program material is being digitally recorded.

The first generation of CD players like the Sony CDP-101, used what we now realise were rather nasty digital filters, which were appropriately described as 'brick wall' filters. The filtering process in the frequency domain worked in precisely the manner anticipated, and it was only afterwards was it discovered that the transient characteristics were decidedly different from what had been originally anticipated.

The designers tried many approaches, and finally adopted an eight-times oversampling procedure, with significantly modified low-pass filter characteristics to reduce the ringing characteristics of the transients signals passing through the circuitry. The digital filters still ensure that no frequencies above 20kHz are produced, and do this by computing seven additional data values from each read from the disc, a process which is referred to as interpolation. The digital filter performs convolution processing on the sampled data and the impulse response still only vaguely looks like the original signal.

What Pioneer claims

The data which I received from Pioneer in America last January is identical to the data which Pioneer Australia gave me more recently. It is extremely basic, and appears to be the original rough schematic sketches that somebody prepared more than a year ago.

At first I believed that the data I had been given was an accurate description of what the Legato Link system is doing. But as I progressed with my testing, I realised that what I had been given was not necessarily either an appropriate or accurate description of the circuitry actually contained within the new PD-S901 CD player.

Pioneer claims that what they have set out to do is reconstitute the 'lost' frequencies (in the 20-25kHz region) that are eliminated by other CD players. They also claim that real music signals and other natural sounds still contain useful data above the normal 20kHz cutoff frequency. They state very positively that some researchers have found that it is these high frequencies and harmonics that give music 'its atmospheric and spatial qualities'.

Having made these claims, which I don't fully agree with, they come back to earth and tacitly admit what is now generally accepted: that it is the ringing generated by the anti-aliasing filters which degrades the music with unwanted high frequency spurious distortion.

Measured Performance of Pioneer Legato Link Conversion System Model No. PD-S901 — Serial No. MF 260 3327 AS

1. Frequency Response — Record to Replay

Digital input	5Hz to 17kHz +/-0.45dB
Analog input	2Hz to 22.05kHz +/- 2.5dB

2. Linearity (Record to Replay at 1kHz)

Nominal Level	Left Output	Right Output
0dB	0.0	0.0
-1.0	-1.0	-1.0
-3.0	-3.0	-3.0
-6.0	-6.0	-6.0
-10.0	-10.0	-10.0
-20.0	-20.0	-20.0
-30.0	-30.0	-30.0
-40.0	-40.0	-40.0
-50.0	-50.0	-50.0
-60.0	-60.0	-60.0
-70.0	-70.0	-70.0
-80.0	-80.1	-80.1
-90.0	-89.4	-89.4

3. Channel Separation

Frequency	Right into Left dB	Left into Right dB
100Hz	-131	-125.6
1kHz	<-136	-133.5
10kHz	-129.2	-127.6
20kHz	-125.4	-125.0

4. Distortion (@ 1kHz)

	Level	2nd	3rd	4th	5th	THD%
	0	-99.2	-94.8	-112.9	-112.7	0.002
	-1.0	-101.4	-96.1	-112.3	-110.8	0.0018
	-3.0	-105.5	-99.4	-	-112.4	0.0012
	-6.0	-	-102.5	-	-105.2	0.0009
	-10	-	-	-	-107.3	0.0004
	-20	-	-	-	-100.9	0.0009
	-30	<-100.0	<-100.0	<-100.0	-	0.0013
	-40	<-90.0	<-90.0	<-90.0	-	0.003
	-50	-75.1	-76.1	-75.7	-	0.028
	-60	-62.6	-58.2	-65.6	-64.6	0.16
	-70	-69.0	-36.4	-	-39.7	1.83
	-80	-	-25.7	-	-27.2	6.8
	-90	-	-25.6	-	-12.4	24.6
@ 100Hz	0	-98.6	-95.5	-	-102.8	0.0022
	-20	-96.0	-99.5	-	-103.3	0.002
	-40	-	-84.9	-	-83.9	0.0086
	-60	-62.7	-	-69.0	-65.0	0.099
@ 6.3kHz	51	-104.4	-93.2	-	-91.9	0.0034

5. Emphasis

Frequency	Recorded	Output	Output
1kHz	-0.37dB	-0.35dB	-0.35dB
5kHz	-4.53dB	-4.48dB	-4.52dB
16kHz	-9.04dB	-10.21dB	-10.2dB

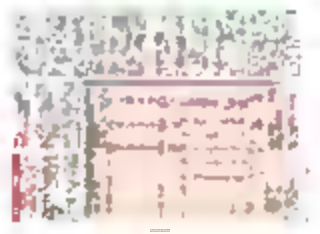
6. Signal to Noise Ratio

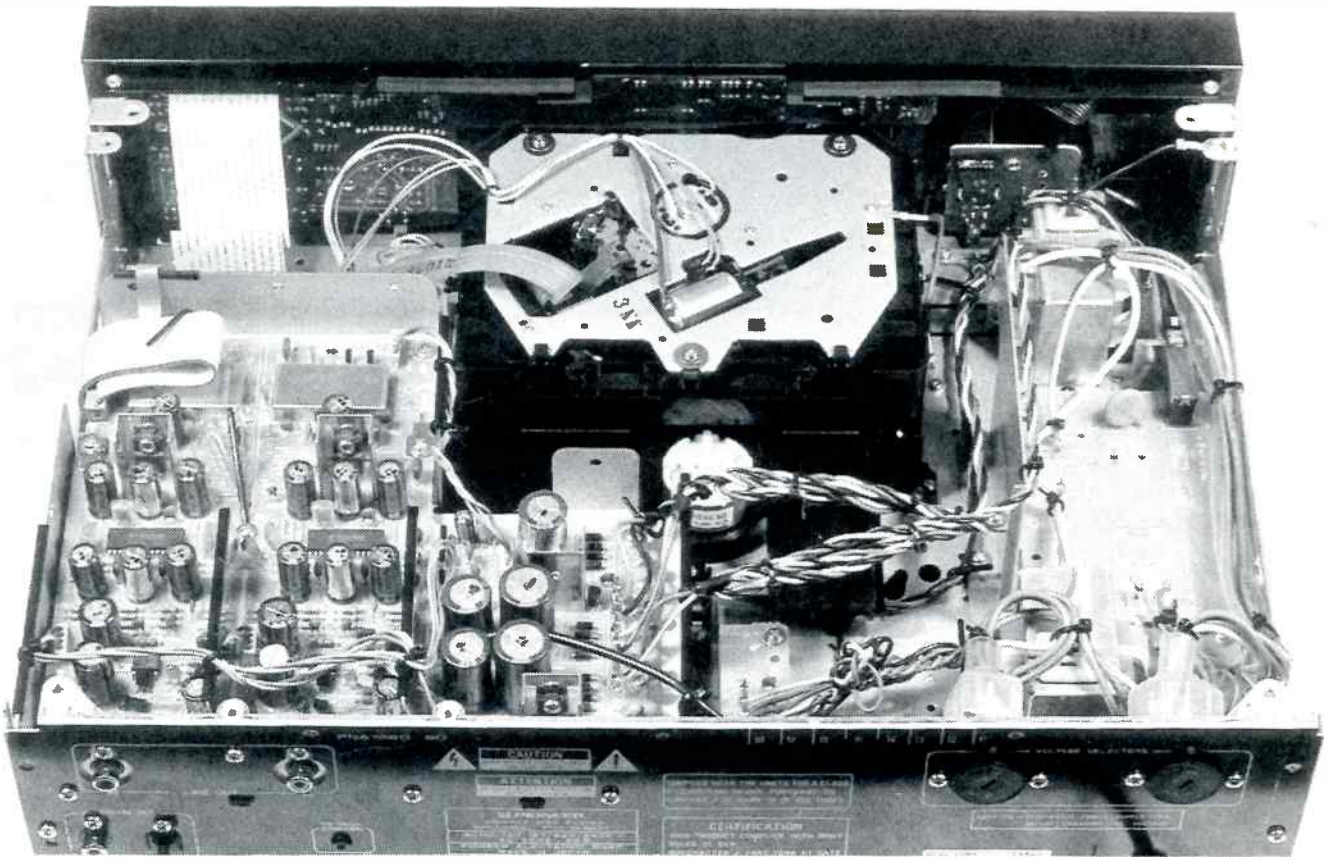
Without emphasis	81.5dB unweighted	85.0dB(A)
With emphasis	81.05dB unweighted	85.5dB(A)

7. Frequency accuracy — Reference signal 19.999kHz; Frequency Error -0.5Hz

8. Dirty record test

Interuption in information	Passed all levels up to 900 micrometres
Black Dot at Read Out Side	Passed all levels up to 800 micrometres
Black Stripe Test	Passed all levels





A general view inside the player. The mechanism in the centre looks rather unusual, because of its inverted nature compared with most other players. The PC board at lower left contains the separated D/A converters and analog output circuitry, with a great deal of shielding and careful layout evident.

The Legato Link conversion system claims to provide a playback signal that is free of such unwanted ringing distortion. It performs digital processing of the sampled data to recreate a waveform closer to the original music signals, by modifying the post-digital high frequency filter slope characteristics to reduce ringing.

As I read between the lines, it became apparent to me that what Pioneer had done, was to select a top-end filter response on the basis of both hard data and carefully controlled listening tests, which confirmed the need to obviate the harshness of filtering exhibited by conventional CD players.

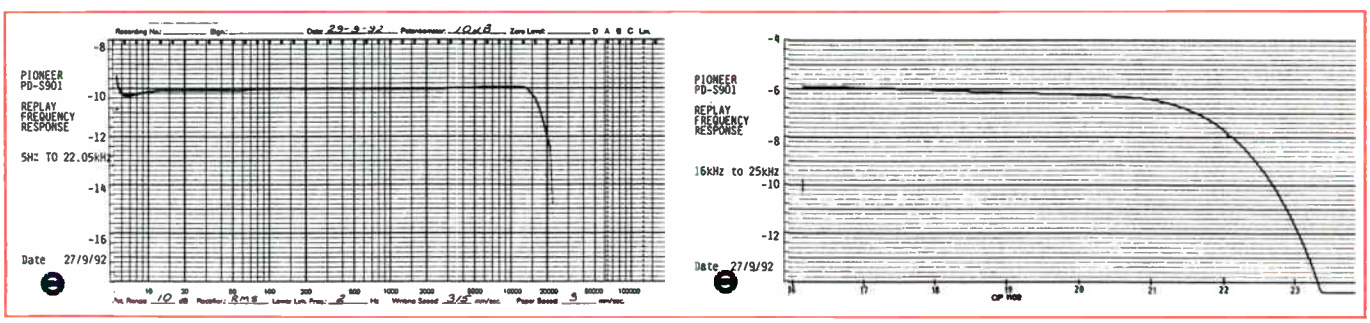
Whilst the Legato Link CD players use a conventional eight-times oversampling filter to create seven interpolation data values based on each original data sample, more significantly they have also adopted the principles observed above. Specifically they use a wider cutoff filter whose outer skirt extends well beyond 23kHz, rather than adhering to the sharp 20kHz filter that other manufacturers have religiously adopted.

The Legato Link brochure presents sketches of composite DSP ROM chips with processing algorithms which at first sight appear to have magical characteristics, I tend to discount both the claims and the overall thrust and direction. Frankly I suspect they are purely 'hype', presented with the intention of having reviewers such as myself and my readers, believe the unbelievable.

That's not to say that Legato Link doesn't achieve a significant and worthwhile improvement in CD reproduction, I hasten to add. The argument is over Pioneer's explanation of *how* this quite real improvement has been achieved.

The new player

An examination of the PD-S901 reveals that it is a very neat unit, with somewhat unusual turntable drawer system. This in-



At left is the measured overall frequency response for the player, while at right is an expanded plot of the response above 16kHz, made using a special test disc produced with a Micromega Solo R CD recorder.

corporates a stable platter mechanism, on which the disc is placed *inverted* — i.e., with the label on the underside.

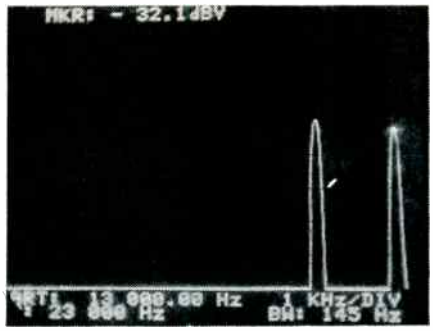
The player's front panel has three push-buttons on the left-hand side, which are respectively, a POWER switch, DISPLAY on/off, and DIGITAL/ANALOG OUTPUT on/off. On the right-hand side of the panel are six conventional pushbuttons which activate STOP, SKIP BACKWARDS, SKIP FORWARDS, drawer OPEN/CLOSE, PLAY and PAUSE.

The nature and number of controls are the fewest and simplest I have yet seen, as all the fancy controls are provided on the neat little remote control unit. This provides INDEXING, REPEAT, RANDOM PLAY and TRACK SELECTIONS, as well as DRAWER OPEN and CLOSE — but no remote level control, which I regard as a must in this day and age.

On the rear of the cabinet are two analog line output sockets, a digital coaxial line output socket and an optical digital line output socket. These are supplemented by a CD deck synchro plug, which facilitates full automatic control from a system or CD player designed to provide the appropriate circuitry and controls.

Objective testing

The objective performance valuation produced a number of surprises. The frequency linearity on replay with a standard test disc is remarkably smooth from 5Hz to 13kHz, but above 13kHz the frequency response displays a slow gradual droop all the way out to 22.05kHz.



A shot taken of the FFT display, showing a 23kHz reconstructed signal at right — together with its alias at 21.1kHz. Note that the alias is actually slightly larger than the signal itself.

I have not previously seen a CD player which displays as much high frequency droop as this player exhibits, and so I decided to produce my own test disc with a swept frequency sinewave signal extending from 16kHz to 25kHz — making use of the Micromega Solo R CD recorder.

With a 90 second recorded sweep at a fixed input level of -5dB, this enabled me to evaluate the frequency response of the PD-S901 on replay in terms of its total level, and more significantly in terms of its handling of the alias frequencies which I suspected would prove to be of interest.

I used one of the latest TDK small recordable compact discs, the CD-W08. This provided enough recording time for the 90-second sweep and a 1kHz reference test tone, as well as 16 separate test frequencies each of 60 seconds duration, at 500Hz increments from 18kHz to 25.5kHz.

On replaying the test disc in the PD-S901 and observing the output on a wide range FFT analyser, I was able to examine the magnitude of the fundamental and its alias frequencies as the swept sinewave signal progressed from 16kHz to 25kHz.

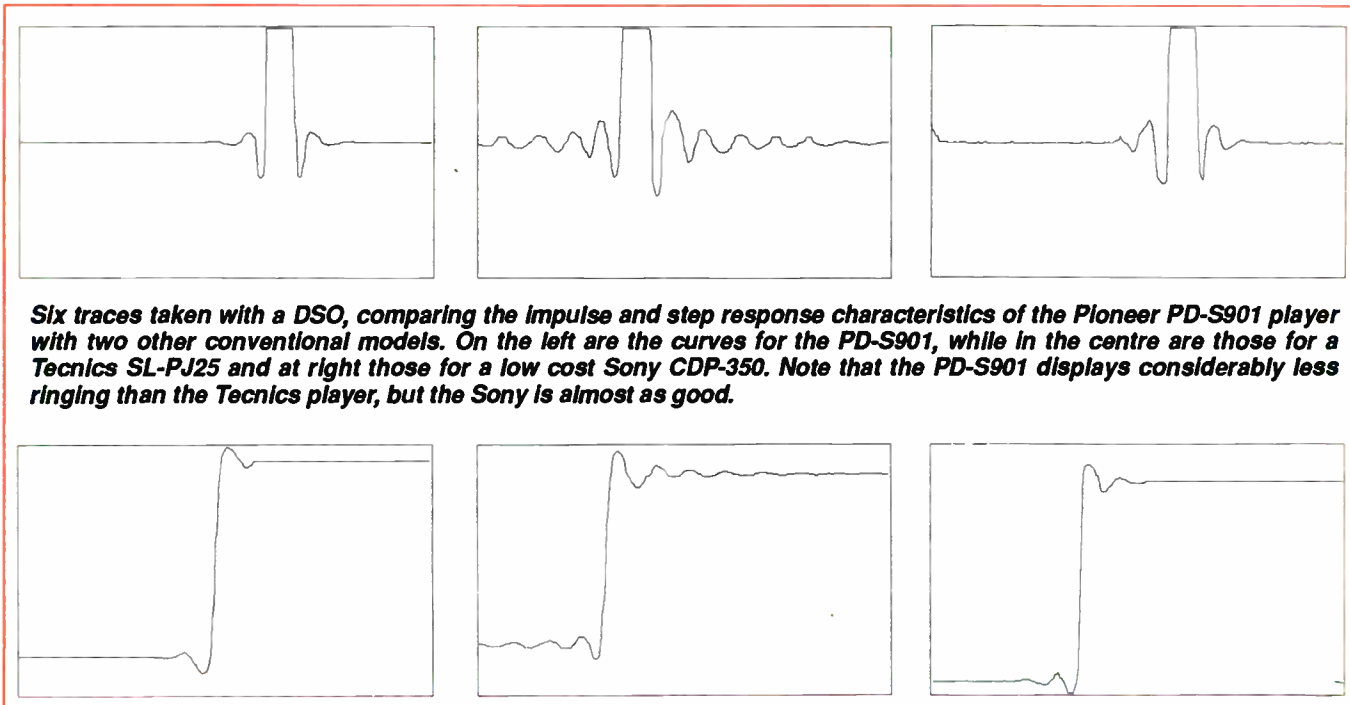
The nature of my observations were somewhat different from what I might have expected, and as the frequency progressed past 16kHz, I watched two peaks — one the fundamental and the other the alias frequency — approach one another from opposite sides of the 22.05kHz 'divide' frequency.

The initially low level of the alias frequency increased rapidly, as the fundamental frequency reached 22.05kHz, virtually swapping positions on opposite sides of the divide, as the fundamental slowly dropped in level and virtually disappeared just above 24kHz.

All of Pioneer's blurb about 'reconstituting the frequencies above 22kHz' proved to be true, in a sense. Regrettably what they forgot to mention was that you get 'two frequencies for the price of one', and you can never be quite sure whether you are listening to the original high frequency component, or its alias.

I progressed with the evaluation of the CD player's replay linearity and was pleasantly surprised to find that the Legato Link system offers the smoothest, flattest and *most linear* digital to analog conversion linearity of any CD player I have ever seen. As if that wasn't enough, the channel separation performance was nigh-on perfect, with separations that are unbelievably good.

I progressed with my distortion evaluation, and discovered that the total har-



Six traces taken with a DSO, comparing the impulse and step response characteristics of the Pioneer PD-S901 player with two other conventional models. On the left are the curves for the PD-S901, while in the centre are those for a Tecnics SL-PJ25 and at right those for a low cost Sony CDP-350. Note that the PD-S901 displays considerably less ringing than the Tecnics player, but the Sony is almost as good.

monic distortion levels down to -50dB are exemplary. It is only once you get to below -65dB that the distortion levels become significant.

The measured emphasis characteristics of the player are also extremely good, as are the signal to noise (S/N) ratio performance, which although good is not the best that I have seen.

With a replay frequency accuracy of 0.5Hz, and impeccable handling of the Dirty Records Test, I was satisfied that this CD player offers overall performance characteristics which are extremely good. In general terms, its performance stands head and shoulders above the rest of the crowd.

Listening tests

The subjective evaluation was a rare pleasure, as like it or not, the Legato Link system achieves a transient performance which is significantly different, and unquestionably smoother than that offered by more conventional CD players with their eight times oversampling, and more conventional low-pass filtering.

The first disc which I used in my evaluation was of guitarist John Williams in his latest disc *Iberia* (Sony Classical SK 48480), which is a real gem.

I carried out a series of comparisons of this disc on my existing conventional CD player and then on the PD-S901, and was surprised that I could hear the difference. The Legato Link circuitry does produce a different quality of sound, and I am convinced that the Legato Link's sound is closer to the original than that provided by my existing CD player.

I progressed to one of Rossini's lesser known operas, *Tancredi*, featuring Marilyn Horne (Sony Classical SK 39073). This is a very fine opera, which I had not previously heard, and which I thoroughly enjoyed. The audible differences in Marilyn Horne's voice were quite astounding, and the Legato Link system proved its worth in terms of a clearly superior sound.

I progressed in my subjective evaluation with a series of other discs, all of which produced a slightly different sound, depending on which CD player was used, and in virtually every case, sounding better when played on the PD-S901.

Conclusions

In my view, the design philosophies which have been incorporated in the Pioneer PD-S901 are as much evolutionary as they are revolutionary. It is almost unthinkable to contemplate having a set of alias frequencies superimposed on the top of higher order fundamental frequencies, which extend up to and beyond 22.05kHz.

My appraisal of what Pioneer have set out to do, and what they have actually done, is of course somewhat different from their naively stated position. This is because what they have done would be considered heretical if they were to state it in clear and positive terms (which of course they have not).

Whilst I must acknowledge that what Pioneer has achieved is laudable in an aural sense, it is nonetheless regrettable that they had to adopt such a circumspect way of sanitising their philosophy (and the nature of their circuitry), for fear of discouraging would-be buyers.

The bottom line is that by using a less severe filter characteristic, they have achieved a significant reduction in ringing, and hence much smoother reproduction. Inevitably the 'price' for this reduced ringing is the addition of some aliasing components to the output, but it's to Pioneer's credit that with Legato Link they have achieved what seems to be a very acceptable balance between these two factors.

The PD-S901 CD player measures 420 x 130 x 330mm (W x H x D), and weighs 8kg. It has a recommended retail price of $999, and should be available from most Pioneer dealers.

Further information is available from Pioneer Electronics Australia, 178 Boundary Road, Braeside 3195; phone (03) 580 9911. ❖

Space technology: That 'tethered satellite' mission...

SHUTTLE ON A STRING!

A good deal of interest was created by the recent space shuttle mission STS-46, where five NASA astronauts and two European crew members aboard the *Atlantis* attempted to deploy the European Space Agency's TSS-1 tethered satellite. The experiment struck trouble, but nevertheless it looks to have yielded quite a lot of valuable information.

by KATE DOOLAN

In the early years of this century, Russian space visionary Konstantin Tsiolkovsky (1857-1935) envisioned the idea of building a tower-like structure that would reach from the Earth's surface to a geostationary orbit of 36,000 kilometres(!). Tsiolkovsky also envisioned that there would be a laboratory on top of the tower, where scientists could conduct experiments in zero gravity. Since that time, many scientists — in particular Italian Guiseppe Colombo — have formulated a variety of ways to access space using wires or cables. In the early seventies, Professor Colombo headed a team

that developed the first practical 'space tether' applications. The team also actively promoted the concept of tethers being a useful space tool for the future. Unfortunately, Professor Colombo died in 1984, before he was able to see his ideas come to fruition.

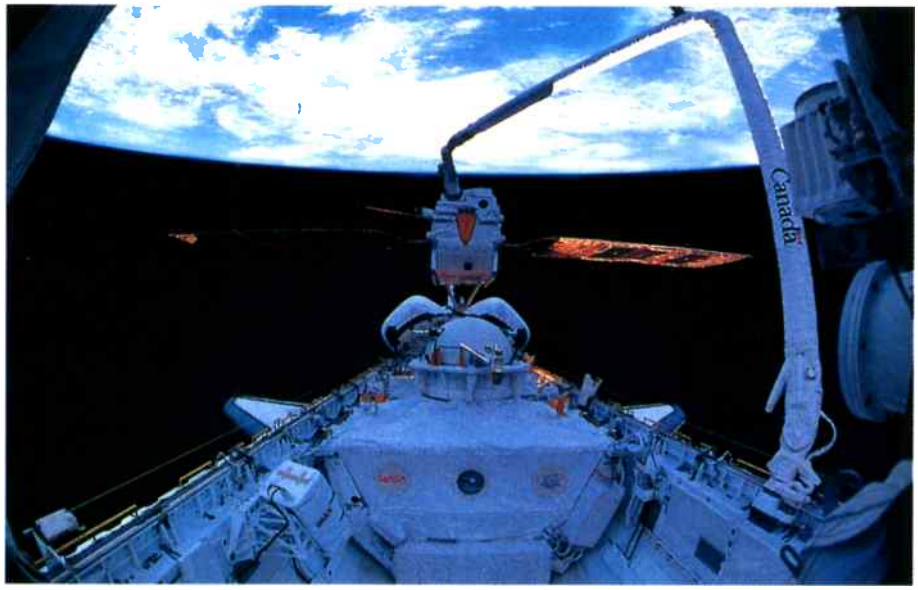
A space tether is a structural element composed of a thin cable fabricated of materials strong enough to resist the environment of space. The tether also has to have sufficient strength to keep orbiting masses bound together.

There has actually been one previous flight of a basic tether system, before this year's mission. During the Gemini program that took place in the mid-1960's, two flights had a tether connected between the spacecraft and an empty Agena rocket stage. The tether buckled violently, and the astronauts were not able to pull it taut; as a result the experiment had to be abandoned.

The above activities form the historical background to this year's flight of the Italian Tethered Satellite System 1 (TSS-1) aboard the space shuttle *Atlantis*, in late July. Although the flight was not 100% successful, it may well lead the way for the use of tethers in space in the future.

Joint venture

The Tethered Satellite System 1 (TSS-1) was a joint venture between the Agenzia Spaziale Italiana (ASI, otherwise known as the Italian Space Agency) and the US National Aeronautics and Space Administration (NASA). A Memorandum of Understanding between ASI and NASA was signed in 1984, and divided the responsibility for the program. ASI was to design and develop the reusable satellite, whilst NASA was responsible for the design and development of the deployer system, integration of the payload and transportation into space aboard the space shuttle.



The 'EURECA' satellite is hoisted above Atlantis' cargo bay by the remote manipulator system during early mission activity. The Tether Satellite System (TSS) is stowed in the cargo bay awaiting extensive operations by the crew.

The TSS-1 had five major components: the deployer system, the tether, the satellite, the carriers on which the system was mounted and the scientific instruments. These elements were supported by the standard capabilities of NASA's space shuttle orbiter, payload bay mounting equipment and control facilities on the ground.

The TSS hardware was mounted on two carriers in the payload bay. The deployer system rode on a Spacelab Enhanced Multiplexer Demultiplexer Pallet ('SEMDP'), which is a general purpose unpressurised platform. The pallet provided functional and structural support to the deployer system and its enhanced features included temperature control, power distribution, and command and data transmission capabilities.

The second carrier was a Multi-Purpose Equipment Support Structure ('MPESS'), an inverted A-frame truss located aft of the enhanced pallet. This structure held deployer equipment and two mission experiments.

The deployer system included the satellite support structure, the deployment boom, the tether reel mechanism, a power system and a data acquisition and control assembly. The deployer system weighed 2027 kilograms and had a power capacity of 500 to 1000 watts, with 1500W available in peak periods.

An articulating tower of 12m length was used to move the satellite to and from the payload bay. The tower was stored in a canister in the lower section of the satellite support structure during the launch and landing phases of the flight. Umbilical cables which were woven through the deployer system provided power and data lines to the satellite before the mission left the Earth. The umbilicals disconnected during the launch of the shuttle, after which the satellite relied on internal battery power.

The tether reel mechanism controlled the length, rate and tension of the tether. This mechanism consisted of the tether reel and reel motor, and was capable of letting the tether out at a rate of up to 16km per hour.

When fully deployed, the Tethered Satellite System and shuttle orbiter would have been 100 times longer than any previous spacecraft launched. The TSS-1 tether line was 22km long and was expected to develop a potential of 5000

Mission commander, astronaut Loren J. Shriver, pursues several chocolate M&M's on the flight deck of the Space Shuttle Atlantis.

Shuttle on a String!

volts, with the ability to carry a current of up to one ampere.

The tether line itself had a core made of Nomex, wrapped with copper wire to act as an electrical conductor. The layer of wire was insulated with Teflon, which was then covered with Kevlar to strengthen the tether. Braided Nomex formed the outer jacket, which was to protect the tether from atomic oxygen corrosion and mechanism-induced abrasion. The tether had a diameter of 2.54mm (0.1") and was designed to operate in the temperature range of -100°C to +125°C. On future flights, it is expected that tethers may be up to 110 kilometres in length.

The crewmembers for STS-46 are Andrew M. Allen, pilot; Franco Malerba, representing the Italian Space Agency (ASI) and Swiss scientist Claude Nicollier, representing the European Space Agency (ESA).

The TSS satellite

Weighing 518 kilograms, the TSS satellite was 1.6 metres in diameter and carried a scientific payload of 68 kilograms. The satellite was mounted on top of the deployer satellite support structure and consisted of eight exterior sections, which had access doors for the easy installation of batteries or the servicing of them. There were also windows for Earth and Sun sensors.

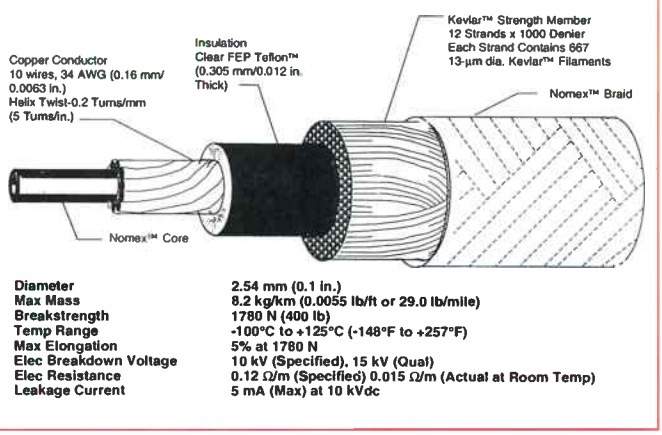
The satellite had an S-band antenna, as well as a fixed boom where scientific exeriments could be mounted. There were another two booms which could be extended up to 2.5m from the satellite, also available for use by scientists. The tether line itself was connected to the bottom polar area of the satellite.

The satellite was covered by white conductive paint, with black paint on the internal skin. Some areas of the internal skin were further protected by multi-layer insulation blankets. Heaters were also installed in the service and payload modules, and on the batteries and sensors. One hemisphere of the satellite (the 'upper' half) housed the scientific instruments, while the lower half contained the support subsystems — power distribution, data handling, telemetry and navigational equipment. There was also a pressurised tank of gaseous nitrogen, for the cold-gas thrusters that were fitted in the central 'equatorial' ring of the satellite. This tank along with various thrusters and plumbing equipment formed the Auxiliary Propulsion Module, which controlled the motion of the tethered satellite and its spinning rate of up to 0.7 revolutions per minute.

The satellite's control and data system included equipment to interface with the space shuttle orbiter, the satellite and ground controllers. An avionics computer was also included to interface with the orbiter whilst the satellite was sitting in the latter's payload bay. The astronauts controlled the deployment and retrieval of the satellite from the flight deck of the orbiter.

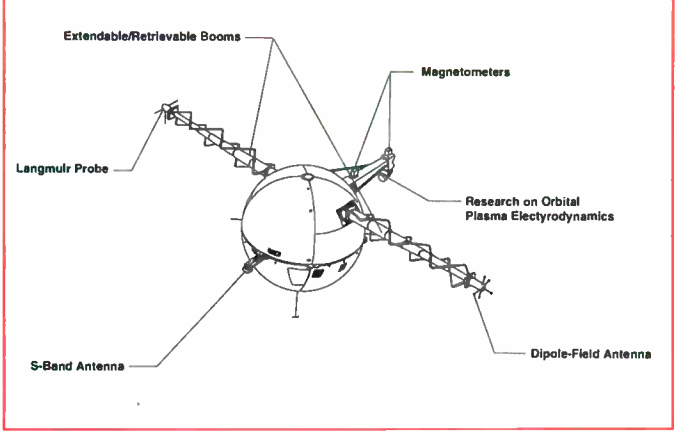
After the deployment from the orbiter, an S-band 'payload interrogator' provided control and receive telemetry from the satellite. The orbiter's Ku-band system was used to track the satellite. The Tracking and Data Relay Satellite (TDRS) network sent data from the orbiter and satellite to ground stations at the Johnson Space Centre in Houston, Texas and the Marshall Space Flight Centre in Huntsville, Alabama where scientists were able to operate their experiments in real time.

NASA and ASI selected nine scientific experiments for the TSS-1 flight. The experiments were to provide measurements of the behaviour of charged particles around the satellite and orbiter, and measure the magnetic and electric fields associated with the satellite. Other investigations represented a wide range of

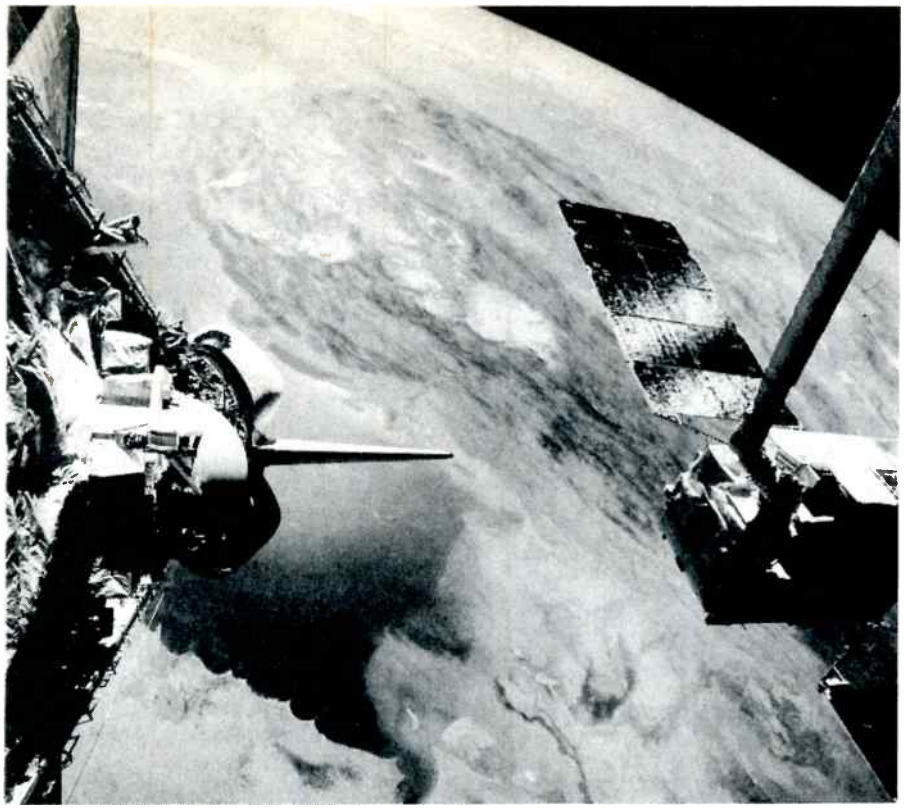


Diameter	2.54 mm (0.1 in.)
Max Mass	8.2 kg/km (0.0055 lb/ft or 29.0 lb/mile)
Breakstrength	1780 N (400 lb)
Temp Range	-100°C to +125°C (-148°F to +257°F)
Max Elongation	5% at 1780 N
Elec Breakdown Voltage	10 kV (Specified), 15 kV (Qual)
Elec Resistance	0.12 Ω/m (Specified) 0.015 Ω/m (Actual at Room Temp)
Leakage Current	5 mA (Max) at 10 kVdc

Supplied by NASA, this diagram shows in detail the construction of the TSS Tether Line.



NASA also supplied this diagram showing the main elements of the TSS satellite itself.



The EURECA satellite remains in the grasp of Atlantis' remote manipulator system as the shuttle passes over the Persian Gulf. The Tethered Satellite System (TSS) remains stowed in the aft cargo bay.

scientific fields, and were designed to provide an understanding of the basic electrodynamic interactions between the tethered satellite and the surrounding space plasma, and also tethered satellite dynamics.

Instrumentation for the satellite included electron guns and tether control hardware, with a set of interdependent diagnostic instruments that measured the behaviour of charged particles. To complement the main experiments, there was a set of core equipment common to the tethered satellite experiments. This core equipment included a high-capacity electron gun and diagnostic equipment.

Preparations

The Tethered Satellite System was flown to the United States and arrived at the Kennedy Space Centre in Florida during November 1990. It was then transported to the Operations and Checkout Building for inspection, integration and checkout work. The TSS-1 was then taken to the Vertical Processing Facility when it joined the mission's other flight payload, the EURECA satellite. The two spacecraft were then placed in the payload bay of the space shuttle *Atlantis* in July 1992.

The main objective of the Tethered Satellite System 1 flight was to deploy the satellite to a distance of 22km above the orbiter and then return it to the payload bay. In a year of space shuttle spectaculars, the TSS-1 flight debut was even expected to top the sensational STS-49 flight. You may recall that this was the one when three astronauts manhandled a communications satellite, in the longest spacewalk in space history (see *EA*, August 1992).

In the event, the twelfth flight of *Atlantis* was launched from the Kennedy Space Centre on 31 July 1992, at 9:56am (local time). The flight was delayed by 48 seconds, after a computer detected a switch failure in the hydrazine fuel tank in the orbiter's auxillary power units.

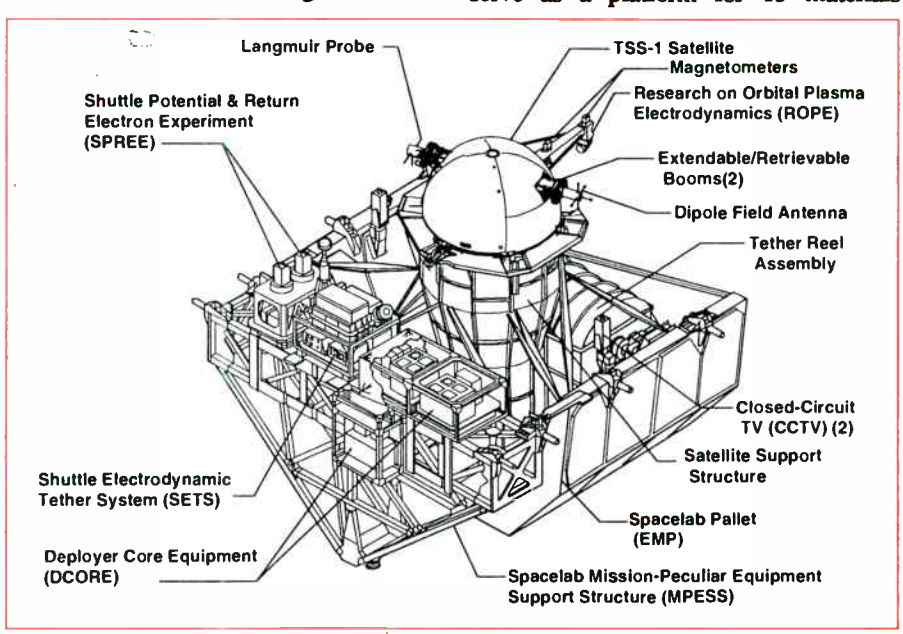
Aboard *Atlantis* was a crew of six men and one woman. Commanding the flight was veteran astronaut Loren Shriver, with space rookie Andy Allen as pilot. The Mission Specialists were Jeff Hoffman, Marsha Ivins, Franklin Chang-Diaz and European Space Agency representive Claude Nicollier, who had waited 12 years for his first flight. Franco Malerba of Italy was the Payload Specialist.

The crew was divided into two teams, red and blue, which were to work continous 12-hour shifts to provide around-the-clock operations. Hoffman, Ivins and Chang-Diaz were the red team, with the blue team comprising Allen, Nicollier and Malerba. Commander Shriver was not assigned to a team and was free to provide overall supervision and assistance when required.

Uneventful launch

After a successful launch, *Atlantis* was inserted into a 425km-high orbit where preparations were made for the deployment of the EUropean REtrievable C-Arrier (EURECA).

EURECA is a free flying re-usable science payload carrier which was designed and developed by the European Space Agency (ESA) for deployment and eventual retrieval by the space shuttle. During its debut flight, EURECA will serve as a platform for 15 materials



The TSS-1 satellite and all of its deployment systems were stored in the shuttle payload bay on two linked pallets — the space lab pallet (EMP) and the Spacelab Mission-Peculiar Equipment Support Structure (MPESS).

Shuttle on a String!

Astronaut Marsha S Ivins, STS-46 mission specialist, prepares to operate a tandem of 70mm Hasselblad cameras on Atlantis' aft flight deck.

science, life science and space science experiments.

EURECA weighs 4491kg amd measures 2.5 metres long by four metres wide. The onboard propulsion system contains 620kg of hydrazine fuel and is used for the transfer of EURECA to different orbits. After deployment, EURECA was to use this fuel to transfer to an orbit of 525km altitude. The spacecraft has a retractable solar array which provides 1kW of power.

The deployment of EURECA was on the first day of the STS-46 flight, and there was a delay of 24 hours after it was discovered that the spacecraft could not communicate properly with ground controllers. EURECA was left attached to the end of the shuttle's Remote Manipulator System arm, whilst ground controllers reconfigured the data paths inside the spacecraft.

This procedure proved successful on day three of the flight. After the deployment, *Atlantis* manoeuvred 300 metres away from the spacecraft and remained there for three hours, in case any problems arose.

(In 1993, *Atlantis* and the crew of mission STS-57 will retrieve EURECA. It will then be returned to Earth for examination, and finally returned to Europe where it will be prepared for another flight.)

For the next three days of the flight, the astronauts conducted a variety of experiments that included a study on the effects of the space environment on materials and equipment mounted in the payload bay. Materials science and medical experiments were performed inside the orbiter, as was an extensive program of Earth observations — which included the photography of several environmental troublespots, such as the effects of the eruption of the Mount Pinatubo volcano in the Phillipines and the continuing cleanup of the Kuwaiti oil fields. There were no major problems with *Atlantis*, apart from the almost traditional problems with the shuttle's toilet being blocked!

Trouble strikes

In preparation for the TSS-1 satellite deployment, *Atlantis* was lowered into an orbit of 320km. The following day, TSS-1 was slowly released from the payload bay. At first, the satellite rose properly from the shuttle until a power cord was found stuck. The astronauts were able to pull the cord out and continue the deployment. However when the satellite reached a distance of 260m from the shuttle, the tether jammed.

Following the failure to unreel the tether, the astronauts then tried to pull it back into the payload bay. But they struck more problems, because it would not move.

The tether was left where it was, whilst NASA and ASI engineers determined how to reel the satellite back in. One of the options that was considered was using astronauts Hoffman and Chang-Diaz to undertake an emergency spacewalk, so they could reel the tether back in manually.

The two astronauts started 'pre breathing' to eliminate nitrogen from their bloodstreams before suiting up, but it was then determined that the satellite could be reeled in without a spacewalk.

After several hours of meetings on the ground, a plan was developed in which the tether would be partially retracted whilst trying to keep it as taut as possible — so it would not tangle or jam again. This was expected to allow the satellite to be reeled back into the payload bay. The plan worked, and after an hour, the satellite and tether were safely back in the payload bay.

Following the failure of TSS-1, plans were cancelled to drag the satellite through the Earth's magnetic field to produce electricity. Some electricity had been produced by the deployment of the tethered satellite at 260m from the shuttle, but it was only 40 volts, not the 5000V that had been anticipated.

The remaining two days of the mission were spent completing experiments and participating in the traditional inflight press conference, in which journalists from both Europe and America were able to talk to the astronauts.

Back to Earth

The *Atlantis* made a trouble-free landing at the Kennedy Space Centre on August 8 at 9:11am (local time). After the removal of EURECA and TSS-1, the shuttle was prepared to be flown back to the Rockwell International factory in California. Here it is undergoing a six-month overhaul, which will include the installation of new flight computers and a drag parachute. If negotiations between NASA and the Russian space authorities are successful, a Russian-built docking probe could be added to *Atlantis* for future joint activities.

On the return of TSS-1 to Earth by *Atlantis*, an investigation board was formed and the finding of the board was that the failure of TSS-1 was due to a 6mm bolt which had jammed the line. The bolt had been added earlier in the year, to help strengthen the tether's attachment points and ensure it would withstand the stresses caused by the shuttle launching and landing...

The Agenzia Spaziale Italiana have requested another flight of the Tethered Satellite System, but NASA have not committed themselves. In any case the next available opportunity on the current space shuttle manifest would not be until March 1994.

In closing, the author wishes to thank Kay Grinter of the Kennedy Space Center and Lisa Vazquez of the Johnson Space Center, for their assistance in the completion of this article. All photographs reproduced are courtesy of the Johnson Space Center. ❖

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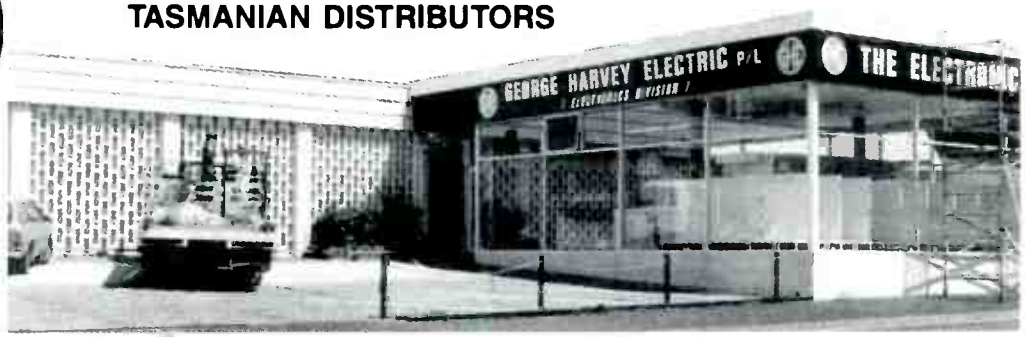

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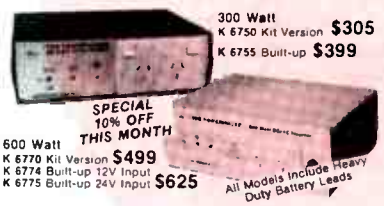

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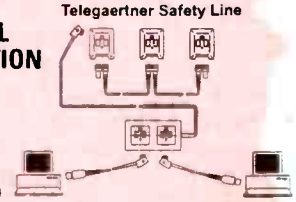

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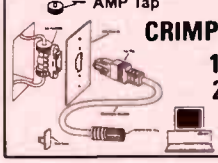

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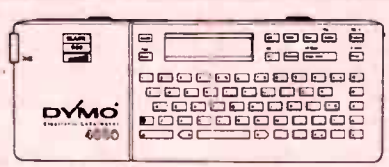

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When I Think Back...

by Neville Williams

Price's Radio: 'Toys' for boys of all ages — from seven years to seventy!

Running between George and Pitt Streets in Sydney there was/is a network of narrow lanes servicing buildings on the Circular Quay side of Martin Place. Comprising principally Angel Place and Ash Street, the lanes provided a lunchtime mini-Mecca, in the old days, for technically minded hobbyists who frequented that part of the city. This month, we revisit the scene as it once was.

At the Pitt Street end of Angel Place was Swain's bookshop, where with discretion, one could browse through the latest technical books and magazines. At the other end was Palings music store, displaying phono discs, sheet music and albums — along with instruments ranging all the way from 'Boomerang' harmonicas to the first generation of electronic organs.

Between the two was Price's Radio (spelt with an apostrophe) fronted by windows that were re-dressed with 'goodies' every week or so and backed up inside by other interesting bits and pieces. Price's Radio no longer exists, but it will certainly be remembered by those who patronised it in person or by way of mail order.

Back in the 1920's, the store had been founded and run by the late Aub Price, with the subsequent assistance of a young recruit by the name of Allan Falson, who joined them in 1928. For Allan it was supposed to be a 'fill in' job, but he remained there for long enough to serve two masters and become acquainted with successive generations of wireless/radio enthusiasts — from Charles Maclurcan and Don Knock to my own contemporaries.

Even *EA*'s present Managing Editor Jim Rowe confesses to visiting Price's — 'but only as a kid', and not frequently enough to have struck up a friendship with the staff.

In correspondence to hand a few weeks back, Allan Falson tells me that, at age 83, he is currently living in retirement in Cronulla, NSW. I am indebted to him for his recollections of the shop in Angel Place. While Allan's health is not the best these days, one thing he can manage without undue stress is to tap away at his computer — a world apart from the analog technology which once paid his bills!

Although I myself worked nearby in the early 1930's, I was not a regular customer of Price's Radio in those years — for two main reasons. Firstly, I was working for £1 ($2.00) per week and, by the time I paid fares and board, I had nothing left to spend on radio parts.

Secondly, if I felt inclined to indulge in a spot of window shopping, I was more likely to head up-town to Levensons and Radio House in Pitt Street, to wireless shops in the nearby Royal Arcade and to Murdoch's — also spelt with an apostrophe. Here a brief word about the last-named:

It was situated on the corner of George and Park Streets, diagonally across from the Sydney Town Hall. Murdoch's was a respected menswear store, which maintained a radio department upstairs — along with a range of home handyman tools like drills, grinders and hobby lathes.

Murdoch's Advertising Manager was an archetypal Scottish gentleman called John Davis, with as rich an Edinburgh brogue as one might hear in a lifetime. A family friend, John Davis later became well known for a session called 'Church in the Wildwood', which he hosted each Sunday on Sydney radio 2CH.

When he knew that I had taken up radio as a career, he insisted that I visit him at Murdoch's, where he would introduce me to the Manager of their radio department — another Scot (presumably) by the name of Daniel McIntyre. This I did in due course, and met the somewhat portly Mr McIntyre, who was gracious enough to conduct a penniless process worker on an inspection of the many bits and pieces on display.

Little did either of us realise that we were to meet again in entirely different circumstances, as I will explain later. But back to Price's Radio...

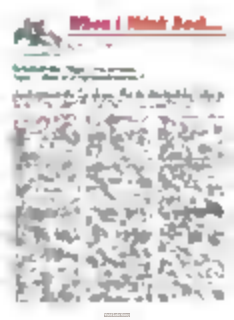
According to Allan Falson, Aub Price's parents had had business interests in the country, and their two children — Aubrey and a younger sister — were well educated and well adjusted socially. Aub's sister ultimately married Leslie Hooker, who founded the L.J. Hooker real estate group, but Aub's dominating passion in his own younger days had to do with fast motor bikes and fast cars.

When Price Senior retired, the family moved to Manly, a Sydney beachside suburb. Aub married circa 1923 and branching out for himself, took over a newsagency at Vaucluse. While there, he fathered a son and a daughter, bought an Essex sedan, and took up radio as a hobby — indicating to all and sundry that he had settled into family life.

The newsagency did well enough, but Aub's new hobby interest gave him the idea of selling radio parts as a sideline. In fact, he soon sensed that it could provide a more acceptable way of making a living than by getting up before dawn to deliver newspapers!

So he sold the newsagency and registered a new business by the name of 'Price's Radio Service Station' — a name apparently inspired by a trend in the automotive industry to set up 'service stations', as distinct from the earlier 'motor garages'! The word 'station' was subsequently dropped.

The new business was established in one of the 10 small shops in Wingello House, in Angel Place, having display



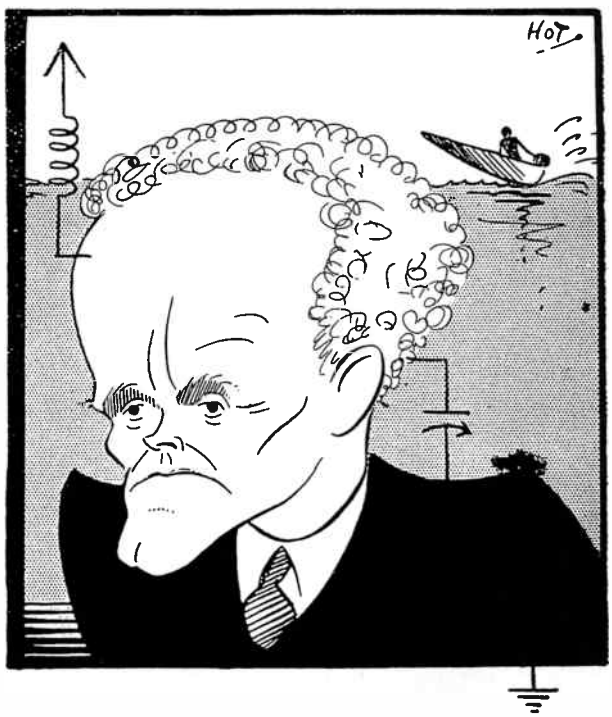


Fig.1: Aub Price, as Wireless Weekly's cartoonist 'Hotpoint" saw him in the Trade Supplement for October 19, 1934. We could not trace any actual photos of either Aub Price or Dan McIntyre.

Fig.2: Allan Falson, as Hotpoint sketched him from the Wireless Weekly Trade Supplement for June 7, 1935. Having worked at Price's Radio for over 30 years, Allan is in a unique position to recount its history.

windows at street level. Aub was fortunate enough to secure a corner position with three such windows, and Price's Radio Service was born, with Aub as proprietor/manager (Fig.1) and Albert Wright as his first employee.

(Curiously, the August 13, 1926 issue of *Wireless Weekly* carries an advert for plug-in coils from The General Trading Co, Wingello House, Martin Lane, but I have no knowledge of what happened to that company.

Again, in later years, Radio Suppliers Pty Ltd advertised Radiokes components from an address in Wingello House, but they also seem to have disappeared without trace.)

Price's Radio did well, however, and against the trend, continued to prosper during the early stages of the Great Depression. In 1928, Allan Falson joined the staff in the dual role of radio mechanic and lunch-time salesman. (Fig.2)

Looking back on those days, Allan says that his own first — and futile — attempt to build a crystal set had been around 1920. His second attempt, as a student of Sydney Technical High School, had been more successful, thanks to the support of the school wireless club and some practical assistance from a then young Gordon Wells, who worked in Miss F.V. Wallace's shop in Sydney's Royal Arcade. (See *EA* for April 1992, p.47.)

While still at school, Allan had also joined the once prominent Waverley Radio Club, and spent more time than a schoolboy should doing the rounds of other clubs and club members, particularly those owning a radio station. Perhaps not surprisingly, in 1926, when he was due to matriculate, he missed out and had to find a job instead — preferably in wireless!

His first position as a serviceman with the Australian Wireless Company did not turn out as expected, most of his time being spent installing radio sets around Sydney. Based in Castlereagh Street in the city, AWC manufactured the once well known 'Radiair' battery receivers, which I remember from my boyhood in the country as being very loud — but also very 'thick' in terms of speech clarity. (Ref. *Wireless Weekly*, August 13, 1926, p.11.)

After a few months, Allan transferred to Aladdin Industries, where he was final testing neutrodyne receivers. Although nominally 'technical', it proved to be a frustrating job trying to make the three tuning dials 'track'; this was with tuning components that were not sufficiently uniform in the first place.

Allan's next move was to Price's Radio where, for a change, he became 'the bloke behind the counter', called upon to assist customers with their technical problems. It was a job that he relished, especially as it obliged him to 'swot up' on the questions raised by referring to technical magazines and the *Admiralty Handbook*, and/or by discussing customers' problems at Club meetings (Fig.3).

By this time, the original corner shop had become too small. But just when it seemed that they would have to find other premises, an adjacent double-shop was vacated. By removing the dividing wall, Price's Radio gained adequate floor space — three times the original — and two extra display windows.

With crystal sets still popular, Allan recalls that Aub Price would periodically buy large lumps of galena — which he would pound into small bits with a hammer. Pieces of appropriate size and shape for a detector would be set aside, ready to go into a box and sold for sixpence each. However, the most eye-catching specimens would be picked out, placed in a pill box on a layer of cotton wool and offered as 'Specially Selected Crystals: 2/-'.

At a personal level, Allan says that Aub Price was of a quiet disposition, although

sometimes impulsive. He was also generous to a fault, and found it difficult to bypass city 'wineoes' with their hard luck stories. In a work situation, it would have been difficult to find a more considerate boss — and he was also mindful of his customers, as evidenced by the following episode.

By the late 1920s, Allan says, Australian radio marketing had gravitated into a rigid structure of suppliers, wholesalers and retailers. Suppliers — manufacturers and/or importers — would consign components in bulk to 'wholesale' distributors, at a negotiated base price. On receipt of formal orders, the wholesalers, in turn, would distribute the components to equipment manufacturers, government departments, instrumentalities, service organisations and retailers. This would be at a so-called 'wholesale' or 'trade' price, plus sales tax where applicable.

In turn, the public was supposed to purchase their requirements only from retailers, paying a pre-determined 'retail' or 'list' price.

Valve companies, in particular, supported the regime as a structured way of processing a multitude of assorted types from their bond stores to the public via suburban radio shops. Everybody, including the Federal Government, got their precise cut!

As a one-time wirer/tester cum spare-time radio repairer, I well remember our collective objection to paying full retail price — and the efforts we all made to find someone behind a wholesaler's counter who would concede that we were 'in the trade'.

Price's Radio was of course a 'specialist' retailer, whose customers included a high proportion of experimenters, amateur operators and spare-time servicemen. As a result Aub Price felt that, in his case, the full retail mark-up was inappropriate; accordingly he began to discount retail prices, on a unilateral basis. Other retailers complained, on principle, and a number of wholesalers duly black-listed him in an effort to force him to toe the official line.

One wholesaler, however, broke ranks by agreeing to fill his orders — providing they carried some name other than Price's Radio! So, when parts were ordered by 'Messrs G. Tunney', they were delivered to a specified city address and paid for by a cheque drawn on a special Tunney account, which Aub had set up!

Fig.3: Allan Falson as some customers may remember him, from the mid 1930's. This studio portrait was taken in 1934.

Philips finally took Aub to court in 1927, with respect to valve prices, and won the case — with one reservation. According to Allan Falson, after delivering his verdict (see panel) the trial judge observed that he could find nothing in law to prevent Price's Radio from offering some other inducement with each valve sale — free of charge, if they so chose!

Perhaps prompted by his early involvement with fast cars, and/or by the widespread interest in aircraft, Aub Price decided, in 1929, that he simply *must* learn to fly. Accordingly he signed up for theory lessons, to be followed by practical training. But at this point his plans came unstuck: every time he left the ground on a training flight, he became violently airsick. Finally he had to abandon the whole idea.

Perhaps by way of compensation, he became involved with fast boats — and ended up as Social Secretary of the Royal Motor Yacht Club, with speedboat racing tying up his weekends and arrangements for dinners and theatre parties occupying a good deal of his time during the week. Allan says that he too was often co-opted to help out — which had its good side, in the form of complimentary tickets to the various functions.

Aub's own practical committment centred around a small, high-speed outboard racer, in which he personally set an open ocean Newcastle-Sydney record.

At one stage he even installed a bracket in the shop, on which he could hang the outboard motor. Sometimes he would spend hours during the week fiddling with it, in the hope of gaining a few more

Get Them All!!

Your present Receiver's wave-band can be doubled if you add a short-wave tuner; all you have to do is to remove the Detector Valve in your present set, and plug in the adaptor, the receiver is then ready for short-wave reception from 20 to 90 metres

PARTS REQUIRED:—

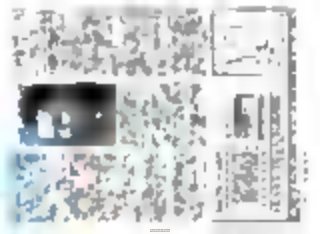
	£	d
2 Pilot .00025 Log. Cond.	24	0.
1 Bakelite Panel, 12 x 6	3	0.
1 Baseboard	1	0.
2 Pilot Vernier Dials	15	0.
1 Centralab Rheostat	3	6.
1 Shock Proof Socket	2	3.
1 W. and M. Grid Cond. and Clip	2	3.
1 Aerovox 5 Meg. Leak	1	9.
1 Lewcos Special S.W. Choke	12	6.
1 Lewcos 6-pin Base for Coil	3	6.
2 Lewcos Coils, 20-90 Metres	30	0.
1 Special Detector Valve	13	6.
1 U.X. Adaptor	1	9.
2 Terminals and Strip	1	0.
TOTAL PRICE	**£5/15/0**	

Obtainable from:—

PRICE'S RADIO SERVICE

THE CORNER STORE

Fig.4: Portion of an early advertisement from the 'Wireless Weekly Call Sign Supplement' for July 18, 1930 — published in the Aub Price era.



'herbs'. He would even start it up on occasions — filling the shop with smoke and fumes, to the intrigue of some customers and the dismay of others!

Unfortunately, Allan says, with the above distractions and the cumulative effects of the depression, the business began to suffer a down-turn. At first Aub preferred to ignore this, but finally, to save rent the dividing wall was re-erected and Price's Radio vacated the corner section of the store. But Aub's heart was no longer in it, and he sold the business in January 1935, presumably for much less than it had once been worth.

Aub continued his association with the Royal Motor Yacht Club, accepting a modest retainer for his once voluntary activities. Further to supplement his income he also became Manager of the once-popular 'Palais Royal Ballroom' at the Sydney Showground.

Unfortunately, Aub was to live only a couple of years after that, being killed in a traffic accident in 1937 when his car skidded in gravel and came into collision with an on-coming Sydney tram.

New owner

So, while Price's Radio continued under its original name, it acquired a new owner/manager from July 1935. The new proprietor was none other than the one-time manager of Murdoch's radio department, Daniel McIntyre, mentioned earlier — who soon came to be known as 'Mac' by the customers!

I gather that Mac had been born in Australia, but had spent much of his young life with a well-to-do Uncle who owned a sheep station on the Canterbury Plains, west of Christchurch in New Zealand. He had been educated at Christ College, had become interested in radio, gained an amateur licence and operated his own station for a time. Back in Australia, he took up radio as a career, but appears not to have remained active as a 'ham'.

Allan Falson recalls that Mac was keen to try out ideas that could not be implemented while he had been at Murdoch's. One was to have graduated scales and templates manufactured commercially, to give home-made projects a more professional appearance. They were an immediate success, and were still being sold in 1960.

Mac also dreamed up the 'Radiomac' label, to identify proprietory lines. Added to this, he was able to import items of special interest to amateur operators through personal contacts in London and San Francisco.

If Aub Price had been a fast cycle/car/boat addict, Dan McIntyre was still a boy at heart — according to Allan Falson — and interested both in models of all description and in the technology of radio control. There had been a hint of this even at Murdoch's — so why not promote technical toys at Price's, to supplement the radio business?

It began with a few Lionel train sets from the USA and Marklin sets from Germany, which went on sale in December, 1936. Technical toys soon became an entrenched part of the business, with sales peaking in the Christmas season.

A full-page advert in *Radio & Hobbies* for December 1939 was typically devoted to model trains, model plane kits, stationary steam engines, Meccano sets, Dinky toys and chemistry sets. The diversion did not seem to deter traditional customers, most of whom were also boys at heart, or fathers, or both! (See also Fig.5.)

Growth overall was steady, giving rise to speculation about new and larger premises. But the war brought an abrupt end to expansion plans. Trade restrictions were imposed by the Federal Government; two of the staff who had been on RAAF Reserve were called up, and the show windows were boarded up as a safety measure.

By 1942, Mac was left to run the business alone or, at best, with part-time assistance from his sister Mrs Mary Belfield — whom I remember myself as an obliging lady, anxious to assist in an unfamiliar situation. They managed, between them, to keep the business solvent until the war ended.

After the War

At that point, businessmen and customers alike were anticipating a freeing-up of component supplies and a return to 'business as usual' but such was not to be the case. True, restrictions on the distribution of new parts were lifted, but the Defence Department also embarked on a massive clearance of surplus war equipment, much of which was auctioned off at 'scrap' prices.

Dealers bought it up by the truckload and stowed it in warehouses, basements, at their own homes, in sheds, on verandahs and under tarpaulins! It was flogged off to hobbyists, who bought it with the idea of adapting it for civilian use or strip-

THE PRICE IS NOT RIGHT!

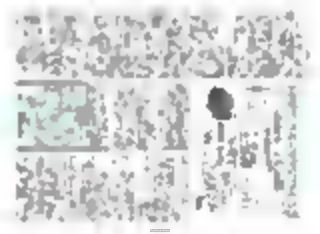
We are advised that by consent of the parties in the Equity suit of Philips Lamps (A'Asia) Ltd against A.F. Price, trading as Price's Radio Stores, Angel Place, Sydney, a decree was made by Mr Justice Harvey, perpetually restraining the defendant, during the continuance of letters patent, covering Philips and Mullard wireless receiving valves, from selling or offering these goods for sale, at other than the retail price imposed and fixed by the plaintiff company.

Defendant is to pay costs of the suit.

It was alleged that the defendant had infringed the plaintiff's letters patent by selling the valves below the fixed price.

(From *Wireless Weekly*, November 18, 1927, page 21)

Fig.5: Even though Dan McIntyre was still doing well from radio bits and pieces in 1951, the December issue was the signal to advertise technical toys.



ping it for components. In practice, many private homes also became cluttered with surplus radio equipment, which the purchasers never quite got around either to using or stripping!

Allan Falson explained how, at a typical auction, hundreds of electronic gadgets would go under the hammer, with potential buyers including a few private individuals, plus a half-dozen or more executives from the major electronic surplus dealers — Ace Radio, National Radio Supplies, Walthams, etc. Having looked over what was on offer on the day, the dealers would decide among themselves what was marketable, the numbers they could cope with and what they would be prepared to offer.

The auctioneer would commonly call first for bids on a 'per unit' basis, and one-off buyers would be supplied accordingly. The remaining units would be offered as a single lot, with (usually) only one collective bidder from among the company buyers.

Other lots would be processed in the same way and, at the end of the day, the dealers would settle their mutual liabilities and arrange to collect their agreed share of the equipment.

I gather that Mac attended many of the auctions, although he did not outlay as much as the major specialist dealers. But this still prompted a question in my discussions with Allan Falson: If Price's Radio bought war surplus in bulk, how come that all I ever saw displayed in the shop were separate components? Who stripped the equipment down?

His answer was surprising, to say the least: "Mac looked after that himself. He stacked the equipment in his house, then in a marquee in the backyard and finally in a rented warehouse. He'd attack it at weekends and most mornings. Every Monday morning, a truck would turn up in Angel Place with boxes of valves, panel meters, variable capacitors and inductors, oddment transformers, knobs and dials, and tagstrips loaded with wiring components."

"They'd be unloaded, tagged and put on the bargain counter or into take-your-pick bins for a few bob! Mac seemed to enjoy it. It was his way of relaxing!"

Mac certainly wasn't the only one! In those days, this magazine (as *Radio & Hobbies*) was produced in the *Sun* building, adjacent to Martin Place. With other members of the staff, I'd make frequent lunch-hour pilgrimages to Angel Place, standing shoulder to shoulder with other 'hams' to rake through the 'goodies'.

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★

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★

Thanks! and an apology

To oll those old ond new customers who ore supporting me in this moil order business I wont to express my thonks. I had expected up to obout twenty orders o doy but some doys I om receiving o hundred or more ! !

I om sorry thot in o few instonces I hove not been oble to get goods owoy os promptly os I would hove liked to.

D. McIntyre,
Propt., Price's Radio.

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PRICE'S RADIO

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Est. 1922

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Fig.6: From our September 1963 issue, Dan McIntyre was thanking readers for their support, little realising that he was facing imminent death from a brain tumour.

It was a painless way of collecting valves, meters and oddments for transmitters and test equipment. These would cost only 'pocket money', and you avoided the hassle of half-stripped units that seemed too good to discard but not good enough to keep!

Behind the counter, Mac, Allan Falson and another amateur Norton McNaughton ('Young Mac') would exchange a cheery "G'day" for our spare cash.

Redevelopment looms

While the supply and demand for new components progressively increased during the postwar period, the trade in surplus components continued throughout the 1950's as an important source of income for Price's Radio. But then trouble loomed ahead: the word was out that Wingello House was to be redeveloped, with Price's having to find new premises.

It came at a time when Allan Falson could see an end to the surplus bonanza, with Price's needing to change its image from an oddments store to a place where an emerging breed of higher-tech enthusiasts would turn for up-to-the-minute advice and supply.

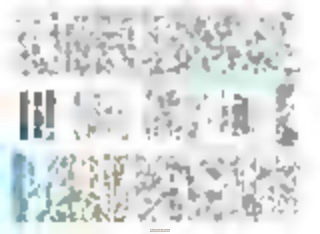
Uncertain as to what lay ahead, Allan Falson resigned in 1959 and rejoined the CSIRO Radiophysics organisation with which he had been associated during the war. In this new role, he spent several years at the Parkes Telescope centre, followed by another period at RP's Epping Laboratory.

Mac, meantime, was served with a notice to quit — but won a reprieve, to extend his occupation of the Angel Place premises until 1961. At that point he had to choose whether to find another shop and, if so, whether to rebuild the business in its existing — and possibly limiting — mould, or to invest capital in a forward looking hifi, hi-tech enterprise.

In the event, Mac chose neither option. He vacated the old store, retained the existing box number, continued his familiar advertisements but endorsed them 'Mail Order Only'. Working alone, from the basement of his family home, he would pick up his mail, collect the required components, then package and mail them to their destinations (see Fig.6).

No longer a young man, he had unknowingly made the right decision. Two years later, in 1963, he took ill and died from a brain tumour.

Such then is the story of Price's Radio — as I said earlier, a Mecca for radio hobbyists who worked in the Sydney's city centre. And, speaking as a former editor of this magazine — Price's was an advertiser about whom we rarely, if ever, received complaints. ❖



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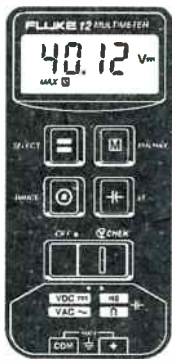

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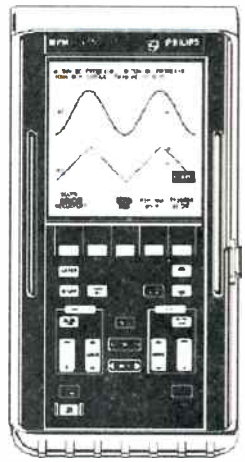

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- Store 8 waveforms (95 & 97) and 10 set-ups (97)
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...Full 3000 count DMM

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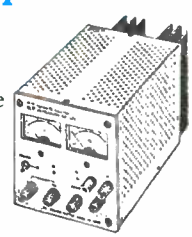

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FORUM

Conducted by Jim Rowe

Another device claimed to improve the performance of CD players...

As promised last month, we're looking this time at another gadget which is claimed to improve the performance of compact disc players — an 'optical spatial filter'. It comes with some fairly plausible technical support, but raises some questions that I think you'll find quite interesting. We also unveil an important and hitherto unrecognised law of nature, discovered by a long-time reader in WA.

Before we look at the latest device for enhancing CD players, I can't resist presenting a short letter that came in a couple of weeks ago, on the general subject of gadgets to enhance the performance of hifi components and systems. It came from Mr Albert Berkavicius, an electronic systems designer of Scarborough in WA, and it gave me such a chuckle that I simply had to share it with you:

Being a faithful reader of EA from way back and having travelled widely and read British and other hifi magazines, sometimes with amazement at some of the claims made, I have now made this momentous discovery — which I cannot possibly withhold selfishly from the rest of the world:

The quality of audio reproduction is severely affected by anything that can be turned into a product saleable to the cognoscenti — i.e., power plugs, record weights, pure gold connectors, speaker cables etc.

Of course the type of connector and cables used in the RECORDING equipment, or even (horror) the fact that it may have run off 60Hz mains through a pitifully thin power cord — not to mention 10 line transformers using (dare I mention it) impure copper windings — has ABSOLUTELY NO EFFECT on the audio quality. This is probably because this equipment is so far away that it falls outside the MAGIC CIRCLE; in addition to which it would require a time warp to get back into the past to change it — and you cannot make money out of this, as any expert will tell you.

I would be honoured if you choose to call this discovery ***Berkavicius's Law No.2****. As no-one could pronounce it, it's probably safe to say that it will be accepted without question.*

By the way, in case you're not aware of ***Berkavicius's Law No.1****, it is this: The number of states in any logic circuitry is the sum of all possible states, plus one.*

How about that, then? I don't know about you, but I reckon Mr Berkavicius may well have hit upon another of the profound laws of nature (sub-category: commercial reality). Why none of the rest of us saw it before, I don't know; it must have been staring us in the face...

Like all good basic laws, it immediately suggests a corollary: If you can't make any money selling something to fix a phenomenon that effects the quality of reproduction, that phenomenon must be having a *beneficial* effect — rather than causing any degradation. Mind you, since you can almost always find some way to sell just about *any* item or service, I suppose the corollary doesn't often apply!

I can't imagine there's any argument about Mr B's request to call his discovery 'Berkavicius's Law No.2'. As far as I'm concerned, that's what it SHALL be called from this day hence — but let's all try to pronounce his name properly, please everyone. Presumably it sounds like '*Berk-a-vishy-us*', but he can correct me if I'm wrong.

What I find particularly impressive is that Mr Berkavicius already *has* a discovery of similar profundity to his name — that one about logic circuitry. I'd often wondered why logic circuits seem to be able to adopt at least *one* state in addition to (instead of?) those they're supposed to be capable of adopting, and now I know why...

Anyway, many thanks for your letter, Mr B, and you certainly have my vote for Berkavicius's Laws joining those of the venerable Murphy and miserable Sod, in the electronics Hall of Fame!

And now that we've all been warmed up to the subject, I trust, let's turn to the main topic of this month's column: a device that is claimed to improve the performance of CD players.

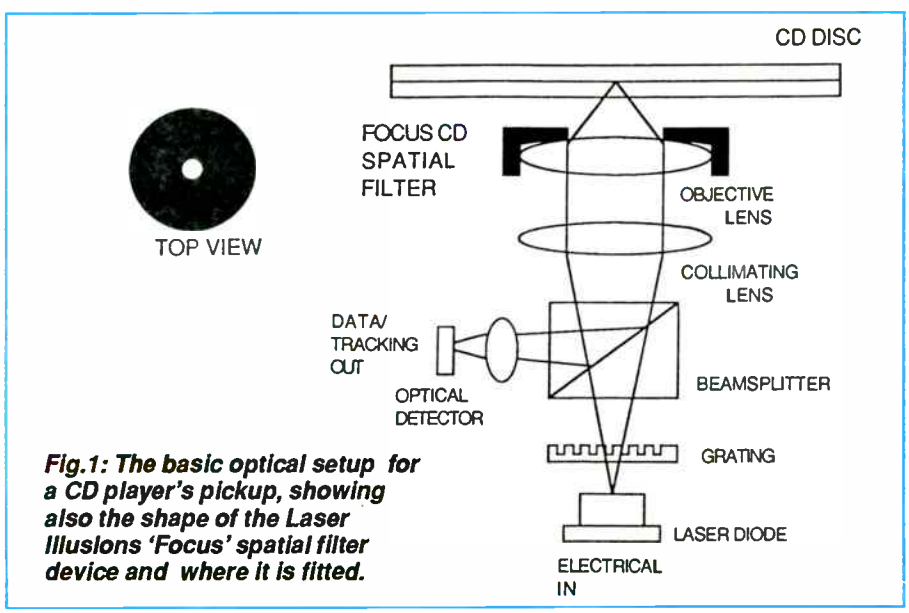
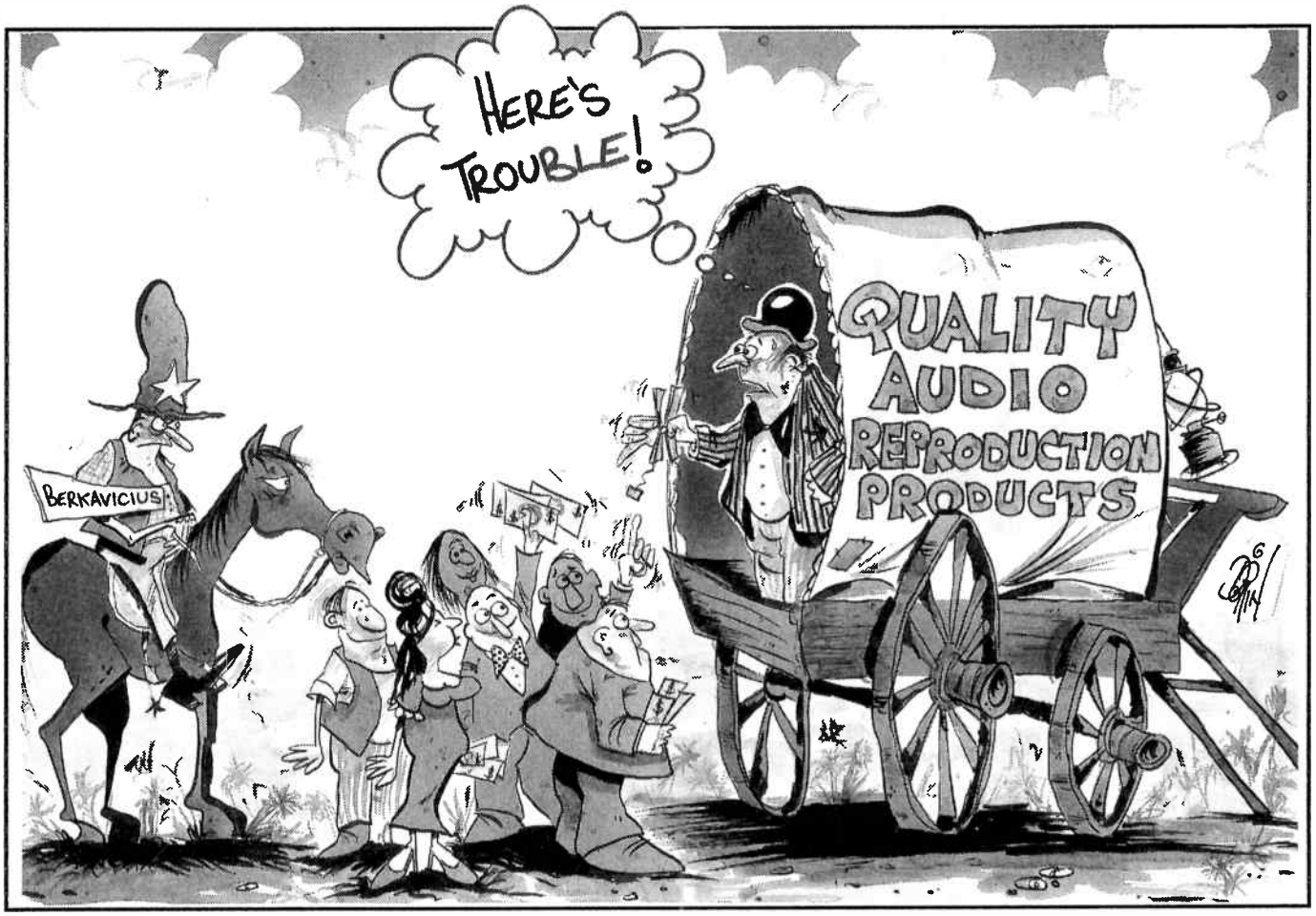


Fig.1: The basic optical setup for a CD player's pickup, showing also the shape of the Laser Illusions 'Focus' spatial filter device and where it is fitted.



'Spatial filter'

The device in question is the 'Focus' Optical Spatial Filter, and it's made by a firm in Naperville, Illinois USA with the slightly disconcerting name of Laser Illusions, Inc. The local agent for Laser Illusions is Symphonia Hi-Fi, of Hawthorn East in Melbourne.

Symphonia's affable manager Vincent Testa thought we might be interested in this latest enhancement product, and very kindly sent me a bundle of technical information on it. Included was a paper by three of Laser Illusions' technical people, titled 'Sonic Improvements in Digital Playback Systems Through Spatial Filtering and Scattered Light Reduction in the Optical Domain'; another shorter paper titled 'Jitter Reduction in Compact Disc Players Through Spatial Filtering of the Optical Signal'; a copy of a review by Robert Harley in the June 1992 issue of the US magazine *Stereophile*; and another review by Kevin Williams in the *Chicago Sun-Times*, for Sunday November 3, 1991.

Needless to say there's far too much in all of this to reproduce everything here, so I'll have to try and pick out the most salient sections. First of all, here's how the Laser Illusions' engineers D.L. Sipes, L. Higley and T. Willy introduce their main paper:

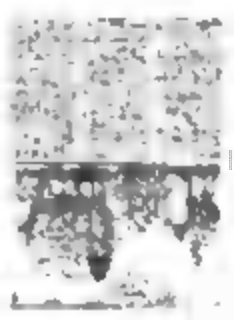
In this paper we report on the positive sonic effects wrought on compact disc optical digital playback systems through spatial filtering and scattered light reduction in the optical receiver. This reduction in extraneous signal is achieved through the use of an aperture-type spatial filter, placed on the pickup lens of the optical receiver. To our knowledge this represents the first report of sonic improvements of this type. Extensive listening tests involving numerous subjects, with several CD players from different manufacturers, reliably identified these positive sonic effects; namely improved imaging and image stability, and increased transparency and resolution. The mechanism for such improvements is believed to be through the reduction of signal to signal noise or intersymbol interference, caused by scattered light imaged from adjacent CD surface features.

In a nutshell, then, their basic idea is to reduce the aperture of the lens in the CD player's optical pickup, by 'stopping it down' with a small annular ring of IR-opaque material. And the 'spatial filtering' achieved by this aperture reduction is claimed to produce an audible improvement in reproduction, by reducing the effect of light scattered by areas of the CD adjacent to the pits actually being 'played'.

Now for a bit more detail. After giving some general background, which we'll take as read, here is the next main section of the paper:

Given the complexity of electro-acoustic analysis in general, and more specifically the difficulty of translating digital domain phenomena into distinct analog effects, we will proceed cautiously in this analysis by first presenting current CD optical pickup structures and then analysing the nature of extraneous light in this system and how spatial filtering effects it. Next, the received optical signal will be studied in detail, as to the effects before and after spatial filtering. Finally various speculations as to how the sonic signal is ultimately effected will be presented.

A generalised schematic of the CD laser/optical receiver head, showing its composite elements, curvatures and distances is shown in Fig.1. Divergent light from the laser diode passes through a grating or analogous structure to 'split' the light, to form the multiple beams necessary for tracking. The light then traverses the beam splitter, a mirror structure designed to pass half the light



and reflect the rest, to the collimator, a lens that acts to make the light travel in a more parallel direction. Finally, the objective lens tightly focuses the light to a spot of approximately 1um in diameter.

Upon reflection from the CD disc, the light is collected by the objective lens and then reflected by the beam splitter and imaged onto the receiver photodiode, where it is converted to an electrical signal and then sent to the decoder and other downstream signal processing, and eventually to the D/A converter and to the rest of the system. Electromechanical servos control the exact placement of the beam with respect to the spinning disc, by moving either the objective lens or the entire optical pickup.

In order to understand the need for spatial filtering, a closer examination of the interaction of the light with the CD disc is required. The pit depth on a CD is only 0.1um, so the CD 'pit' is not so much a hole but rather a slight change in reflectivity, which the CD transport or player is required to make sense of.

In addition, a sizeable amount of the light striking the disc is scattered in all directions and transmitted through the disc, instead of being reflected back into the optical pickup. This scattered light sprays over the surface of the disc, re-reflecting off adjacent pits towards the objective lens.

In order to achieve the small focused spot sizes required for CD reproduction, the objective lens must be very 'fast' — i.e., be able to bend light rays at steep angles, and have a short focal length. As camera buffs know, the higher the speed a lens has, the greater its ability to capture light arriving at the lens over a wide angle (the fastest camera lenses are around F3, while the CD objective is below F1). This feature of the objective lens also has a negative effect, in that it acts as an 'optical vacuum cleaner', collecting the extraneous scattered light as well as the information carrying reflected light.

Information is transmitted from the CD to the CD player by means of the EFM (eight to fourteen modulation) format. The EFM format consists of a series of nine discrete and/or land lengths, embedded into the CD — where a pit-to-land transition or edge denotes a digital '1' and the spaces between such transitions are the digital '0's'. Furthermore the EFM format uses the timing between these transitions as the foundation for the digital code. Thus the critical dimension in CD audio reproduction is the precise shape of these transitions, their arrival in time, and the possible corruption of the transitions due to extraneous scattered light.

Degradation of the edge transitions in the EFM signal due to unwanted scatter can be characterised as coming from two distinct sources. First, the collection of lenses in the optical pickup acts to provide an image of the pit the CD player is currently trying to read, as well as adjacent pits. Light scattered from these adjacent pits is therefore imaged on the photodiode, along with the main reflected laser beam. It then follows that in addition to the primary transitions being detected in the reflected beam, secondary transitions from these adjacent pits will be detected, thus reducing the sharpness and definition of these primary transitions. This noise source is characterised as 'imaged scatter'.

Second, as mentioned earlier, the large light capture angle of the objective lens causes scattered light from a much larger zone around the primary beam to be collected, and transferred to the photodetector in a jumbled, non-imaged fashion. This 'non-imaged scatter' noise source acts as an uncorrelated rise in the phase noise seen by the system.

The process of screening or shielding the optical detection system from both the imaged and non-imaged components of the optical scatter fall into the broad category of optical processing techniques called spatial filtering. The mathematics used to describe spatial filtering is identical to the Fourier techniques used in traditional electronic filtering and signal processing.

If we accept the proposition that scattered light causes degradation of the EFM signal, the optical pickup may be redesigned to take this into account. In the near term, however, is it possible to modify existing CD players in an inexpensive, simple and straightforward way? The answer is a resounding yes, and the Laser Illusions FOCUS spatial filter illustrates how this is possible.

Fig.1 shows the FOCUS spatial filter placed on the objective lens of the CD player, with its diameter precisely matching the diameter of the laser beam at that point. Although the exact analysis is beyond the scope of this paper, the placement of the spatial filtering in this location has a significant impact in reducing both the imaged and non-imaged components of the extraneous optical scatter.

Measurement data

In order to measure accurately the effects of spatial filtering on the EFM signal, we conducted jitter measurements on the EFM signal itself. The EFM format is based on a minimum time interval which is 232 nanoseconds long. The minimum time interval in the CD format is three times this base unit, or 696ns. Our measurements were made using a Hewlett-Packard Model 53310A Time Interval Analyser or Modulation Domain Analyser. This unit measures very accurately the time duration between voltage transitions, and presents multiple measurements in histogram form.

In our experiments the unit was set for AC coupling, triggering on rising-edge transitions only. The minimum observable interval is twice the minimum interval between transitions, or 1.392us. Histograms were then created by saving over 20,000 of these measurements.

For these measurements the disc used was the B52's 'Cosmic Thing' (Reprise 9 2584-2). The spatial filter was a Laser Illusions ESF-2 spatial filter which was attached to the CD player lens. The measurements were made at various inter-

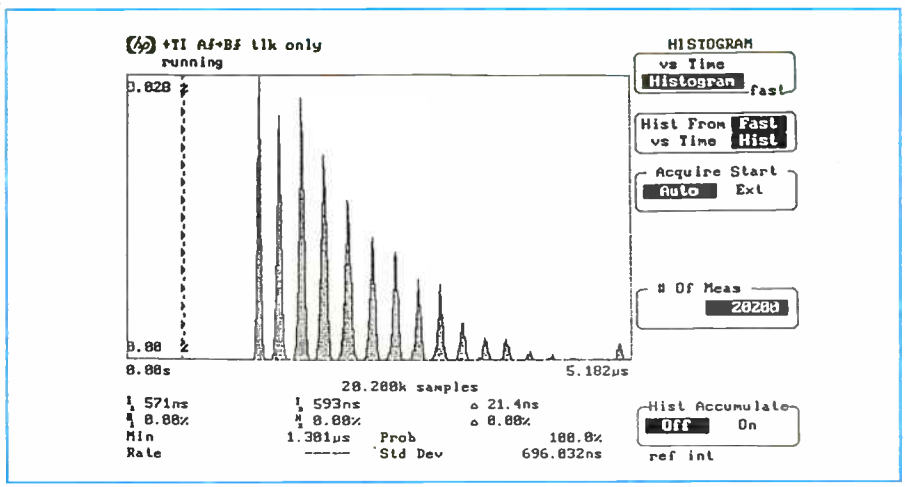
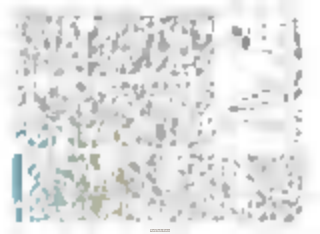


Fig.2: The statistical distribution of rising-edge transitions in the recovered EFM signal from a CD, as measured by the Laser Illusions researchers.



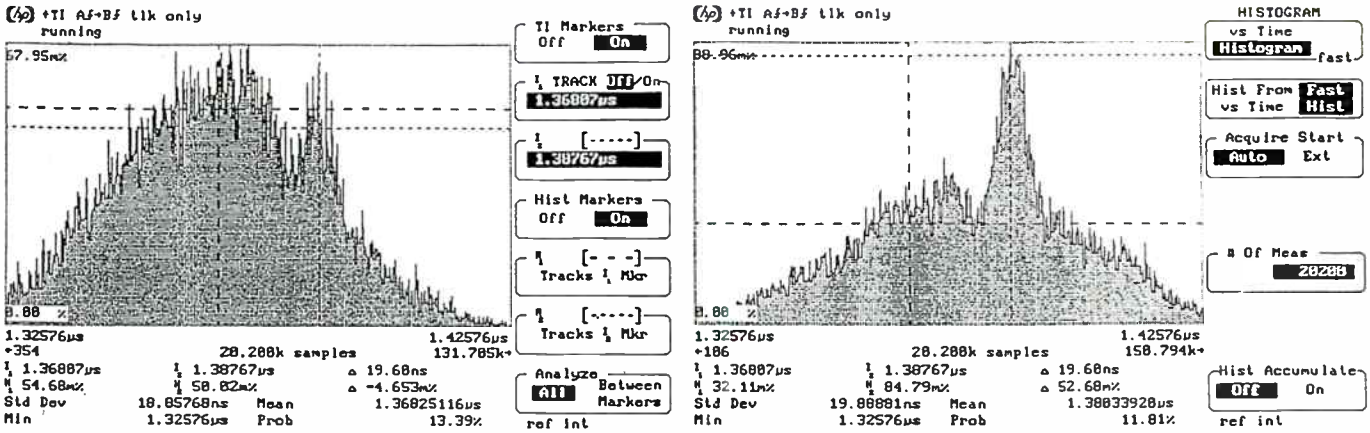


Fig.3 (left): A close-up of the first histogram peak in Fig.2, for a CD player not fitted with the spatial filter device. Note the broad 'accessory' peak at approximately 1.3876us — which is much reduced when the filter is fitted, as in Fig.4 (right).

vals over a four-hour period after turn on. The measurements were repeated over a two week period. The following figures are representative of the observed data.

Fig.2 shows the statistical distribution of rising edge to rising edge transitions for the CD format. Note that the shorter intervals have the highest probability, as most signal encoding schemes favour transitions in order to minimise average voltage fluctuations.

Fig.3 shows the histogram for the non-spatial filtered CD player. Note that the histogram is dominated by a shorter, broad time interval peak at approximately 1.3876us. Fig.4 shows the same peak after spatial filtering. The broad accessory peak has disappeared, and left a slight broadening of the base distribution. It was also observed that the distribution changed slightly as tracks were played from the inner region of the disc to the outer part. Work is under way to further characterise these effects.

Downstream effects

Due to the complexity of the CD reproduction process, at this time we can only speculate as to the mechanism by which reducing jitter in the EFM signal translates into improved sonic quality.

From an information transfer viewpoint, CD sound reproduction can be thought of as being comprised of two dimensions. The first dimension is the data or digital dimension; that is, the ability for the digital decoder to make a correct decision about the data it is receiving. Monitoring the error flag output found on most decoding chips reveals the existence of only a few uncorrectable errors ***per entire CD!*** *This low bit error rate indicates that the 'digital' dimension of the system is doing its job quite well.*

The second, less understood dimension involves the arrival rate of the data to the D/A converter. This dimension is still an analog one, and involves a complex interplay between the EFM signal, tracking network, power supplies, and virtually every other aspect of the CD player. In this dimension it is not sufficient to speak purely of jitter, but rather of the jitter spectrum and the correlations and coherencies that exist within the jitter envelope. It is in this dimension, we believe, that processing in the optical domain has its greatest impact. Further research is being undertaken to evaluate further these effects.

In addition, the interaction between extraneous scatter, and vibrations in the transport mechanism and tracking network are equally complex. Current CD player designs seem to suggest that a certain amount of this 'error' signal is necessary for adequate tracking of the compact disc; this necessity arises from cost limitations placed on the tracking network electronics. These limitations, in turn, force the CD transport designer into a 'false optimum' between acceptable tracking and cleaning up the EFM signal through spatial filtering.

Our research has shown that in higher quality transports (more robust, with more sophisticated tracking networks), a higher degree of spatial filtering is allowable before the point of unacceptable tracking is reached. This result points to the conclusion that a truer optimum can be achieved by upgrading the tracking systems being employed, to accommodate the cleaner EFM signal.

Finally, here is how the authors conclude this main paper:

Given the complexity of the sonic reproduction/human hearing interface and the complete insufficiency of current audio test methods, no work in this area is complete without including listening tests as part of the experimental regimen. To this end, we have performed tests involving over 400 subjects, encompassing a wide range of listening backgrounds and skills. In addition, these tests were performed utilizing many different CD players, from portable 'boom boxes' to expensive transport/processor separates.

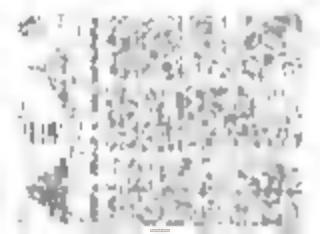
In over 90% of the trials, the subjects clearly identified a difference, and a positive one at that. Furthermore improvements were detectable in even the most advanced and sophisticated systems. Typical comments of the positive change included improved definition, smoothness and sonic three-dimensionality.

In conclusion, we have demonstrated for the first time that spatial filtering of the optical signal leads to both measurable reductions in optical jitter as well as sonic improvements in the musical output. This discovery, along with the already impressive improvements made in CD playback technology, may cause the CD format to approach its theoretical aspirations.

Further information

Well, that's the basic story, from the researchers themselves. In the second and smaller paper, they largely repeat the same material in a briefer form, but also explain that a Proton model AC 300 CD player was used in the experiments, containing a Philips type CDM4 transport.

There's also a little more clarification with regard to the significance of the histogram plots of Figs.2-4. Apparently Fig.2 shows the statistical occurrence of the possible transition time intervals of the CD pit spacings, as read by analysis of the EFM signal at the input of the



decoder chip using an H-P 53310A Modulation Domain Analyser. Then Figs.3 and 4 are essentially 'close-up' views of the *first* histogram peak, corresponding to the shortest of these transition intervals, at nominally 1.392us. As you can see there does appear to be a significant 'cleaning up' of the correct peak, as a result of the stopping-down of the pickup's objective lens.

The two review articles mentioned earlier largely repeat this basic story, but do add a little more in terms of basic background. According to Robert Harley in the *Stereophile* article, Don Sipes is actually a laser physicist and mathematician, and he and his colleague Armando Martinez together hold over 30 patents in laser technology. After analysing the performance of CD players from a theoretical viewpoint, and then measuring the jitter in the EFM signal from the photodiode, they developed their 'Spatial Filter' device in about a year.

Kevin Williams' article in the *Chicago Sun-Times* reveals that the filter device is precision machined from Delrin plastic, and finished by hand. It attaches to the CD player's laser pickup lens with a benzine-solvent adhesive, and apparently reduces the player's objective lens aperture by between 80 and 90% — which seems quite drastic, but Armando Martinez is quoted as saying that such a large reduction is necessary "because it sounds better".

There are apparently a number of different models of the device, carefully designed to achieve the best results with various popular CD player mechanisms.

Puzzling aspects

That's a condensed but fairly complete version of the information available on the Laser Illusions Spatial Filter, then. It all sounds quite plausible in many ways, doesn't it? And I guess the proof of the pudding is ultimately in the listening — apparently many thousands of the devices have been sold already, especially in the USA, and the buyers are very happy with the improvement in sound.

All the same, I do find myself puzzled about a few aspects of the explanation about *how* the devices work.

The founders of Laser Illusions sound as if they know a heck of a lot more than I do about lasers and optics, yet some of their explanation seems a bit garbled. For example in talking about CD player optics they state that the objective lens must be very 'fast', in order to achieve the necessary focussed spot size — because the higher the *speed* of a lens, the greater its ability to capture light arriving over a wide angle. This seems to me to be confusing the 'speed', or ratio of aperture to focal length, with the focal length itself (or strictly, its inverse).

Perhaps things have changed nowadays, but at least when *I* studied optics and photography it was the focal length which determined the angle of view; a short focal length gave a wide angle of view, and a long focal length a narrow angle of view. The speed or aperture/focal length ratio basically only determined the *amount of light* which the lens passed.

I'm also puzzled by the reference to the fastest camera lenses being around F3 (which I gather is the current way of expressing f/3.0), to emphasise the high speed of CD player lens apertures of 'below F1' (i.e., less than f/1.0). Yet many of the more expensive cameras have lenses opening to at least f/1.4 or f/1.2, and lenses as fast as f/0.95 are by no means rare in both cameras and projectors, thanks to modern computer-aided lens design. So if a typical CD pickup lens is f/0.9 or so it's certainly 'fast', but not dramatically faster than modern camera lenses...

But getting back to the CD player's pickup, my understanding of the reason for the objective lens being of *short focal length* (i.e., wide angle of view) is that this makes it possible for the laser beam to be brought to a focused spot of around 1.5um in diameter at the reflective surface inside the CD (to resolve the recorded pits), while still being a much larger 0.8mm or so at the disc's outer surface — to make it relatively immune to mistracking and reading errors due to surface dust and minor scratches, etc. With a longer focal length, the beam would be narrower at the disc surface for the same internal scanning spot diameter (which is essentially fixed), and hence the system would be much more prone to tracking and reading problems.

On the other hand, I don't remember seeing any specific reason given for the objective lens having to be 'fast' — i.e., with a large ratio of aperture to focal length. In fact most of the explanations of CD player operation I've seen make no real reference to lens *speed* at all. I can only assume that if the lenses are in fact 'fast', it's in order to cope with the fact that they're usually carrying three separated beams — the central reading beam, and the other two that are generally used for tracking.

Actually from my own modest knowledge of optics, I would have expected that you'd want to keep the lens aperture as *small* as possible, in view of the fact that you're trying to focus the beam down to a tiny spot of less than 1.5um. Generally it's easier to do this with a small aperture rather than a larger one, because reducing the aperture increases the depth of field and also tends to reduce astigmatism errors, etc.

So I guess what I'm asking here is WHY do our laser experts claim that the CD player's objective lens 'must be very fast', when they really seem to be talking about the need for a short focal length?

The funny thing is, of course, that they then go on to show that if you stop down the lens with their special filter device (making it 'slower'), the player's performance actually seems to improve! So much for the lens having to be 'fast'!

Focal length unchanged

The other side of the same problem is that as far as I can see, stopping down the lens with their filter ring will basically only reduce the amount of IR light passing through it, in each direction. It still isn't changing the lens's focal length, so the *angle of view will actually stay the same...*

Why, then, do they seem to be able to show a reduction in the jitter level of the recovered EFM signal, and report a noticeable improvement in the audio reproduction clarity? I'm blessed if I know, folks; all I do know is that their explanation doesn't seem to make a great deal of sense!

Presumably the filter ring is doing *something* worthwhile, but frankly I suspect it's not working in quite the way they seem to think it is.

I have a couple of other concerns, too. One is that I would expect the CD player's servo focusing system to be pretty finely 'tuned', in terms of its suspension compliance/mass ratio and servo gain, etc. Even a tiny ring of Delrin cemented to the top of the lens structure sounds like it would add significantly to the system's moving mass, and I wonder what effect this would have on the servo's operation.

My understanding also is that with the objective lens having such a short focal length, there is a very small gap between the top of the objective lens and the underside of the revolving CD. That doesn't leave much *room* to fit an extra device like the Spatial Filter ring, surely...

Finally, I have to confess to a niggling doubt of a more general nature. If such a simple remedy as stopping down the player's objective lens can achieve such a worthwhile improvement in performance, why wasn't this discovered years

ago by all those CD and laser experts at Philips, Sony and the other firms so heavily involved in CD player development? Why have *they* all stuck to undesirably 'fast' lenses?

The Laser Illusions people seem to be suggesting that it's because all of these designers settled for some sort of 'false compromise', between tracking and performance — due to the acceptance of tracking systems which 'rely on an error signal'. The implication here seems to be that only 'cheap' tracking servos rely on the existence of an error signal. But anyone who has studied elementary servomechanism theory knows that every servo system *must* have *some* error signal, in order to generate corrective feedback.

In short, then, while I'm quite prepared to believe that the Laser Illusions spatial filter ring may well achieve a worthwhile improvement in CD reproduction, from many players, I do find the designers' explanation of its operation rather unconvincing. How about you?

By the way, Vincent Testa tells me he has already sold quite a few of the devices in Australia, and just about all buyers have been delighted with the results. Virtually the only people who have struck trouble, in the form of increased tracking errors, have been those with very low cost (sub-$399) players, or fairly elderly and well-used players where the laser diode's output seems to have become rather weaker than when they were new...

If you'd like to try one out for yourself, they cost $100 each plus an installation fee of $35 if you're nervous about fitting it yourself. Further information is available from Vincent Testa at Symphonia Hi-Fi, 544 Burwood Road, Hawthorn 3122; phone (03) 819 0173.

I'd be interested in hearing how you go, if you do decide to try one. And if you think you can explain how they might work, we'd like to hear from you as well! See you next month. ❖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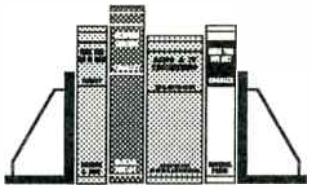


Transistor data, substitution manuals

UP-TO-DATE WORLD'S TRANSISTOR COMPARISON TABLES, Asia-Pacific edition, Volumes 1 and 2. Published by Tech Publications, Singapore, 1992. Soft cover, 215 x 150 x 13mm, and 215 x 150 x 20mm. ISBN 981-214-444-7 and 981-214-492-7. Price for each volume $18.95.

A pair of very handy books to assist with transistor substitution. Volume 1 (Comparison Tables A-Z) contains more than 11,000 different transistors and FETs, all of which are listed alphanumerically, with four columns of information.

Column 1 gives the manufacturer's type number, the material (Ge, Si, MOS, V-MOS), the polarity (NPN, PNP, N-ch, P-ch, and N-P for transistors of different polarity in the same case), and a description of its applications (45 in all, including AF, RF and UHF ranges, antenna amplifier, fast switch, low noise, etc). Column 2 gives guaranteed data values: V_{CBO} (collector-base reverse-bias voltage), I_C or I_D, total leakage power, DC current gain and the transition frequency in GHz or MHz. Column 3 gives a pin-out reference code, which can be referred to drawings at the back of the book to identify all leads; while column 4 gives the type numbers of suitable replacement transistors.

Volume 2 (Comparison Tables 0-μ) has an identical layout, and gives the information for over 15,000 transistors and FETs whose manufacturer's type code is numerical rather than alphabetical.

THE JAPANESE '92 TRANSISTOR DATA AND SUBSTITUTION MANUALS, Asia-Pacific edition, Volumes 1 and 2. Published by Tech Publications, Singapore, 1992. Soft cover, 208 x 150mm, 412 and 282 pages. ISBN 981-214-396-3 and 981-214-372-6. Priced at $19.95 and $17.95, respectively.

The type numbers of Japanese transistors are decided by the Japan Industrial Standard (JIS), and registered, along with their standards, with the Electronic and Mechanical Industrial Association of Japan (EIAJ). All transistors manufactured in Japan are registered with the EIAJ under 2S numbers. These two volumes provide a thorough reference to these devices.

In Volume 1, the Data Manual, the four official groups of bipolar transistors are listed first: 2SA (A=PNP high frequency), 2SB (B=PNP low frequency), 2SC (NPN high frequency) and 2SD (NPN low frequency).

Following the A-D item of information in the type number, there is the EIAJ registered number (from 11 to 9999) — which does not reflect characteristics or applications. This is followed — if appropriate — by a special symbol for a modified version (e.g. shape, noise standard classification, etc.) and/or a symbol for special transistors (e.g. used in communication, industry, etc.). The Japanese manufacturer is given next, followed by the transistor's applications (35 categories) and data. The extensive data includes maximum ratings: V_{CBO}, V_{CEO}, V_{CES} (emitter shorted to base), V_{CER} (resistor R between emitter and base), I_C and power ratings with and without heatsinking.

Next comes the electrical characteristics: collector cut-off current, direct current gain, saturation voltage, cut-off frequency, switching time, capacitance, and other characteristics such as noise index, output power, ohmic resistance, etc. Finally, the transistor shape is given, along with its pin termination, and remarks such as Da for Darlington, R for in-built bias resistor, etc. The number for its complementary transistor is also given, incidentally — very handy.

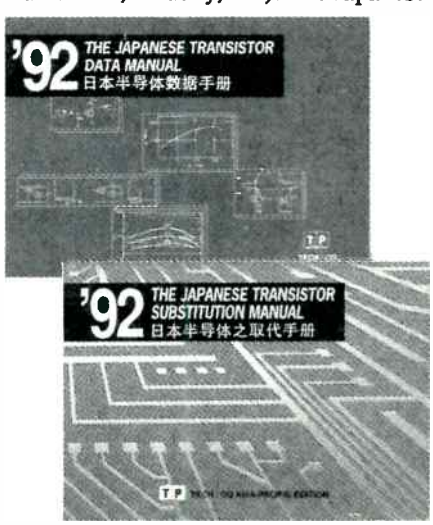
A fifth block of transistors is given after the 2SA-2SD ones, all of which start with a double alphabetical prefix. These are headed 'House Numbers', so presumably they have not been officially registered. Next comes the last block — low noise transistors — arranged in ascending order of their NF values (dB). Their f_T values (in MHz) are also given for reference.

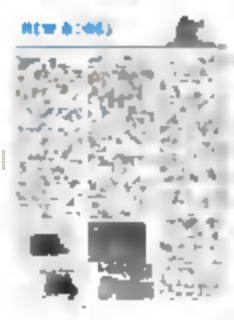
Diagrams of the pin-outs cover the next 33 pages, with the last 13 pages for newly released transistors. A page reference is given for almost 7000 transistors, so that their characteristics can be looked up in the official '1988 Publication Latest Transistor Standard Table'.

Volume 2, the Substitution Manual, allows users to identify the transistors of eight major Japanese manufacturers which have different type numbers but identical performances. These eight are: Sanyo, Toshiba, NEC, Hitachi, Fujitsu, Matsushita, Mitsubishi and Rohm.

All four of these volumes are clearly set out and easy to read, and contain an enormous amount of useful information for those who may need it for design or servicing purposes.

The review copies came from Jaycar Electronics, and are available from all Jaycar stores for the prices quoted. Their catalog numbers are BM4584 and 4585 for Volumes 1 and 2 of the Comparison Tables, and BM4572 and 4570 for the Data and Substitution Manuals. (P.M.) ❖





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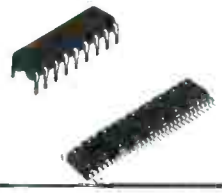

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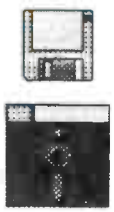

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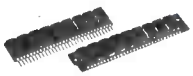

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TECS TECS TECS TECS TECS TECS

THE SERVICEMAN

Problems solved in glowing colour, and a mangled picture that was REALLY colourful!

I have quite a collection of interesting stories for you this month. A couple of them came to me in a particularly novel way — although one that made a lot of sense, considering the kind of faults involved. There's also two other stories about faults that turned out to be much easier to fix than seemed likely, considering the symptoms. One set really looked like a potential 'write-off', but its very dramatic and colourful fault turned out to be something quite simple...

I have just finished looking at a most interesting story contributed from K. McG., a fellow serviceman in Munduberra, Queensland. I say 'looking at' quite specifically, because his contribution was submitted on videotape.

We've had all kinds of contributions — from those that are hand written in pencil, through those that are typed, or more recently word-processed on computer disc. Some contributors send us extracts from the relevant circuit diagram, and others have sent along photos of their problems. But never before have we met a contributor, in living colour, right there in his own workshop.

K. McG's idea of sending a videotape was a good one, in that the two problems he shows would have been very difficult to describe in words. Unfortunately, someone has to put them into words if they are ever going to reach the pages of this magazine. So it falls to me to supply the '1000 words' that will have to substitute for Mr McG's 'picture'.

However, before we get on to the stories, I'd like to comment on a remark in his covering letter. Mr McG. disparaged the recent story about troubles with an electric fence, expressing the opinion that 'The Serviceman' should concentrate on TV and video service problems.

It may well be that Mr McG. is not the only reader with this opinion. The continued popularity of the TETIA 'Fault of the Month' would seem to bear out that a great many of our readers are greatly interested in TV and video servicing.

Nevertheless, electronics nowadays covers an enormous range of products, even if one restricts the coverage to domestic items alone. It would be doing a grave injustice to the hundreds of versatile servicemen who tackle these products if we were to restrict the column to just TV and video.

Once upon a time this column *was* dedicated to just radio and TV, with the occasional public address amplifier thrown in for variety. But in recent years we have made a conscious effort to balance the presentation with stories about other electronic devices — domestic, commercial and professional.

TV and video will always have the bulk of the space in this column, but I'm afraid Mr McG. and others of like mind will have to get used to sharing the space with all manner of other electronic devices — all in the name of greater reader interest, according to the Editor.

Now, with that off my thorax, let's get on with K. McG's stories.

The first one concerns a Kriesler 59-06 chassis in a large console style cabinet. The set was hiccupping, and changing the tripler did nothing to improve matters. Neither was there anything wrong with the line output transistor or the power supply.

It was about this time that K. McG. decided to videotape the set, because of the condition it was in. In his words, it looked as though it had fallen off the back of a truck — literally.

The 59-06 is a Kriesler version of the Philips KL9A chassis. It uses a large vertical motherboard with a hole in the middle to accommodate the base of the picture tube. Small plug-in modules carry the various sub-circuits such as audio, chroma, line drive etc.

In the set that K. McG. was working on, every one of these sub-boards was very loose on the motherboard — so much so that someone had fitted small blocks of foam plastic between the boards to help support them. With the plastic removed, the boards sagged under their own weight until they were lying against one another.

It wasn't long before K. McG. found the reason for the hiccupping. Under each module were two rows of solder pads with lengths of wire soldered between them. Some of these had become dry jointed, and repairing these got the set working again.

It took him quite some time to replace and refix all the little bits of foam, but eventually the set was ready to go home. Unfortunately, it didn't survive the trip of 50 rough country miles and was soon back for more surgery. With a bit of extra reinforcing, it did survive the next trip and is still, apparently, working well.

K. McG. could not make out why the modules were so loose in the chassis, and

attributed it to some kind of accident. I think I can solve the puzzle.

In the 59-06 and the KL9A, the circuit modules were originally mounted in PCB sockets. These sockets made contact by gripping the edge of the modules, while the moulded frame of the socket included support brackets to hold the board erect.

Unfortunately, the contacts in the sockets had a habit of losing tension, leading to an intermittent or open circuit. It was not easy to re-tension the contacts in situ, so the socket had to be removed from the chassis and dismantled.

After cleaning and re-tensioning the contacts, the whole assembly had to be refitted onto the main PCB, a job complicated by the fact of the double row of pins that had to be mated with as many holes on the motherboard.

I have several times come across sets in which there had obviously been troublesome sockets. Some frustrated technician had removed the sockets completely, then hard-wired the modules back onto the motherboard. This sort of treatment would account for the 'pieces of wire' noted by K. McG. under each module.

Mind you, I have never seen a set in such bad condition that it required the treatment to ALL of the sockets. That set must have been in a *really* bad way.

A *real* freezer!

K. McG's second story relates to a Princess model 14CT9, a 20" inch table model of fairly recent vintage using a Korean-made PC-04X chassis.

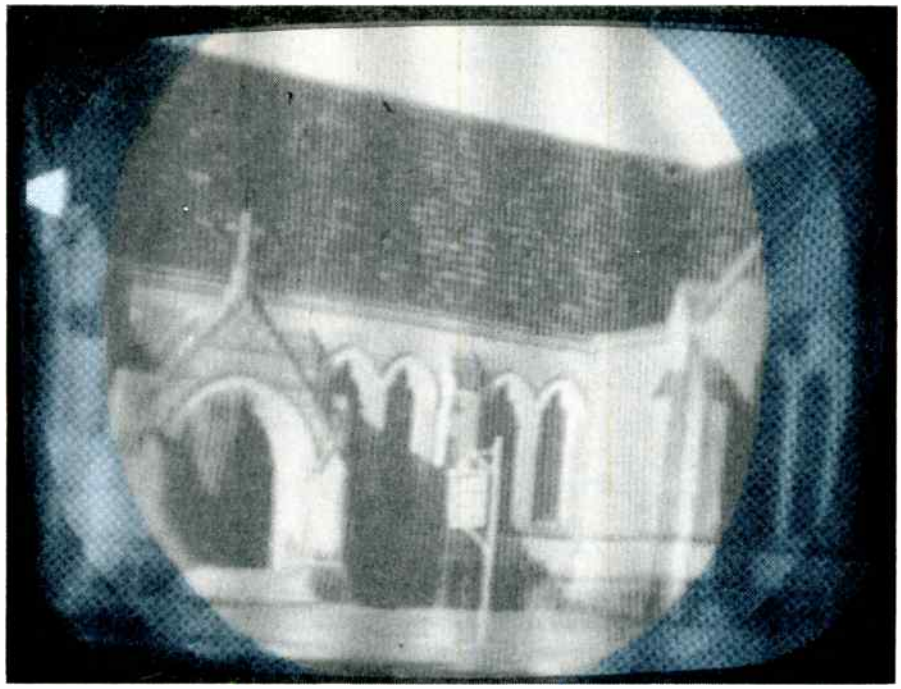
This set came in with two problems. The most spectacular fault was that when first switched on, only the top one inch of picture appeared. Over the next five minutes, the band of picture grew wider until it occupied perhaps a quarter of the depth of the screen.

Then a new band of picture opened across the centre of the screen and expanded upwards until it met the band moving downwards. After they had joined, with about half of the picture revealed, they expanded down the screen until about 10 minutes after switch-on, the picture was complete and would remain so for the rest of the day.

It was fairly obviously a heat sensitive fault, although just what was at fault took K. McG. quite a long time to sort out.

The second fault was a total lack of colour, and this seemed to be permanent since the hot-and-cold treatment he used to track down the first fault had no effect on the second. In fact, it was cured quite incidentally while working on the first one.

K. McG. tackled the heat sensitive trouble first. His first need was to decide what was happening to the signals being supplied to the tube cathodes. Voltage checks showed that nothing was amiss in that department, either at the tube base or on the output transistors.



The Serviceman's own story this month concerns a set that came into his workshop with a picture that looked like this. As you can see, it looks pretty serious — but the problem turned out to be something quite simple.

It wasn't until he used his CRO to look at the video output from the output transistors that he realised that the signal was being blanked for some reason, and the slow recovery was the result of the progressive removal of the blanking voltage. Since most of the video processing occurs in IC501, a TDA3562A, and since this chip was supplied with horizontal and vertical pulses, presumably for blanking among other purposes, it was not unreasonable to suspect the chip as the culprit.

However, despite the fault being heat sensitive, no amount of heating or cooling of this particular chip could vary the onset of the fault. It seemed determined to take its own time, no matter what K. McG. did...

In the end, he decided to change the chip, more out of desperation than any real hope of curing the fault. And in fact, he did cure one of the faults — at next switch on, the colour had returned in all its glory. So it was one down, and one to go. Unfortunately, the nature of the heat sensitivity was so critical that he could not supply enough freezer spray to cool whichever was the responsible component. And the nature of the Queensland climate conspired to keep the component warm for a long time, once it had been initially heated. Then, he had an idea. What would happen if he chilled the whole set, say in the refrigerator?

The next scene in K. McG's video epic shows the family fridge, empty except for a chicken and a six-pack. He wrapped the set in a sheet of plastic to keep the drips off, then shut the door on it for some 10 minutes or so.

When it was taken out, the set was thoroughly chilled, with the fault in full evidence. And it stayed so for quite a long time — a half an hour or more. This allowed him time to poke and probe around with first a heat gun and freezer spray, then a warm soldering iron and freezer spray.

Thus, he was quickly able to localise the fault to the vicinity of the vertical oscillator/output chip IC301, and in particular to C310, a 100uF 25V electrolytic capacitor between pins 6 and 8. This capacitor was so heat sensitive that the fault could be brought on in seconds, and cleared just as quickly.

The previous heating and cooling had been ineffective because the fault looked as though it should have originated in the video chip, and that was far removed from the vertical chip. The spraying had all been in the wrong part of the chassis.

So there it is. I wouldn't have believed it, if I hadn't seen it with my own eyes. But K. McG. had already used a can and a half of freezer spray without any success, so desperate ends called for desperate

means. And the family fridge is about as 'desperately mean' as one can get!

Further North...

Now, from Queensland we go even further north. To Tabuli in Papua New Guinea in fact. P.W. is an electronics technician with the OK Tedi mine in western PNG, and his work deals not only with process control at the mine, but also with general communications.

He relates the story thus:

I was called down to fit upgraded software to the anti-collision radar on a large supertanker.

I had just finished the job and was waiting for the radar to warm up so that I could test it, when the First Mate asked if I would be able to look at a marine VHF set that was playing up.

I had a short time to spare, so I began interrogating him as to the exact nature of the fault. It appeared that the set would function well on channel 16 and a few others, but on the rest of the channels the display and all the front panel LEDs would die.

After I confirmed his observations, I set about seeing if there was any consistency in those channels that would not work. There wasn't any.

We scraped around in a filing cabinet and came up with a circuit diagram of sorts, covered with Japanese hieroglyphics. Thus equipped, I took the covers off and began probing around. I took a few voltage readings in the region of the address lines to the PLL (phase locked loop) chip and everything seemed to be in order.

Then I noticed that although the display had died, the channel incrementation at the address to the PLL chip incremented correctly. So the fault had to be somewhere on the display board.

About this time I was diverted back to the radar and had to spend the next hour making adjustments to that equipment.

When I came back to the VHF it was getting late and close to sailing time. So I informed the First Mate that as I didn't have enough time to sort out the radio properly, I would telex my findings to the technician at their next port and ask him to complete the job.

Now, I have never been a particularly tidy worker, as 'she who must be obeyed' will attest — and in putting the VHF back together I found I had one screw left over. I have always been of the opinion that manufacturers use far too many screws, as this is a common occurrance with me.

Anyway, a quick check of the reassembled VHF showed that all 55 channels were now working perfectly! Realising that the surplus screw must have some bearing on the sudden reappearance of the missing channels, I lost no time in removing the covers to find out why.

The reason was there staring me in the face. It was obvious that the surplus screw was one of a pair that should secure the display board. But whereas the other screw had insulating washers top and bottom, the one in my hand had none. Nor, as far as I can tell, had it ever had one.

I dug around in the tool box and came up with a suitable nylon bolt which I substituted for the correct screw. When I boxed the job off, it still worked perfectly on all 55 channels. So all along, the trouble must have been an intermittent short circuit from that un-insulated screw holding the display board!

I had all but forgotten about this story when 'she who, etc' demanded that I fix a rattle in the washing machine. It was that surplus screw, which I had casually put in my pocket several weeks earlier...

Thanks, P.W. I enjoyed that one, and I'm sure our readers did, too!

I can sympathise about the screw in the pocket. I do the same thing and my wife is forever saying "What's this out of, then?", as she pulls screws, nuts and washers out of my pockets before putting the clothes in the washer.

I guess Adam was the only man who didn't have this trouble. He didn't have any pockets, did he?

What a picture!

Now it's back into my own workshop for a while. This was not a long story, but it was an interesting and unusual one.

In all my years as a television serviceman, I have seen some pretty grotesque picture faults. Most of these have been weird geometrical problems — pincushion distortion, horizontal or vertical linearity distortion, etc.

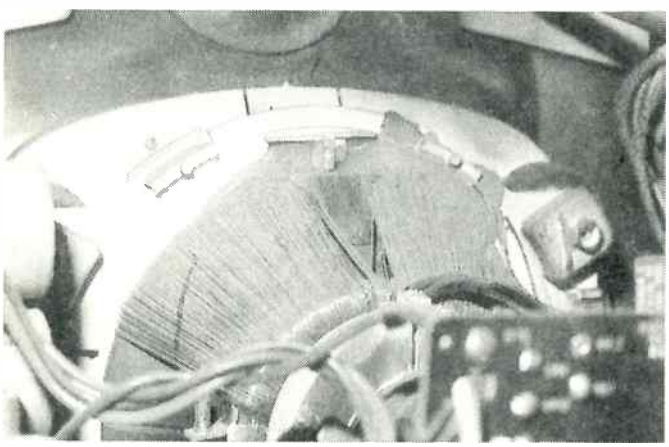
There have also been a lot of queer colour problems and on one occasion, a complete positive/negative reversal of the black and white image.

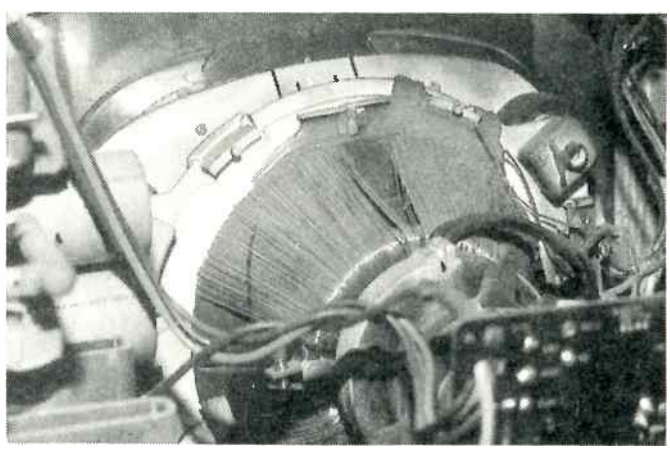
But there has never been a fault such as the one that landed on my bench recently. Although now I come to think of it, it's only the symptoms that were odd. I have seen the particular fault before, though never with such a spectacular display.

This story will only make sense if the Editor can print the photo I took of the set under discussion. Describing the symptoms properly will take more skill with words than I possess.

To begin with, a circular section in the centre of the screen showed a near normal black and white picture, except for three or four broad, pale vertical bars up and down the screen. There was no sign of colour, even with the colour control turned right up.

Around this central section were concentric rings, alternately red, blue and green. Except that the rings were not con-





At left is how the deflection yoke should look, cemented onto the bell of the tube in the correct position. However, the picture at right shows what had occurred in the set which had the strange colour rings around a substantially monochrome picture. Once discovered, the problem was easily fixed using Super Glue.

tinuous, but more or less made up from unconnected patches of colour.

The vertical stripes mentioned earlier continued over the coloured rings, and the edges of the black and white picture also continued under everything. As I said before, it was the most spectacular fault I have ever seen, and I stood there looking at it for a long time, trying to work out what could possibly cause such a mixup.

In fact, my train of thought will take much longer to spell out here than it actually took to spin through my mind. This was an example of a fault where the screen told me enough to eventually work out what the trouble had to be.

Idea number one was 'colour fault', but this was quickly discarded when I found that the colour control could increase the noise, or snow, on the screen. This suggested that the control was working and that colour might return when the other problems had been solved.

Idea number two was a gross impurity problem. This was soon discounted when my degaussing wand produced no sign of improvement.

Idea number three was that the purity rings on the tube neck were misplaced. However, I couldn't see any mechanism by which the purity rings could cause the circular patches on the screen.

Idea number four suggested that the shadow mask inside the tube itself might have become misplaced. Again, this would have produced bad colour, but not the geometrical patterns that this set was displaying.

Idea number five was not so much a reason for the trouble as puzzlement. I simply could not work out how the 'picture' in the background could remain so disturbingly normal, while the rest of the screen displayed such extraordinary symptoms.

I tossed around these thoughts, and a few more way-out ideas, for several minutes while I stared at the screen. And then the vital clue caught my eye. The picture on the screen was not quite straight. The horizon was sloping slightly upwards.

Now, the only way this can happen is if the deflection yoke becomes twisted on the tube neck. I've seen this dozens of times and it is a quite unremarkable problem. One simply straightens the yoke, tightens the clamp and the job is done.

So, I knew I had solved the problem even before I took the back off the cabinet. The only trouble was, I still couldn't explain the concentric circles, colour patches and vertical shadings. These symptoms did not fit the simple twisted yoke pattern.

I lost no time removing the cabinet back and took a quick look at the yoke. At first, the twist was so slight as to escape my notice but soon after, another, much more relevant detail caught my eye.

This set used one of those tubes that has the yoke cemented permanently into place on the bell. Normally, one cannot see any sign of the means of attachment. Only rarely does a small patch of cement become visible, where it has oozed out from under the rim of the yoke mounting flange.

On this occasion, there were two large, shiny patches of hardened glue attached to the bell of the tube. And the edge of the yoke housing was lying a good centimetre below the glue line. What had happened was that the glue had given way and allowed the yoke to slide back and down on the tube neck.

Fault of the month

PANASONIC NV-H70A VCR

SYMPTOM: Won't record picture. Playback is normal, and a normal EE signal can be received. Cleaning the video heads made a slight difference, but the result was still unwatchable. Sound recorded quite normally.

CURE: Adjust record current. On this occasion, it seems the record current must have been set initially to a low, but useable level. If then suffered a spontaneous reduction in sensitivity (?), which was cured completely by re-adjustment.

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

I reached into the set and lifted the yoke up, then pushed it forward into a more or less correct position. And all the symptoms disappeared, except for a small patch of impurity in one corner of the screen. When I released the yoke, it fell back and down and all the symptoms returned. So that was the answer. All I needed to do was to refix the yoke into its original position.

I carefully pushed the yoke back into position, trying to get it to sit over the hardened glue in the same alignment as it had been originally. Then I used a couple of rubber wedges to hold it temporarily in place. When I switched on, I found that all traces of the trouble had gone. Even that small patch of impurity had disappeared.

Now to fix it...

Now that I knew that the yoke could be repositioned accurately, all I had to do was to find some way of securing it permanently in place. Because the yoke would fit closely over the glue patches, I had a strong suspicion that Super Glue would be a suitable medium for fixing it back in place.

This product will only work where the parts fit closely together. Any gaps weaken its grip quite alarmingly. The problem with this application was how to get the Super Glue to spread evenly over the inside of the yoke housing.

In the end, I decided that I had to remove the yoke from the tube. But this involved removing the purity magnet assembly first, and this would not be so easy to restore correctly. I had no wish to go through a complete purity adjustment if it could be avoided.

I got a waterproof felt-tip marker pen and put two lines on the tube neck — one marking the fore and aft position of the rings, and the other marking the side to side position.

Provided that the marks didn't rub off the glass, I believed that I could get the rings back very close to their original positions. From there on the whole exercise proved ridiculously easy.

I spread half a tube of Super Glue around the inside of the yoke housing, wherever clean plastic indicated that it had once been attached to the hardened glue on the tube.

I offered up the yoke and within seconds I imagined I felt the Super Glue grab the tube and hang on. Fifteen seconds later no amount of gentle persuasion would move the yoke, so I pronounced it stuck.

I replaced the rubber wedges under the

Continued on page 84

Moffat's Madhouse...

by TOM MOFFAT

Flubby the wonder technician

How do you learn to be a technician? The usual way nowadays is to go to tech school, and then go out and get a job (hopefully). You are said to be 'qualified'. But even though you have that nice piece of paper, you aren't really a technician until you've had some experience — usually under the guidance of someone who's already there.

That guide, often referred to as the 'old bugger', will have had many years training in the school of hard knocks. He will have found his own ways of solving problems that aren't in the textbooks. He will be your mentor, your source of infinite wisdom. My mentor's name was Flubby.

I discovered Flubby while I was a student at the University of New Mexico in the USA. I had a part-time job in a hifi shop to finance my uni expenses. Everybody had a part-time job back then; they were so easy to get, unlike the situation today. The job was usually as a flunky, in the industry where you would eventually make your career. The money wasn't much, but you learned the 'nuts-and-bolts' side of the theoretical stuff you were taught at school.

Flubby was the master technician in the hifi shop. He knew all the tricks of the trade; what was most likely to go wrong with amplifiers, where you looked first for trouble, what to jiggle, what to bash, what to knock. And part of his job was to pass on his special knowledge to the youngsters like me working under him.

Flubby was — how would you say — a rough diamond. Had he been an Australian, he would have been known as 'rough as guts'. Deep down inside Flubby had a heart of gold, but on the surface, well, he had a certain way about him.

Flubby had learned his trade in the US Navy, and as a result his speech was punctuated with a continuous stream of profanity. But he only knew *one* swear word, the dreaded F-word. It was used in every sentence he uttered, but because of social pressures he had altered it. So F— became FLUB.

Everything was 'flubbin' this' or 'flubbin' that'. "I can't see any flubbin' volts there, I guess I'll have to change that flubbin' resistor. Here, Tom, hold this flubbin' thing still for me." Yeah. That was our Flubby.

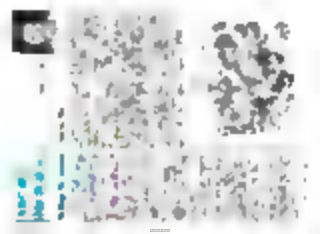
Many of you older readers would have seen Flubby, actually. *EA* used to have a column called 'Let's Buy An Argument', now known as 'Forum'. The earlier column featured a drawing of a guy bashing away on a typewriter, with the typewriter rapidly falling to bits and keys flying everywhere. Well, the face on that cartoon was Flubby — I recognised him the first time I saw it. And the typewriter keys were really flying bits of record changer, as Flubby 'fixed' it in his very special way.

Flubby continuously smoked cigarettes — Camels, I think, mega-stinko. I'm sure he even smoked them under the shower (not real often, as I remember). But he never, never touched a cigarette. It was bad for his health. Instead he sort of flipped the pack, tossing up a cigarette which he deftly caught between his lips. He lit it with his soldering iron (is there any other way for a skilled technician?).

The cigarette would then remain between his lips, ash falling on the workbench, as Flubby puffed away. So as not to waste any tobacco, Flubby would keep puffing until his lips were about to catch alight; then he'd spit the butt onto the floor and stomp on it. His end of the bench was littered with gray ash, and the floor had black splotches all over it where Flubby had extinguished his weeds.

One of Flubby's undisputed talents was the repair of record changers. Things like this went out of fashion years ago, in favour of single-play turntables; the 'fi' was more 'hi', you see. But record changers had a certain convenience. You could load a pile of 10 or so records onto a common spindle and then they'd drop down onto the platter, one by one, as each was played. This could provide hours of uninterrupted music.

Record changers were pretty complicated gadgets, but this didn't worry Flub-



by. Anyone who could fix a battleship could surely fix a record changer. Most problems came about simply because something was gummed up or stuck. Flubby's solution was the 'gravity release' method — he'd hold the record changer high above the workbench and drop it. After a resounding crash and possibly a few bounces everything was nicely loosened. Flubby would then give the changer a 'COA' (clean, oil, and adjust), and it would be good as new.

Of course, these procedures were never carried out within view of the customer. If the job was 'while you wait' the customer was escorted to the sales area and shown possible replacements for his dud record changer. The beginning of the repair was signalled by a mighty crash from the workshop. And a few minutes later, "Somebody come get this flubbin' thing!".

I remember one time the customer had not yet been successfully herded into the sales area when the crash came. He bolted back through the workshop door, just in time to see his prized record changer lying upside down quivering on its springs.

"What are you doing!?" he bellowed.

Flubby was quick: "I'm replacing the counter-rotating coreopsis bar." Simple answer to a simple question and the customer's concern was relieved. But — as I remember, a coreopsis is some kind of flower. Flubby was also a master of bulldust...

When an amplifier arrived for repair, Flubby had his very own way of assessing its condition — the 'Blap Test'. Above the workbench was mounted a pair of very expensive and powerful stereo speakers. These were there for us to give a repaired amplifier its final listening test, for any obvious hum, noise, or distortion. But Flubby used them for his INITIAL listening test. He would connect both speakers, switch the amplifier to the PHONO input, turn up the volume all the way, and touch his finger to each input in turn.

Unless the amplifier was completely dead, the speakers would then erupt in a roar of full-blast mains hum: BLAAAP! BLAAAP! Flubby could estimate, by the nature and intensity of the BLAPs, if the amplifier was down in output power, insensitive in the input, distorted, or unbalanced between the stereo channels.

If the amplifier was rated for around 60 watts, and it was working more-or-less OK, the BLAP's were magnificent to behold. There's no way you can do a quiet BLAP test. The speakers shook the walls, the walls shook the rest of the building, the building shook the floor, and the owner shook his fist.

This particular establishment liked to refer to itself as a 'salon', not a shop. The front area was filled with expensive furniture and vases, and the walls were decorated with original paintings. The entry led into a 'listening room' in which the goods for sale were displayed. This was top of the range stuff, with names like Scott, Fisher, KLH, Wharfedale, and AR — and truly up into the stratosphere, Ampex and McIntosh (stereo systems — the computers did not exist back then).

The listening room was presided over by an impeccably dressed salesman of somewhat undefined sexual preference. He would mince up to a potential client and say, "Are you being served?". The salesman was the sort of fellow who seemed to have a certain influence over women ("My husband is such a slob, and this salesman is such a gentleman...").

A husband and wife would come in just to 'look' at a stereo system. The man would drool over the top-shelf goodies, knowing full well his wife would chuck a fit if he even suggested such a purchase. Then the salesman would deliver his spiel about how a truly elegant home must have nothing less than this Scott amplifier and these AR speakers. The wife would nod, Yes! Yes!, the husband's eyes would light up, and the deal would be done. Unless, that is, Flubby decided to conduct a BLAP test.

The strains of Mozart would be wafting from the speakers; the wife, dreamy-eyed, imagining such prestigious equipment in HER home. The husband would be grinning at his good fortune, and... BLAAAP! Mozart submerged in a sea of raucous, distorted, mains hum. "We can't have that in our house!" The salesman would try to explain that the noise was from the technician in the back room, but by then the spell had been broken. No sale!

Below this hifi salon was a large cellar, which extended beneath our own shop and under the next two as well. The areas under our shop and the one next door were used as storerooms. Those were the days of low interest rates, and shops thought nothing of laying in thousands and thousands of dollars worth of goods. Anyone wanting to buy something on display would have what they wanted brought up from the cellar within seconds; none of this "We'll have to get one in for you". One quick job on that cellar would have set a burglar up for life.

Beyond the storeroom was a third section of cellar, more a 'chamber', entered via a small door. And inside the chamber was a big, strong workbench made of timber that looked more like ships' planking. This area was disused, filled with scorpions and enormous spiders and little else.

But one day, after a particularly trying series of blap tests, the boss got an idea.

"Hey Flubby, how would you like to have a private workshop of your very own?". Flubby thought that was a flubbin' good idea... he could smoke, he could spit, he could swear, and best of all, he was well out of reach of the boss. Gear to be repaired would be left of a shelf near the stairs; Flubby would collect it and return it to the shelf after it was fixed. The rest of the time he would remain out of sight in the cellar.

All hands pitched in to equip Flubby's workshop, naturally under his direction. We flushed out spiders and scorpions and installed power points, big fluorescent lights above the bench, pretty pin- up girls on the walls, and of course a pair of wall-mounted speakers for the BLAP tests. Flubby was in hog heaven.

The peace of the hifi salon was no longer interrupted by blaps and crashes and bellowed flubbins. In fact the whole place seemed a bit dead to me, and I soon wangled my way into the cellar chamber as Flubby's personal assistant. Life there wasn't very peaceful, but at least it wasn't dull.

Then, a couple of months later, we had a visit from the owner of the paint and wallpaper shop two doors down. He'd been hearing bangs and shrieks and buzzing noises from under his floor, and finally one of his lady customers had fled in panic in the midst of a particularly spectacular manifestation. Had we noticed anything unusual? Noooo — not us!

Well, that was the end of Flubby's private laboratory. And not long after that came the end of Flubby. He wasn't sacked or anything like that; he was too good a technician, despite his idiosyncracies. Flubby just went, as people like that do. One day he was there, the next day he wasn't. He just drifted on, I guess.

I never knew Flubby's real name. I guess the boss did, in order to pay him. But that might not have been entirely accurate either. Flubby wasn't one to stoop to the wishes of the flubbin' tax man.

That was 30 years ago. Flubby would be — well, I guess 70 or so now. Is he in a nursing home somewhere? I can see it now...

"Flubby, put out that cigarette!"

"Arrh, shove it up your flubbin' nostril, you flubbin' old bag!"

Go, Flubby! And thanks for everything, mate. ❖

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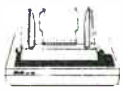

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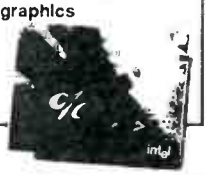

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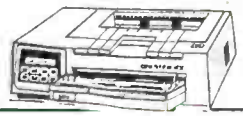

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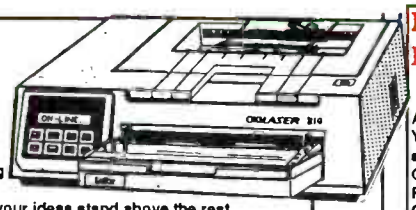

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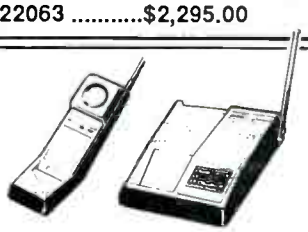

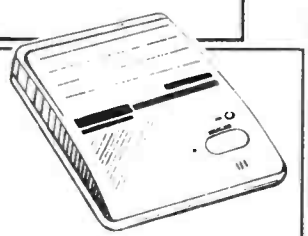

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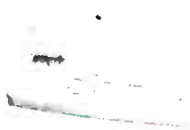

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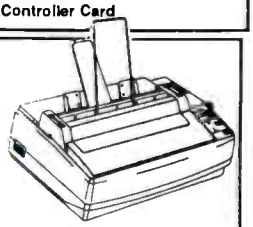
- Call Screening
- Message Light
- One Touch message playback
- Voice activated recording
- Music during fast forward
- Power fail protection
- Personal Memo record

$89.95

MANNESMANN TALLY MT 82



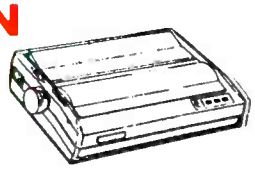
Mannesmann Tally have for many years enjoyed international acclaim for the quality and functionality of their computer printers. The matrix printer lives up this reputation. It can offer professional printing of the highest quality. Due to the printer's high resolution capabilities, graphics too can be printed with outstanding clarity. The computer printer can be connected to most of the more common computer systems by means of its modular interface. Even if you have had little experience with computer printers. you won't have any problem using this model because it was designed to be user-friendly. The integrated automatic sheet feeder is a main feature of this printer. It supports different character sizes, character densities line spacings and man y other functions, so that you can produce printed text to your individual requirements.

SPECIFICATIONS :

Printing method	Serial printing with 24-needle matrix print head
Print Speed	
Draft	160 cps at 10 cpi/192 cps at 12cpi
Letter Quality	53 cps at 10 cpi/64 cps at12 cpi
Character densities	10 cpi, 12 cpi, 15 cpi, 17 cpi, 20 cpi proportional
Resolution horizontal:	60, 80, 90, 120, 180, 240, 360, dpi.
	vertical: 60, 72, 180 dots per inch
Ribbon life	approx. 2 million characters
Dimensions	439mm x 162mm x 310mm
Automatic cut sheet feeder	
Capacity of paper bin	60 sheet cut sheet A4 size

C93040.....$549.00

MANNESMANN TALLY MT 81



A Matrix printer that is built to last.
The MT81 is designed to meet most of your personal computer printing requirements and will perform to its highest level without the operator requiring any previous technical expertise. With various character densities, line spacings and many more functions, this printer is a valuable addition for your personal computing applications (e.g. Word Processing, Graphics).

SPECIFICATIONS :

Printing method	Serial printing with 9-needle print head
Print Speed	
Draft	130 char./sec.
NLQ	24 Char/sec.
Characters per line	80 char. at 10cpi
Form length	up to 22"
Paper dimensions	width: 3" to 10"
	thickness: 0.002" to 0.004"
Ribbon	black 1.2 mill. draft char.
Power source	120 V AC, 60 Hz; 220/240 V AC, 50 Hz
Acoustic noise level	below 60dB (A)
Weight	4.5kg
Dimensions	(W xH xD) 370mm x 100mm x 250mm

C93000.....$299.00

CHRISTMAS COMES BUT ONCE A YEAR! SO HURRY IN FOR THESE BARGAINS!

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ELECTRONIC DIGITAL KITCHEN SCALES

Whether your a professional chef or dream about being a professional chef, these are the kitchen scales that you need. Don't rely on luck by throwing in a dash of this and a pinch of that. With the Arlec electronic kitchen scales, it's a simple matter of pressing a button to separate the weight of different ingredients. No need to separately weigh different ingredients in different bowls. The add and weigh facility enables the weight of the bowl and/or contents to be zeroed. This allows other ingredients to be added by weight more accurately.
The digital display displays weight in kilograms and grams or pounds and ounces and can be converted from one to the other at the touch of a key.
The Arlec Kitchen Scales also come with a beeper timer
and a plastic bowl in the form of a jug which can also double as a mixing bowl.

A15076.....$69.95

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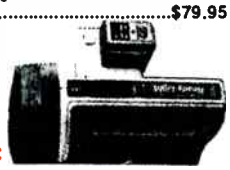
RECHARGEABLE DRIVE AND DRILL 1000

Two Speed Cordless Drill and screwdriver.
Probably one of the most handy tools you'll ever have!
This screwdriver will drill or drive screws into timber, sheetmetal, and hardened plastic.
- Has a powerful 4.8 volt motor.
- Convenient cordless operation.
- Two speed: Drill - 325 RPM Screwdriver - 150 RPM
- Drilling capability - 250 holes
- Screwing capability - 150 screws
- Torque: 33 kg/cm
- Forward or reversible operation
- Quality Jacobs Chuck (1/4" or 6.5mm)
- Chuck key holder on the unit
- Rechargeable through an adapter which simply plugs into a regular household powerpoint (240 Volt) and reduces the voltage to a safe low level
- Supplied with 4 screwdriver bits:- 2 slotted-heads & two Phillps-heads
- Pilot lamps adds light to dark or confined work place
- Charge indicator
- 12 month guarantee

T12298.....$79.95



ARLEC RECHARGABLE READY-LIGHT

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It's always ready for use and uses an extra brightness Krypton globe
which is 70% brighter than a normal vacuum type globe. Its rechargeable batteries can be chraged over 1000 times from a regular household powerpoint (240 Volt). The Ready-light has a strong magnetic base allowing it to be clamped to any steel or iron surface. Comes complete with wall bracket to conveiniently and recharge torch

A15054.....$39.95

Go-Go LAMINATOR

Is that precious photo of your loved ones in your wallet getting a bit tattery? Don't lose those precious memories protect them by laminating them with your own laminating machine Important Business cards, membership cards,
recipes etc. last a life time longer when laminated.
Now ROD IRVING ELECTRONICS have imported
this laminator that your budget can afford. Don't pay hundreds of dollars for some big machine
Pay a 1/4 of the price for an attractive compact laminator that is so simple to use. Heats up in only 2 to 3 minutes.

A91100.....$95.00
Laminate Sheets....95mm x 57mm (2.25" x 3.25")
for business cards
A91110.....$18.95
pack of 100

Laminate Sheets....156mm x 112mm (4.25" x 6.75")
for photos
A91111.....$11.95
pack of 24

Laminate Sheets....135mm x 95mm (3 3/4" x 5 5/16")
for photos and cards
A91113.....$8.95
pack of 24

Laminate sheets....110mm x 170mm (4.25" x 6.25")
with punch holes for photo album
A91112.....$10.95
pack of 24

Indoor / Outdoor Digital thermometer

You'll never have to press your nose up against a thermometer again to read what temperature it is.With this great digital thermometer the temperature can be read quickly and easily. But best of all it will read
the temperature indoors or outdoors at the flick of a switch.
By placing the thermometers sensor outside, the thermometer will read outdoor temperatures of -20°C to +70°C. Then by simply pushing the switch to the "IN" position the thermometer will read indoor temperatures of 0°C to +50°C.

A91200.....$22.95 Celsius only

(Note Celsius & Fahrenheit thermometer has a smaller digital display)

A91201..$24.95 Celsius & Fahrenheit.

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- AUTHENTIC AIRCRAFT CONTROL YOKE
- AUTOMATIC CONTROL YOKE CENTERING
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- 6-FOOT CABLE WITH 15-PIN CONNECTOR
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- 6 U.S MILITARY INSIGNIA STICKERS

C14250.....$89.95

*** Requires Smart Games Card...C14260.....$39.95**

INTRUDER 5

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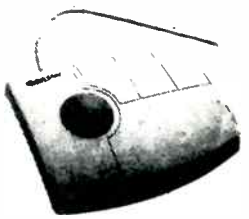
- 6-FOOT CABLE WITH 15-PIN CONNECTOR
- STABILIZING SUCTION CUPS
- 6 U.S MILITARY INSIGNIA STICKERS

C14240.....$79.95

*** Requires Smart Games Card C14260....$39.95**

QuickShot™

QUICKTRAC 100



A new concept in Mice!
What do you do when you haven't got enough room on your desk to use a mouse?
You get a Quicktrac 100.
The latest innovation in mice technology. Unlike a normal mouse the Quicktrac does not require any operating space other than that taken up by its tiny footprint.
You simply have to use your fingers to control the curser rather than move your whole hand. Use your thumb to roll the tracking ball . The Quicktrac 100 is responsive enough to detect changes without much thumb movement. The left and right control buttons can be controlled by your index and right finger, respectively and the key-lock button by your middle finger. They're are great for laptops and notebooks or anywhere where there is very little desk space.
100% Microsoft Mouse compatible.
Includes Qtrac™ Driver software
QMenu™ Pop-Up Library
Menu making Utility
DB9 to DB25 Adapter.
System Requirements: Any IBM, PC, XT, AT or compatible computer
- One 9-pin or 25-pin RS232 serial port.

C14230.....$69.95

SMART GAMES CARD

SUPPORTS 4.77 TO 80MHz

Complete with Calibration software
FEATURES:
- Intelligent software controlled game card
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- Complete with easy-to-use menu driven calibration software on 5.25" floppy diskette
- Software selectable clock speed - from 4.77 to 80MHz
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- Hot-key program for fine-tuning clock speed during game
- 2 15-pin joystick port-supports 1 or 2 joysticks operation

C14260.....$39.95

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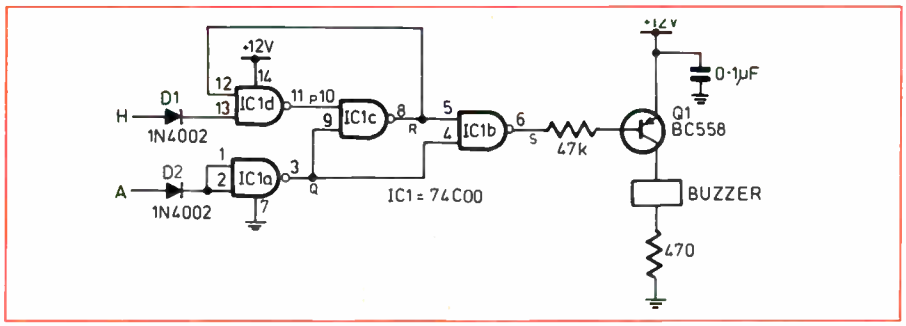
Circuit & Design Ideas

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.

Headlight warning



There are many different circuits to remind you to switch off your parking lights. Here is a simple and cheap one that allows your warning device to work in a similar fashion to those found in many modern cars.

The buzzer only sounds when the ignition is turned off with the headlights/parking lights left on. If the ignition is already off, then turning on the headlights will *not* activate the alarm. This means that if you want to leave your lights on, you turn the car ignition off, then switch the lights off and back on again.

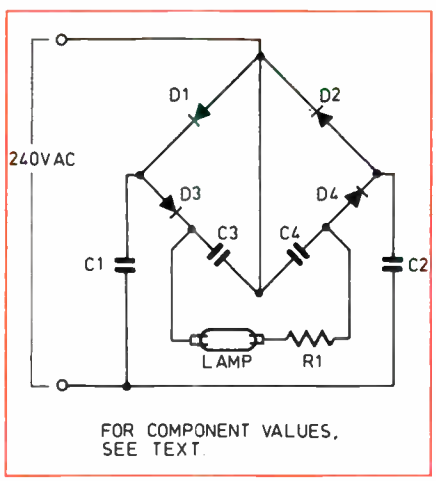
The operation of the circuit is simple. The four NAND gates of the 74C00 provide the logic to drive point 'S' low, and so turn on transistor Q1 to drive the buzzer. This occurs only when point 'A' is driven low (by turning the ignition off) while point 'H' is already high — the head/parking lights must be on when the ignition switch off occurs. The two resistors provide current limiting.

All the components were mounted in a plastic jiffy box mounted under the dashboard of the car. A few holes were drilled in the box to improve the sound. The buzzer used came from DSE, (part No. L-7009).

Four connections need to be made from the device to the car circuit. These connections are: pin 14 of IC1 to the 12V supply; pin 7 to ground; 'H' (from pin 13 via D1) to a point that becomes active when the head/parking lights are turned on; and A (from pins 1 and 2 via D2) to a point that becomes active when the accessories (radio, windscreen wiper, etc.) are turned on via the ignition switch. Points H and A should be connected to the passive side of the headlight and ignition switches to give a low impedance pathway to ground when they are turned off.

Jeremy Ginger,
Oakleigh, Vic **$45**

Fluorescent lamp driver



This circuit allows you to double the life time of a fluorescent lamp, and even to re-use unserviceable ones.

Refer first to the left hand side of the schematic diagram. In the first half of the 240V AC waveform, capacitor C1 is charged through diode D1.

Then during the second half, capacitor C3 is charged via diode D3, with the charge already stored in C1 aiding the process.

On the right hand side of the circuit, capacitor C4 is charged up in a similar manner, but of course half a cycle later.

As a result, the charge stored in capacitors C3 and C4 are added and reach a considerable value. This high voltage creates an impulse which ionises the gas in the lamp, which then emits light. Resistor R stabilises the current in the circuit.

The circuit does not require the filaments in the lamp, so they can be shorted out — connect each lead to both pins at their respective ends of the lamp.

Below is a list of component values for lamps of different power ratings.

Lamp	C1=C2	C3=C4	D1-D4	R
20W	4uF	330pF	1N4006	60
40W	10uF	6.8nF	1N4006	60
80W	20uF	6.8nF	1N5408	30
100W	20uF	6.8nF	1N5408	30

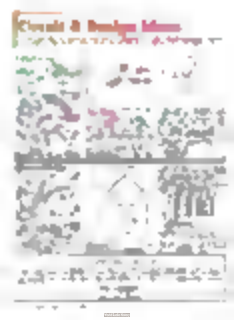
A Fakira,
Beaconsfield, WA **$40**

Editor's note: The capacitors and diodes used in this circuit will of course have to have a suitable voltage and current rating — the capacitors at least 350VW, for example. Resistor R will also have to be of an appropriate wattage.

DREAMED UP A GREAT IDEA?

If you have developed an interesting circuit or design idea, like those we publish in this column, why not send us in the details? As you can see, we pay for those we publish — not a fortune, but surely enough to pay for the effort of drawing out your circuit, jotting down some brief notes and popping the lot in the post (together with your name and address) and send them to Jim Rowe at -

Electronics Australia,
PO Box 199,
Alexandria, NSW 2015



Twinkling star

With Christmas upon us, here is a circuit for a twinkling star which you can mount on top of your Christmas tree. It uses one dual 556 timer, wired as two separate astable multivibrators.

Outputs from the 556 timer are at pins 5 and 9, and the frequency at which they oscillate is determined by the values of C2, C3 and their series resistors.

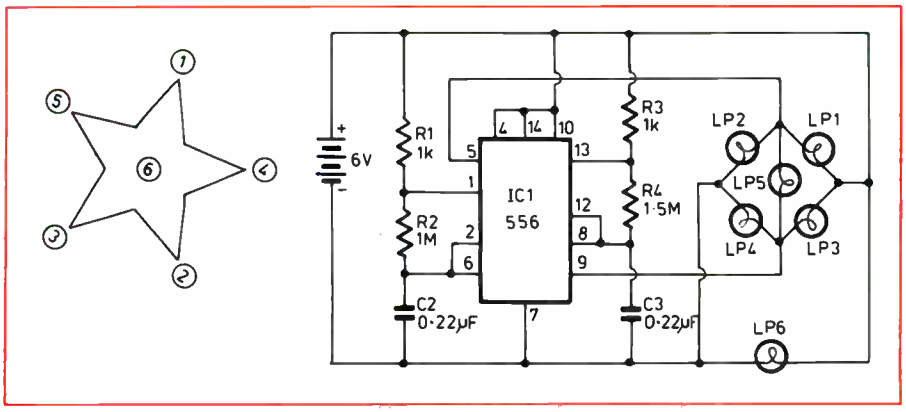
The exact values of the two frequencies are not important, but their ratio is — this determines the flashing rate and brightness of LP5. I found a frequency ratio of 2:3 was the most suitable.

When power is applied to the circuit, lamp pair LP1 and LP2 will flash alternatively at 2.3Hz, with pair LP3 and LP4 at 1.5Hz. LP5 will be on only when pin 5 is low and pin 9 is high, or vice versa. Lamp LP6 remains on all the time, since it is connected directly across the supply lines. The total effect simulates a twinkling star.

The circuit runs on anything from 5-10V and draws approximately 400mA — I used a 6V transformer/rectifier taken from an old radio/cassette recorder. The two capacitors are both 0.22uF greencaps. I placed the PCB in a cigarette box, wrapped it in Christmas paper, and placed it under the tree!

Four rainbow ribbon wires run up to the top of the tree to connect to the star. The star itself is of hollow design, with red cellophane across the front. Lamp LP6 is positioned at its centre, with the other lamps at the five points, in the order shown in the diagram. Their bulbs are rated at 6V, 100mA (Tandy part No. S-3836).

Owen Winter,
Algester, Qld **$40**



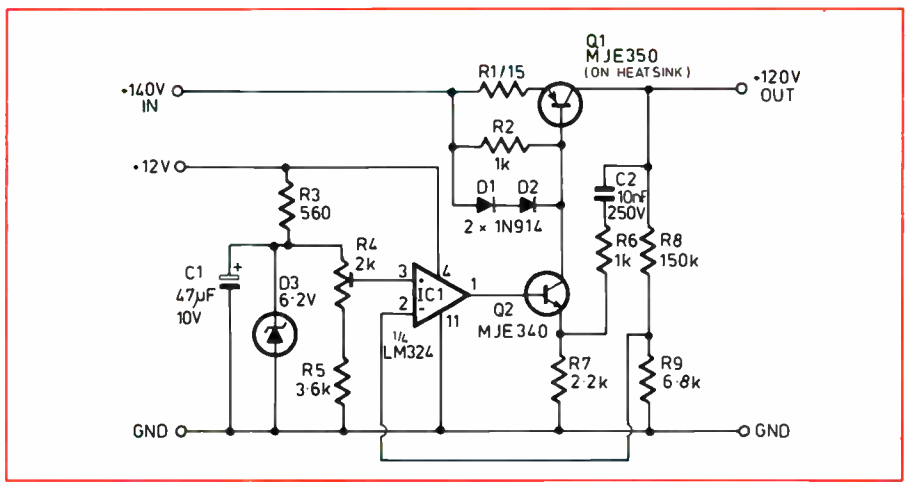
Current-limited 120V regulator

When the low voltage power supply board of my 24 year old BWD 521 oscilloscope spectacularly self-destructed for the second time a couple of years ago, I decided to re-design the whole circuit using modern semiconductors.

This circuit now supplies the horizontal deflection stage, with similar regulators also supplying +100V and +50V for other parts of the machine. I have also provided current-limiting to 40mA for protection against faults.

Resistors R8 and R9 provide a sample of the output voltage, which IC1 compares against a reference voltage derived from D3. The error signal modulates the collector current of Q2, configured as a variable current source, which in turn determines the collector current of Q1, the series pass transistor. C2 and R6 provide high frequency negative feedback to compensate for the drooping frequency response of IC1, keeping the circuit stable.

Current limiting is provided by D1 and D2, which clamp the voltage across R1 to about 0.65V, keeping Q1 within its safe operating area in the event of an output short circuit. If current limiting is not required, D1, D2 and R1 can be deleted.



The circuit requires about 15mA at 12V. This could be derived from a zener diode and power resistor running from the unregulated supply voltage, if a more suitable supply is not available.

I used an LM324 because I needed four opamps, but half an LM358 (electrically equivalent) could be used for IC1. A 741 would probably work just as well, although I haven't tried it.

The output hum and noise of the original is less than 20mV p-p (as measured by th CRO of which it is a part!).

Bob Parker,
Carlton, NSW **$45**

CORRECTION

In the Computer News and New Products section of the November issue, on page 151, we reported a special offer by Protel Technology with regard to their Autotrax and Schematic CAD packages.

Unfortunately we omitted to note that the special offer of both packages for $495 only applies to existing registered users in Australia. The standard price for new users is $995.

Construction Project:

An Electronic Christmas Tree

'Tis the season to be jolly, and also to make a state-of- the-art Christmas tree. It looks the part, has a sophisticated 32 LED display sequence, and even plays some of your favourite carols!

by BARRY ROZEMA

Technology is invading most parts of our lives, so an electronic Christmas tree probably comes as no surprise. But when you realise that this unusual project uses a microprocessor, you can see it's about as hi-tech as a Christmas decoration can be.

In fact, it's the microprocessor that makes this project simple, easy to build and cheap. True, you have to buy a pre-programmed 68705P3 (see end of article for the details), but otherwise its simply a matter of make a PCB, add 32 LEDs, a few resistors, some transistors and capacitors and that's it.

So why would you want such a thing? The entertainment value alone is one good reason, as the light sequence is a quantum leap from the traditional flashing lights found on most Christmas trees. You'll find that friends will probably 'want one too' and it also gives a chance for you to share your hobby with the family.

For those with the facilities (such as the 68705 development kit described in this issue), there's no reason why you couldn't experiment by programming your own 68705. A great way to learn, while producing something the whole family can enjoy...

But what does the tree actually *do*? The PCB is 260mm high by 230mm wide, so it's best suited as a decoration that hangs on the wall or against a window. The LEDs are arranged around the 'tree' which is simply the track pattern of the PCB. The sequence causes the LEDs to light in a number of patterns, such as bars of lights 'walking' across the tree. Other patterns might have all the red LEDs on; another starts with one LED on, progressively lighting others until all LEDs are on, and so on.

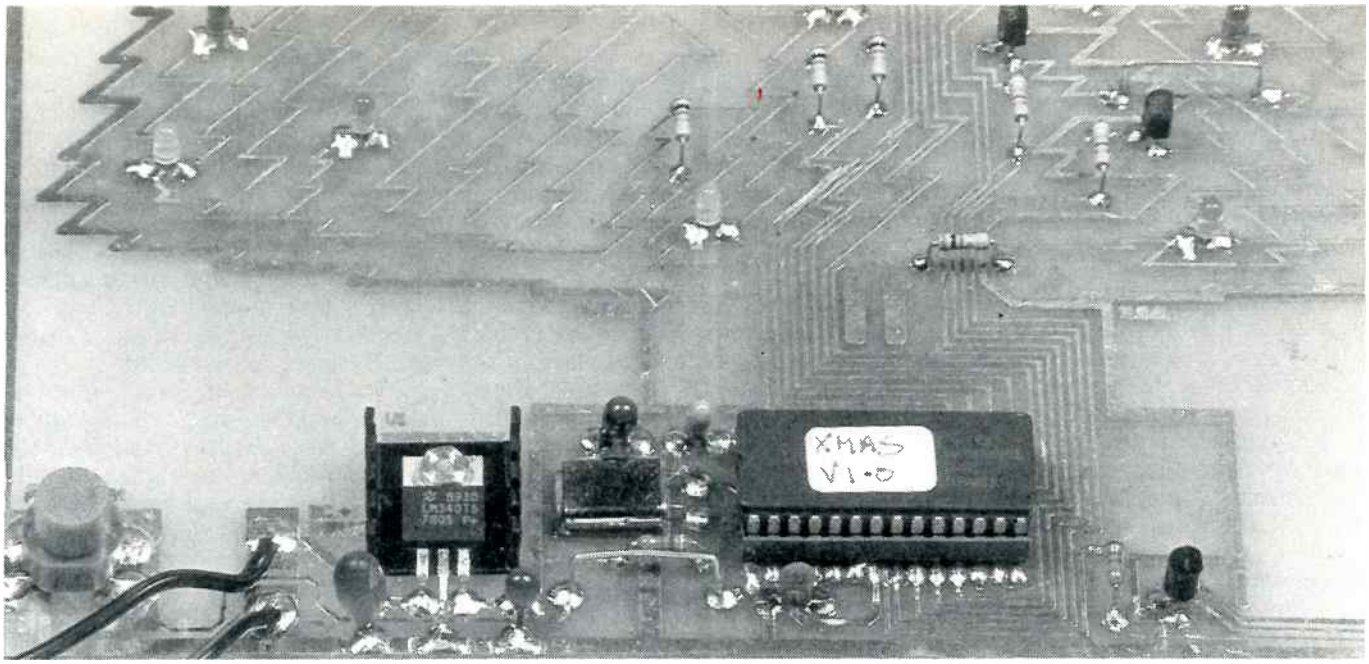
The sequence repeats, taking several minutes for all patterns to be displayed. And when you want to liven things up a bit, press a button and a number of Christmas carols are played. So it's not just a light display, it plays music. Not quite your average Christmas tree!

How it works

As you can see from the circuit diagram, all the work is done by the 68705P3. This Motorola microcontroller is an EPROM version of the 6805 family, and like most of these devices has three I/O ports. The program sends binary codes to the appropriate output lines, with a suitable delay between each code.

The program is burnt into the internal EPROM of the micro, and while it seems simple enough, quite a lot of development work is required to perfect such a program. There are 32 LEDs, driven as a multiplexed array of columns and rows.

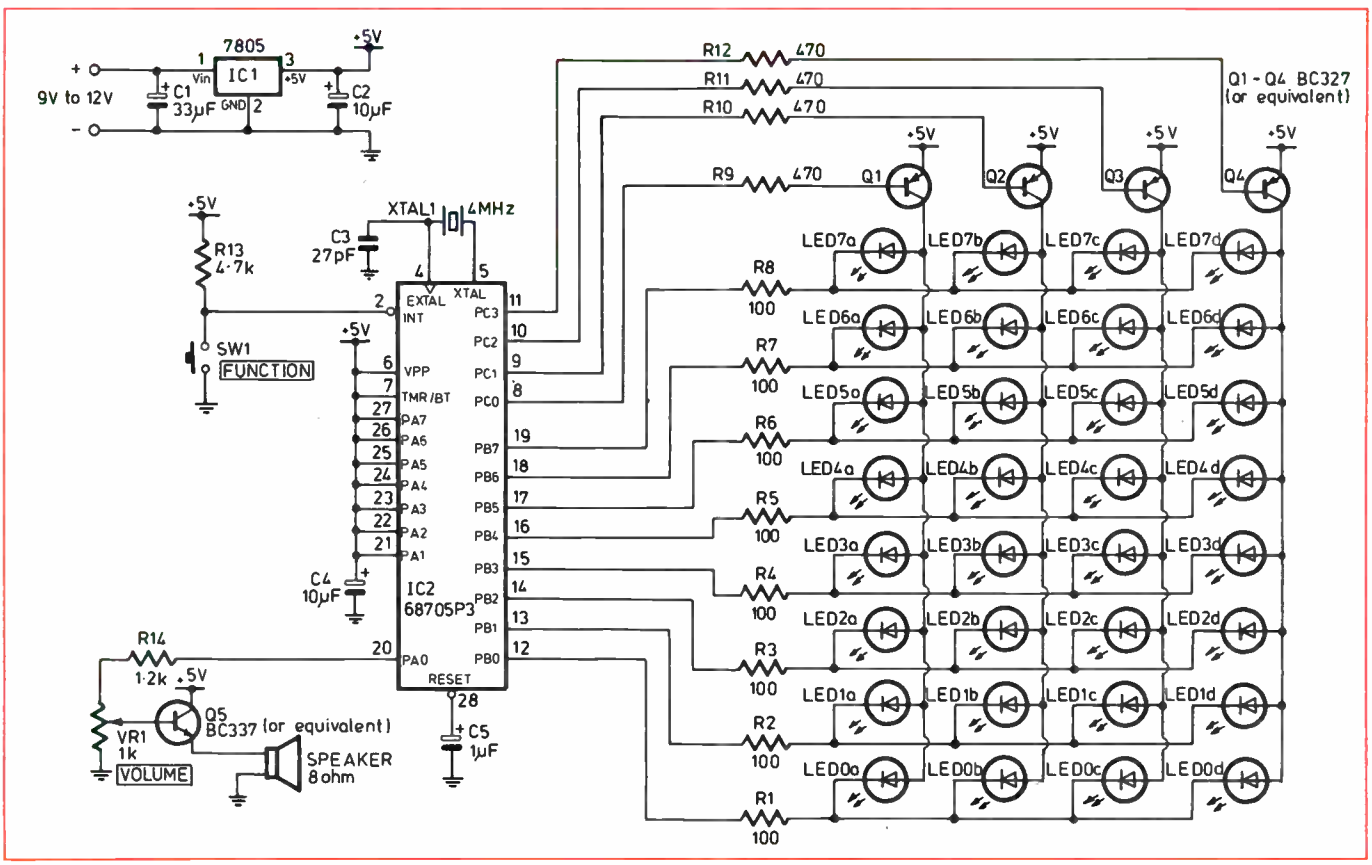
An Electronic Christmas Tree



A close up of the 'active' part of the circuitry, at the bottom of the 'tree'. As you can see, there is very little involved apart from the microcontroller, its clock crystal and the regulator chip. Also visible are some of the 'tree' LEDs and resistors.

For example, to turn on LED7A, output PB7 of port B is sent to a low, and Q1 is turned on by a high at PC0 (port C). Therefore, the LEDs are individually controlled by a total of only 12 output lines, from two output ports. The circuit is relatively simple because of the current sinking capability of port B, where each terminal is able to sink up to 10mA. Because port C can't supply this value of current, four transistors (Q1-Q4) are needed to buffer its output.

The 68705P3 is clocked by a 4MHz crystal, connected to pins 4 and 5. This frequency is internally divided by four,



The circuit has a multiplexed array of LEDs operated by a pre-programmed 68705P3 microcontroller. The program also has a number of Christmas carols that are reproduced by the speaker via Q5.

giving a 1MHz clocking rate. Other clocking modes are possible, but the crystal mode is the most accurate — important when generating musical tones.

When power is first applied, C5 holds the micro's reset terminal (pin 28) low until the capacitor is charged. Once the reset condition is released (when C5 is charged) the program commences, continuing until you turn off the power.

The musical sequences programmed into the EPROM are initiated when SW1 (a pushbutton on the PCB) is pressed. This asserts the interrupt input of IC2, and the program then goes to an interrupt service routine that plays the tunes stored in the EPROM. Each tone is developed by sending a series of pulses to data line D0 of I/O port A. The pitch of each tone is set by the time interval between each pulse. The output signal is then coupled to the base of Q5, via the volume control of VR1. The transistor buffers the pulse output and drives the speaker.

The input voltage is regulated by IC1, a 5V three-terminal regulator. The input voltage comes from a standard 9-12V plug pack.

Construction

The PCB is designed so the components mount on the copper track side. You only need to drill one hole in the board, to mount the TO-220 regulator (IC1) and its heatsink. Each component is therefore 'surface mounted' and the pads are larger than usual to make this task straightforward. There are extra 'tracks' to make the PCB pattern look like a Christmas tree, and the surface mounted components are rather like its 'decorations'.

Start by inspecting the PCB for any manufacturing errors such as broken or shorted tracks. Take a bit of time to do this, as it's easier to spot faults on the bare board than when it's fully assembled.

Once you're happy with the PCB, solder the IC socket (for IC2) into place. You'll need to bend the pins outward at right angles, so they can be soldered to the pads. It's best to bend all the pins and make all the necessary forming adjustments so each pin is aligned with its pad before soldering.

Also, make sure you mount the socket with the identification for pin 1 at the bottom left of the PCB. While an IC socket is not polarised, it's helpful to have it mounted correctly so you know which way round to fit the IC.

Next solder the 14 links into place. As shown in Fig.1, you'll need to form the links so they clear the tracks being bridged. A gap of 5mm or so will reduce the possibility of a link being accidentally pressed into contact with a bridged track. You'll find it easier to form the link first, tack one end to hold it in place, then readjust the link to the correct shape using long nose pliers before finally soldering it.

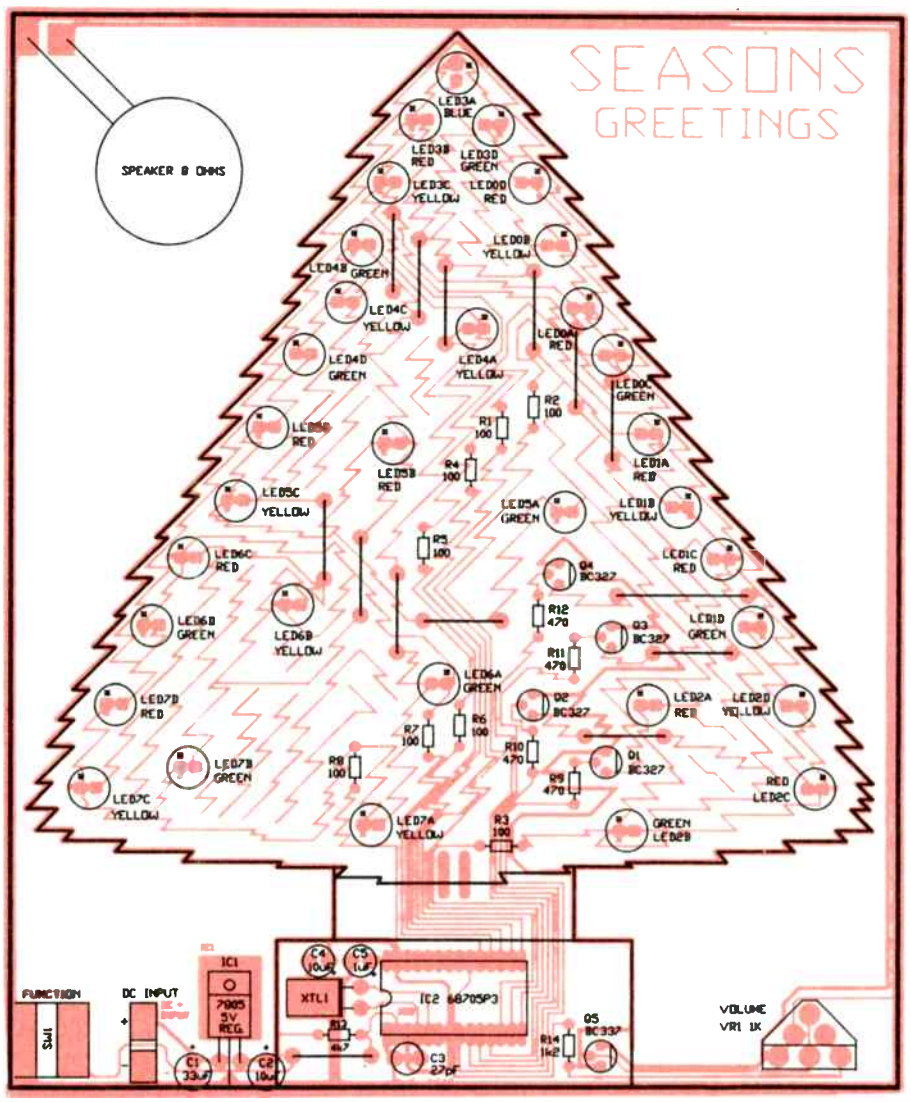
Now fit the resistors. Again form the leads so the body of the resistor is about 5mm above a bridged track. The capacitors are all mounted at the 'base' of the tree, and some need to straddle tracks run between their solder pads. As usual, check that you've got the right polarity for the tantalum capacitors before soldering.

The transistors are the next to be soldered in. All five have the flat side facing to the right. Form the leads for each transistor with long-nose pliers to the shape shown in Fig.1. Notice that the base lead is formed *away* from the flat side of the transistor.

Next solder the 32 light emitting diodes onto the board. The cathode connection is marked by an asterisk on the PCB. Most LEDs have a flat on the base to mark the cathode, otherwise the long lead of the LED indicates the anode. Again form the leads of each LED as shown in Fig.1. Be careful when you do this, as it's possible to break the case of the LED if you apply too much force. I lost two expensive blue LEDs this way, so be warned!

The volume control VR1 is mounted next. The PCB pattern allows different types of pots to be used, so select the pads that suit, then solder the pot in place. Then solder the crystal to the board. The crystal should lie flat on the PCB with its case soldered to the pad underneath (but don't overheat it!).

The 5V regulator is the next component to fit. A small heatsink is required, placed between the IC and the PCB. There's no



All components are 'surface mounted' on the trace side of the PCB. The asterisk identifies the cathode connection of the LEDs.

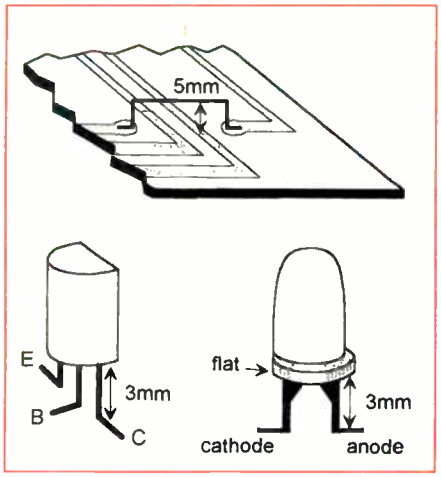


Fig.1: Form the links, LED and transistor legs as shown here.

need to use an insulating washer between the heatsink and the IC, as the tab of the IC is at earth potential. A dab of heatsink compound on the back of the regulator will help heat transfer.

Position the heatsink and the regulator on the board, and form the legs of the regulator so they contact their respective PCB pads. As the layout diagram shows, the centre leg is longer than the other two. Form the legs so they have little 'feet' that lie on the pads, then fit and tighten a 3mm bolt and nut so the regulator and its heatsink are held in place. Then solder the IC leads to the pads.

Now fit the PCB mount pushbutton SW1. The PCB pads will suit a range of pushbuttons, so select the best orientation for the switch you're using, then solder it in place. As the layout shows, the speaker is mounted at the top left of the PCB. Attach it to the board with glue or double-sided tape. Any small (40-50mm dia) 8-ohm speaker is suitable, and its connections are to the pads at the top left of the board.

Finally, insert the 68705P3 microcontroller into its socket. Make sure you have the IC correctly orientated, as it will be damaged if it's plugged in the wrong way round.

PARTS LIST

Resistors

All 1/4W:

R1-8	100 ohm
R9-12	470 ohm
R13	4.7k
R14	1.2k
VR1	1k, PCB mount trim pot

Capacitors

C1	33uF 16V tantalum
C2,4	10uF 16V tantalum
C3	27pF ceramic
C5	1uF 6V tantalum

Semiconductors

LEDs	10 x yellow, 10 x green, 11 x red, 1 x blue 3mm LEDs
Q1-4	BC327 (or equiv) PNP transistor
Q5	BC337 (or equiv) NPN transistor
IC1	7805 3-terminal 5V regulator
IC2	68705P3, pre-programmed microcontroller

Miscellaneous

PCB, 220 x 265mm; 4MHz HC18 PCB mount crystal; 50mm diameter, 8-ohm speaker; PCB mount pushbutton; 9V or 12V, 300mA DC plugpack; heatsink for 7805; length of tinned copper wire.

Kits for this project are available from:
ESD Electronic System Designs
PO Box 73,
Glenbrook, NSW 2773.
Phone (047) 39 4039

PCB and pre-programmed MC68705P3	.... $62.30
Pre-programmed MC68705-P3	..... $22.80
Postage and packing	..... $3.00

Testing

Connect a DC voltage of between 9V and 12V to the PCB as shown on the layout diagram. A DC plug pack rated at 300mA is suggested, although any suitable power source can be used. When power is applied, the lights should start their sequence after a two second delay. Check that the supply voltage from the regulator is between 4.75V and 5.25V, just to make sure the regulator is functioning correctly.

About all that can go wrong are LEDs and transistors mounted with the wrong polarity, bad connections, bridged tracks and so on. If you suspect the 68705, you can simulate its operation to make sure. Remove the IC, then connect pin 12 of its socket to ground. If you now apply +5V to pin 8 of the socket, LED0A should light. By moving the ground to pin 13, LED1A should light.

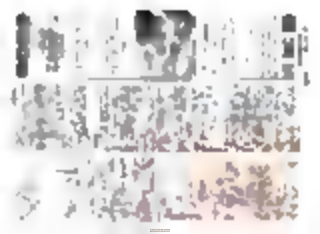
If you 'walk' the ground connection along the rest of the pins for port B, the eight LEDs driven by Q1 can be tested. The remaining LEDs can be tested in a similar way, by moving the +5V connection to pin 9, followed by pin 10 then pin 11.

Enhancements

There are several things that can be done to enhance the tree. For instance, if you've used a fibreglass PCB, the tree can be made to stand out by painting the back of the board so the tree shape is filled in. Use either black or dark green paint.

The components at the bottom can be dressed up to look like presents by adorning them with a few bows or similar decorations. You could also use regular decorations on the tree section, although make sure these don't conduct electricity.

But whatever you do with the tree, at least you'll have a Christmas decoration that will excite comments for many years. ❖



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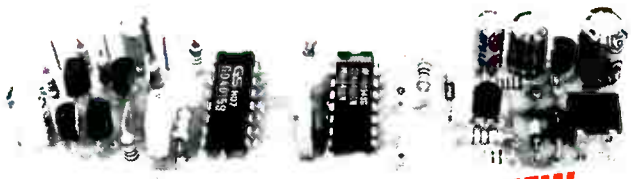

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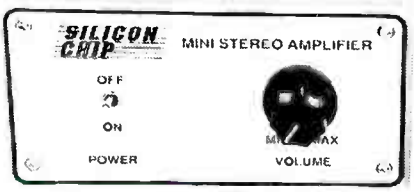

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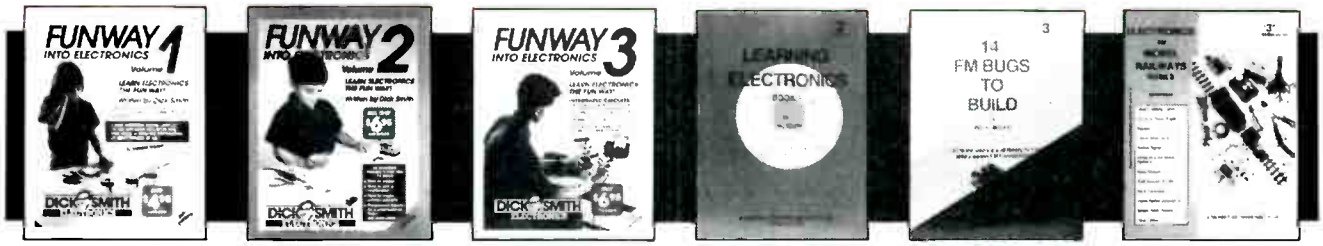

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$$\text{Maximum Heatsink Thermal Resistance (°C/W)} = \frac{\frac{T}{P} - R}{N}$$

Where:
N is the number of identical devices mounted on the heatsink.
P is the power dissipated by each device on the heatsink.
T is the maximum allowed junction temperature rise.
R is the combined thermal resistance from junction to heatsink.

Typical values for T and R can be found in Table 1, or calculated from manufacturers data. Always use a heatsink with a thermal resistance equal to, or lower than, the calculated value.

Table 1

Semiconductor	T (°C)	R (°C/W)
T0220 transistor	100	4
T03 transistor	150	2
T0220 IC	75	7
T03 IC	75	5

Notes:
1. Values for T based on 50°C maximum ambient temperature.
2. Values for R include insulating washer with heat transfer compound.

B1410

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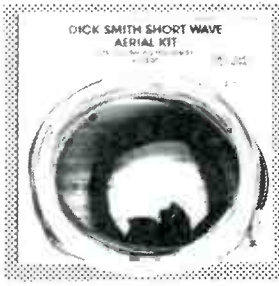

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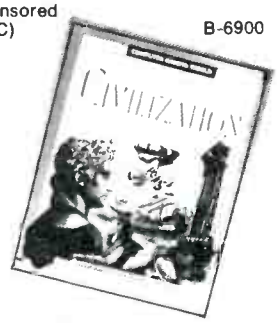

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B1410

Construction Project:

COMPACT, HIGH ENERGY STROBE LIGHT

Here's a new design for a flexible, low cost strobe light. It's housed in a compact plastic case, and has been designed with a strong emphasis on both safety and reliability. The flash rate can be adjusted between one and 10 flashes per second, and trigger input and output connectors are provided so that a number of units can be made to operate in synchronism.

by ANDREW PALMER

This new design for a strobe light provides a high energy flash of white light, generated by a linear Xenon flash tube mounted in a high-efficiency reflector. The flashes can be triggered by either an internal oscillator or an external source. As the strobe also provides a trigger output, which operates for both internal and external triggering, pulses can be fed to other strobes so that any number of them may be linked together to flash synchronously.

The maximum flash rate is 10 per second, limited by the internal circuitry. This applies for both internal and external triggering, and should be adequate for all normal applications of this kind of strobe light. When the unit is switched to internal triggering, the flash rate can be continuously varied between approximately one and 10 per second using the flash rate control on the rear panel.

When the unit is switched to external triggering, a pulse of between about 3-volts and 15 volts applied to the trigger input will cause it to flash.

The trigger input and output connectors are both five-pin DIN sockets, which have been wired to the MIDI configuration in the hope that this might facilitate future applications for the strobe. For the present, this means little more than the convenience of being able to use MIDI-type cables to interconnect a number of strobe lights; however if there's enough interest, we may be able to describe a small triggering sequencer.

The complete strobe light is housed in a compact plastic instrument case, measuring 200 x 139 x 105mm overall. Unlike some earlier designs, all of the circuitry is isolated from the mains using a standard 15V/1A power transformer, and one side of the circuit is connected to mains earth for maximum safety.

It should be noted, however, that as with any strobe light circuit the energy to operate the flash tube is achieved by charging a bank of capacitors up to a relative high voltage (many hundreds of volts). This means that despite the precautions which have been taken to make this project as safe as possible, it would still be possible to receive a very severe and possibly life-threatening shock, if you accidentally come into contact with the charged capacitors.

We therefore advise very strongly that you do NOT operate this project unless it is built exactly as described, and is fully enclosed in the plastic case before power is applied. If you ever DO need to service it, you should normally allow at least three minutes after turning off the power, before opening the case.

If you can't wait for three minutes, make yourself a 'discharger': a 10k 1W resistor, connected to two short leads fitted with alligator clips, and all covered with insulation sleeving. You can use this to discharge the capacitors quickly, by attaching one clip to each end of the flash tube.

If at any time you MUST operate the strobe light with the case open, for troubleshooting purposes, take GREAT CARE to ensure that you do not come into contact with any of the high-voltage circuit components.

Incidentally this project has been developed by the R&D department of Dick Smith Electronics, and that firm is retaining copyright on the PCB patterns and front panel design for the project. This means that other firms will not be able to offer either PC boards or kits for the project, although individual constructors could make up their own boards and build it 'from scratch' if they wish. However DSE itself will be offering a complete kit of parts for the project, and this should make it very easy to build. The kit will have the catalog number K-3155, and will be priced at a very reasonable $109.

Circuit operation

The heart of the strobe light is the linear Xenon flash tube, X1. To make this type of tube flash, it must have between 300 and 500 volts DC applied between its anode and cathode — i.e., between the two ends of the tube (either end can be used as the anode or cathode). A pulse of 6kV must then be applied to the trigger electrode, which is a wire wrapped around the outside of the tube. In this circuit the cathode is at earth potential.

When the tube conducts, as well as emitting a brilliant flash of light it also becomes a very low impedance. This means that the high voltage DC applied across the tube cannot be supplied from a low impedance source, or the tube would remain conducting and destroy itself.

To prevent this happening, only a small amount of high voltage energy (about 1.8 joules) is stored in a bank of capacitors (C4-C5-C6), so that when the tube conducts it can only receive this amount of energy before the capacitors discharge and the voltage falls to the point where the tube extinguishes. The capacitors must then be recharged again, before this process can be repeated.

The high voltage energy needed to charge the capacitor bank between flashes is supplied by a self-oscillating flyback DC-DC converter, based on power transistor Q4, transformer T2 and rectifier diode D3. Transformer winding W1 provides the positive feedback to the base of Q4, to make it oscillate, while primary winding W2 and secondary W3 provide the step-up necessary to develop the high voltage.

Resistors R6, R7 and R8, diode D2 and capacitor C3 are used to establish the correct bias for Q4, while zener diode ZD2 together with transistors Q1-Q2-Q3 and their associated resistors are used to regulate the output high-voltage DC, and prevent it from exceeding the Xenon tube's rated maximum anode voltage of 500V.

The supply voltage for the converter (Vcc1) is a 100Hz pulsing DC waveform derived from the mains using transformer T1 and bridge rectifier B1. It was found that this pulsing supply voltage, with a small amount of filtering provided by C1, was adequate to run the inverter.

The operation of the inverter is as follows. When power is applied to the circuit, a small bias current supplied by R8 charges C3 via R6 and starts to turn on Q4 via winding W1.

The collector current of Q4 produces a voltage across W2 which induces positive feedback into W1, causing Q4 to turn hard on. The voltage induced across W1 causes D2 to be forward biased, which provides a low resistance path via R7 for the base current to hold Q4 on.

With Q4 applying Vcc1 across winding W2, a magnetising current builds up linearly through W2 until the ferrite core of T2 saturates.

At this point the effective inductance of W2 collapses, and the current increases at a much higher rate. When this current reaches a level that cannot be supported by the transistor's base current, Q4 comes out of saturation and the feedback action now causes Q4 to turn off rapidly.

At the rear of the strobe are the flash rate control, the trigger selector switch, and the trigger in and out connectors.

During this 'flyback' period, the voltage induced across secondary winding W3 forward biases diode D3 and dumps the magnetising energy into the output capacitors C4, C5 and C6. The current flowing out of W3 follows a linear ramp, falling from an initial peak to zero in a mirror image of Q4's on cycle. During this period the collector voltage of Q4 is held at a constant level, defined by the supply voltage added to the product of the output voltage and the turns ratio W2/W3.

When W3's current reaches zero, the collector voltage of Q4 then falls and feedback given by W2 to W1 initiates the next switching cycle of the inverter. The network consisting of R6 and C3 assists the inverter operation during start-up and switching.

When the output voltage reaches between 420V and 500V (this range reflecting component tolerances), zener diode ZD2 starts to conduct. This current is amplified by transistors Q1 and Q2 to saturate Q3, removing the drive from Q4. And so when the strobe is not flashing, the output voltage rises to the maximum voltage and then remains stable at this level.

The voltage divider across the high voltage output, formed by resistors R9, R10, R11 and R12, has three functions. One is to distribute the high voltage

evenly across the three series-connected capacitors, so that they 'share the load'.

Another function is to 'bleed' away the charge on the capacitors, when the power is removed. Finally the resistors act as a voltage divider, to provide a sample of the output voltage for the voltage regulating circuit.

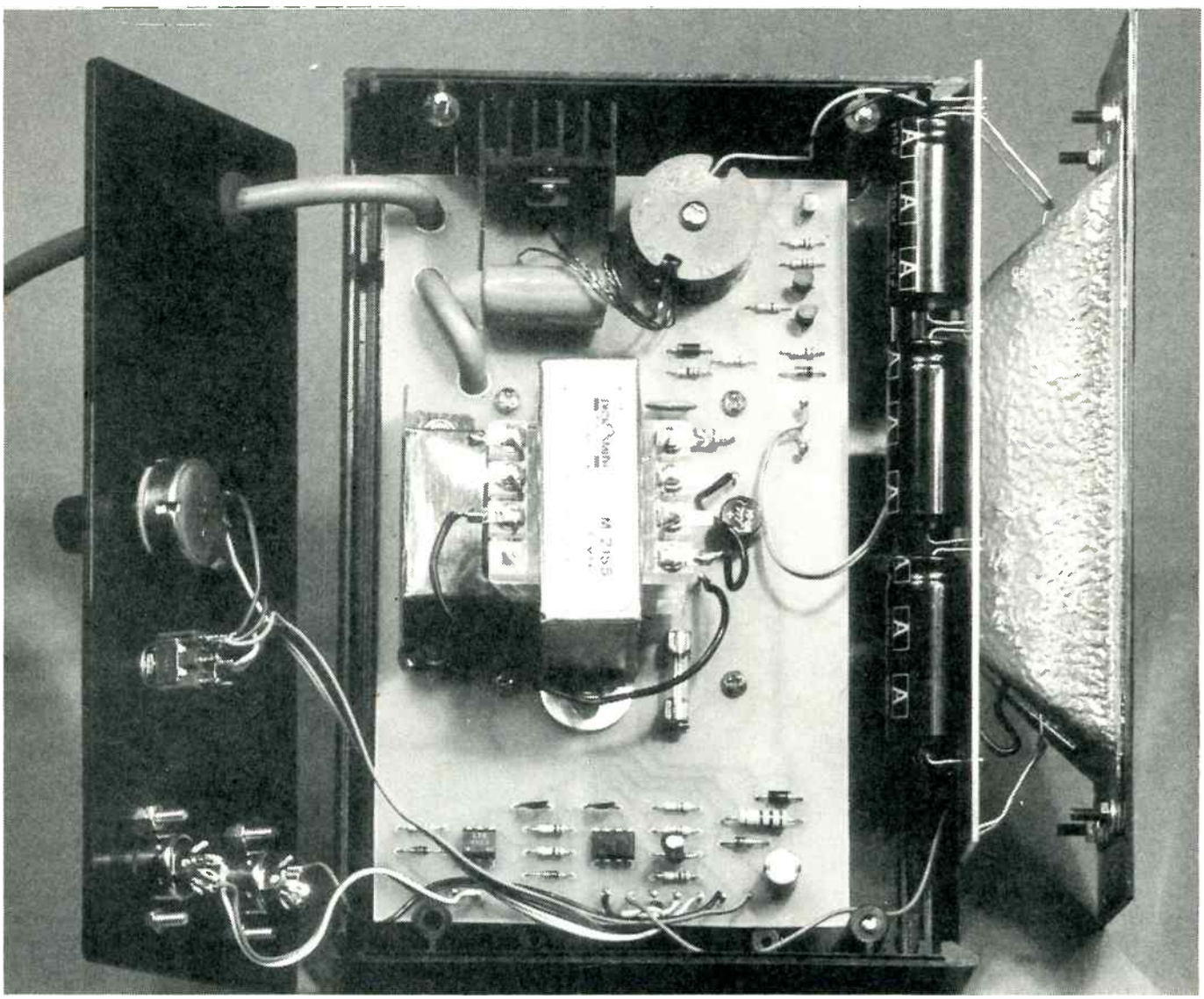
To make the Xenon tube flash, a short duration high voltage pulse is applied between the trigger electrode and the cathode. The trigger electrode on the tube used here consists of a single bare wire, wrapped in helical fashion around the outside of the tube for its full length. The nominal minimum trigger voltage required for the tube is 6kV, which is provided by trigger transformer T3.

The operation of the trigger circuit is as follows. With SCR Q5 switched off, capacitor C7 charges from the 500V rail via resistors R14 and R15, to a maximum value of about 350V — determined by the voltage divider action introduced by R16, and also on the exact level of high voltage at the instant of firing. The voltage divider is used to prevent the voltage applied to the primary of the trigger transformer from exceeding its rated maximum of 350V, and resistors R14-R15 are used in place of a single resistor because the 1/4W carbon resistors used have a rated maximum voltage of 250V.

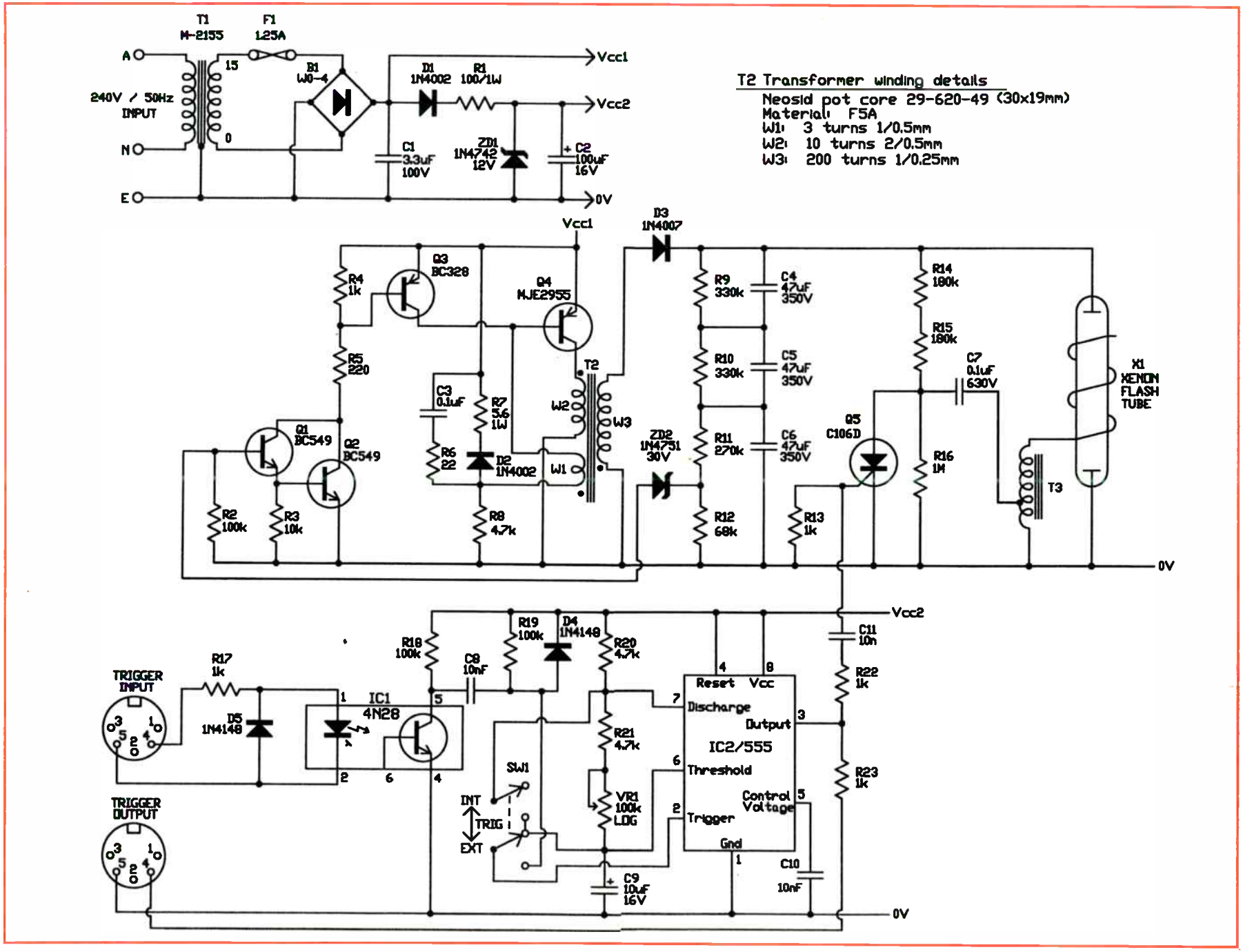
When a low voltage pulse is applied to the gate of SCR Q5, it switches on. This connects charged capacitor C7 across the primary section of autotransformer T3, which transforms the energy stored in C7 to a pulse of about 6kV across the full secondary. The resulting electric field in the flash tube ionises enough gas molecules to start a very heavy avalanche of current between the anode and cathode, which causes the high intensity emission of light that we want.

Of course once the tube fires, its heavy current rapidly discharges capacitors C4, C5 and C6. When the stored energy falls to a certain point, the flash tube cuts off, and then the converter recharges the capacitors ready for the next trigger pulse.

Because of the time it takes for the converter to recharge the capacitors, the high voltage only reaches its maximum of about 500V at the lowest flash rates.



A general view inside the strobe case. Apart from the components mounted on the back panel, the rest of the parts and circuitry are supported by two PC boards — the main horizontal board and a smaller vertical board mounted behind the reflector. The latter board is used for the high voltage components and wiring.



As you can see from the schematic, the circuit of the strobe is relatively straightforward. The high voltage to run the flash tube is generated by a small DC to DC converter based on transformer T2 and power transistor Q4.

High energy strobe light

As the flash rate increases, the maximum voltage and hence the energy per flash ($1/2.C.V^2$) progressively decreases. This reduction of flash energy with increasing flash frequency serves to keep the flash tube within its maximum power dissipation rating, over the full range of flash rates.

The low voltage trigger pulse that is used to switch on Q5 the trigger SCR comes from multivibrator IC2, a standard 555 timer chip, via R22 and C11. The power supply for the multivibrator circuitry is +12V, obtained by filtering and voltage limiting the raw Vcc1 rail using C2 and ZD1 respectively.

When internal triggering is selected using SW1, IC2 is configured as an astable multivibrator with potentiometer VR1 used to select a flash rate between about 1Hz and 10Hz. When external triggering is selected, IC2 is configured as a monostable which gets its trigger pulses from the trigger input socket via opto-coupler IC1. Using an opto-coupler to isolate the trigger input ensures that there are no problems when multiple strobes are connected together, or when the strobe is triggered from a sequencer, etc.

The external trigger input pulses need to be between 3 and 15V in amplitude and of greater than 0.1ms in duration, making it possible to operate the strobe from either CMOS or TTL sources.

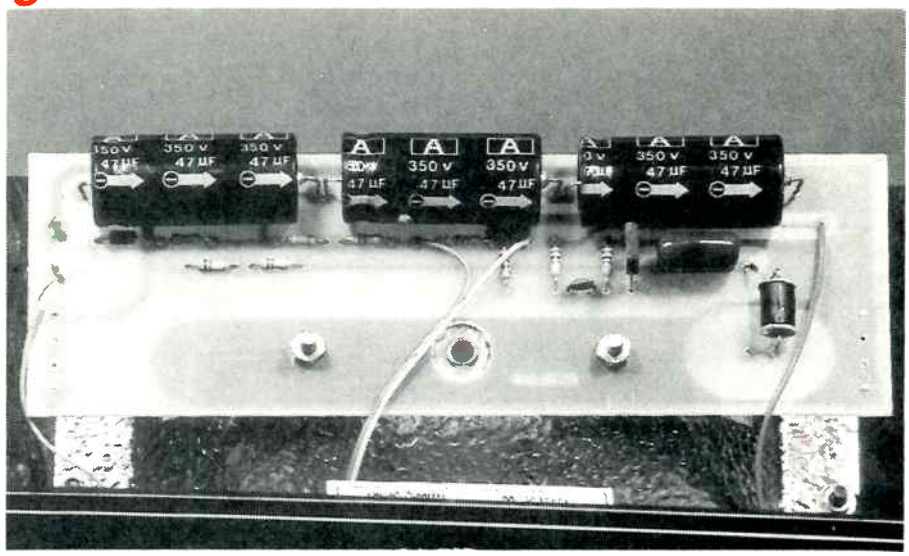
The purpose of IC2 in external trigger mode is to condition the external trigger pulses and to limit the trigger rate to the maximum that the flash circuitry can reliably operate at — i.e., 10 flashes per second.

The monostable output is also taken via a 1k resistor R23 to the trigger output socket, providing trigger pulses for synchronising other strobes.

Construction

With the exception of the flash rate pot VR1, the triggering switch SW1 and the triggering connectors, all of the parts used in the strobe are mounted on two PC boards.

One of these boards, coded ZA-1372 and measuring 170 x 53.3mm, is used to support all of the high voltage and triggering circuitry. This board mounts on the back of the flash tube's reflector, and is thus located vertically inside the case. The rest of the circuitry is mounted on the main board, coded ZA-1371 and measuring 170 x 104mm. This board is mounted horizontally in the bottom of the case.



A close up of the high voltage PCB attached to the rear of the tube reflector. Note that the three large electrolytic caps visible are those which store the high voltage energy — so beware!

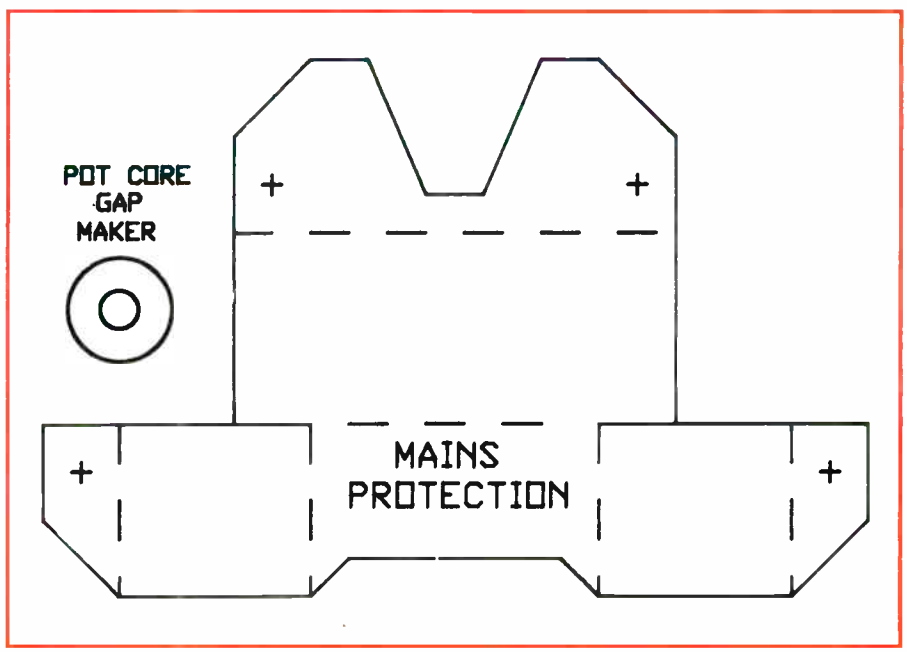
As you can see from the photo's, the two controls VR1 and SW1 are mounted on the rear panel of the case, along with two triggering connectors.

The mains cable also enters through a hole in the rear panel, fitted with a rubber grommet to prevent chafing. It is then anchored by passing it through four 6mm holes in the main PCB ('Loch Ness Monster' fashion), before having its conductors terminated. More about this shortly.

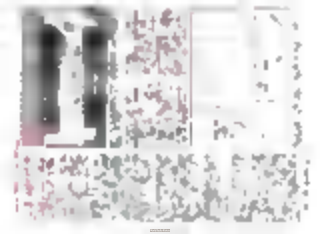
It's probably easiest to begin assembly by fitting all of the smaller components to the high voltage board, using its overlay diagram as a guide.

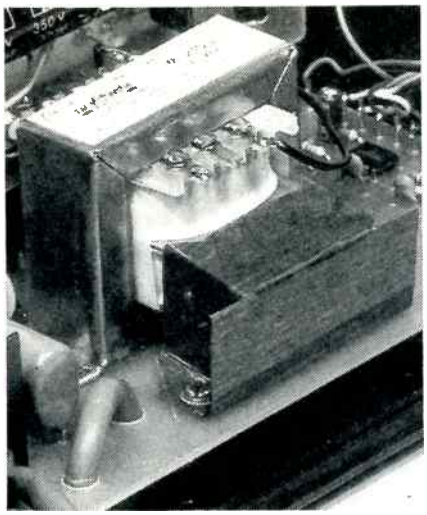
This means the resistors and capacitors (including the three big electrolytics), and the triggering transformer T3. Take special care with the polarities of C4, C5 and C6, and also with the connections for T3.

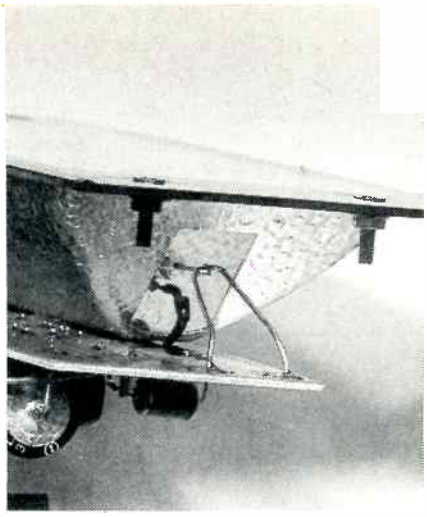
At this stage you can also fit the two PCB pins, used later for the connections from the converter transformer T2. These are fitted to the two uppermost end pads at the C4 end of the board. Also fit the two loops of tinned copper wire



Here are actual size templates for the two items to be cut from 'elephant hide' insulating paper — a piece of which is included in the DSE kit.







Three close-up shots inside the strobe, showing (a) the mains wiring insulating cover, and also the mains cable threaded in 'Loch Ness Monster' fashion through the PCB holes; (b) the completed converter transformer T2, mounted on the board; and (c) one of the flash tube support/connection loops, with the triggering electrode wire also visible.

which will be used to support and connect to the flash tube. These are each bent up from 70mm lengths of 1mm tinned copper wire. But don't try to fit the flash tube itself, just yet.

Next, solder in the SCR Q5, again taking special care to fit it the correct way around (bared metal surface nearer C7). Its outer leads should be splayed out carefully about 4mm down from the SCR case, and then made parallel again when they are each 0.2" away from the centre lead. This should allow the SCR to be mounted to the PCB with its body only about 6 - 7mm above the board surface.

Now cut three 100mm lengths of insulated hookup wire, and strip away 5mm of the insulation from each end of all three. Then tin the ends, and solder one end of each to the pads between R11 and R12, between R16 and R22, and in the upper right corner (near C6, and above T3). These leads will be connected to the main PCB, during the final assembly.

After checking all of your solder joints, the PCB can now be attached to the rear of the reflector using a pair of 4BA x 4mm screws with 'star' lock washers and nuts. Note that the *copper side* of the board is towards the reflector, and the 'dimpled' centre hole of the reflector sits centrally in the large circular cutout in the PCB.

The star lockwashers go between the reflector metal and the large area of copper on the PCB, so that the reflector metalwork is connected reliably to earth. Needless to say the screws are fitted with their slotted heads inside the reflector, and the nuts on the component side of the PCB.

Now cut a 50mm length of insulated hookup wire, and strip away about 5mm of the insulation from each end. Then tin both ends, and quickly but carefully solder one end to the small lug provided on one of the flash tube's trigger wire clamp rings.

You should now be able to mount the flash tube inside the reflector, with its main axial electrodes soldered to the support loops at the ends of the boards, and the other end of the insulated trigger lead to the pad at the bottom end of T3.

Note that before the tube leads are soldered to the loops, you should carefully bend the loops so that the tube ends and leads will be positioned centrally in the large holes in the reflector. This is necessary to prevent arc-overs (especially at the end furthest from T3); but the loop shaping is best done *before* you solder the tube leads, to prevent strain and possible breakage of the tube.

The completed reflector/HV PCB as-

Winding Instructions for T2

Converter transformer T2 is wound on a Neosid ferrite pot core, part no. 29-620-49. This uses F5A material and measures 30 x 19mm. The windings themselves are wound on a plastic former which fits inside the pot core, and are as follows:

W1: 3 turns of 1/0.5mm enamelled copper
W2: 10 turns of 2/0.5mm " "
W3: 200 turns of 1/0.25mm " "

W2, the main primary winding, gets placed on the former first. Take two lengths of 0.5mm ECW, each approximately 700mm long, and wind them in bifilar fashion (i.e., in parallel as a single wire) in one layer, on the former. Wind 10 turns and this winding should fit neatly across the full width of the former.

On top of this winding, tightly wrap a couple of layers of thin insulating tape. Ordinary clear adhesive tape which is about the same width as the former will do the job.

Make sure the tape rides up the sides of the former slightly, to stop the following layers of wire from slipping down past the edges of the tape.

Twist the wires together at both ends of the winding, so that they will act as a single wire when soldered.

For the second winding (W1) take one length of 0.5mm ECW approximately 300mm long, and wind it on top of the first winding in the same direction. This winding is only three turns, but they should be spread evenly across the width of the former.

The start of this winding should come out of the same slot in the former as the start of the first winding, and the end should come out of the same slot as the end of the first winding. On top of this layer tightly wrap a couple of layers of insulating tape as before, with the edges again riding up the sides of the former.

The last winding to go on is the high voltage secondary winding, W3. This winding will start and finish in the two spare slots in the former, with its leads away from those coming from the first two windings.

Before starting this winding, tie a knot in the starting end of the wire so that later you will be able to distinguish between the inner and outer ends. The inner end, which is closest to the primary windings, will be connected to earth.

There is no need to try laying each turn of this winding neatly side by side, but do try to wind it so that the depth of wire is fairly even right across. As before, lay this winding in the same direction as the other windings so that the starting ends all come out on the same side of the former. Put on a final few layers of insulating tape when this winding is finished.

The final step is to cut out the pot core spacing washer from the 'elephant hide' insulating paper provided, and assemble the transformer with the spacing washer and former both between the two halves of the pot core. Your converter transformer should now be complete.

sembly can now be attached to the front panel, using four black anodised countersunk 6BA x 12mm screws flat washers and nuts. The PCB/reflector assembly mounts with the three electrolytics C4-C6 uppermost, as shown in the photo's. This assembly can now be put aside while you work on the main PCB.

As before, it's probably easiest to fit the resistors and capacitors to the main PCB first, along with the 14 PCB pins used for off-board connections. Take care with the polarity of electrolytics C2 and C9, which are shown on the overlay diagram. The fuse clips for F1 can also be fitted at this point.

Next, fit the transistors, diodes, rectifier bridge and IC's — again taking care with their orientation as shown on the overlay diagram. Note that bridge B1 is fitted with its '+' lead nearest to transformer T1.

Power transistor Q4 is best fitted in the following way. First, screw it to the small finned heatsink with its metal plate side nearest the heatsink surface, and its pins protruding from the same end of the heatsink as its own two mounting pins. Then introduce the leads and pins to the PCB, so that they pass through the board holes. Finally solder the heatsink pins, and then the transistor leads.

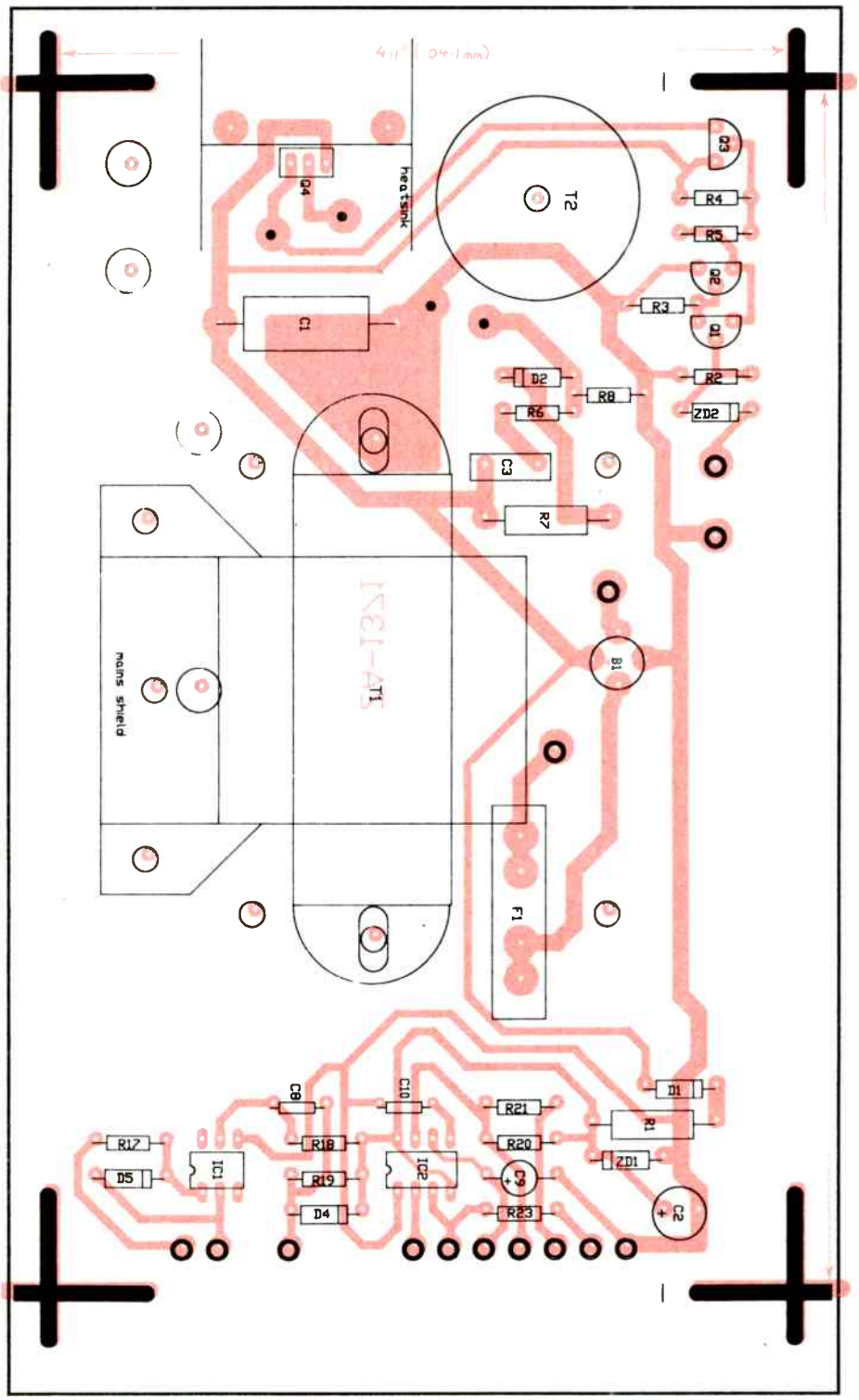
At this stage it would be best to wind the converter transformer T2, if you haven't already done so. The winding details are shown in the box. The finished transformer is mounted to the main PCB using a 25mm long 4BA screw and nut, as shown in the photo, with the slot for the low voltage winding leads positioned between D2 and C1, and the other slot diagonally opposite.

Once the transformer is mounted, you can terminate the leads for the low voltage windings to the appropriate pads on the board. The start of the bifilar winding W2 connects to the pad inside the heatsink nearer to T2, while the end of the same winding goes to the pad near the T2 end of C1; the start of the feedback winding W1 goes to the pad near D2, while the end of this winding goes to the remaining pad inside the heatsink, nearer the rear end of C1.

At this stage the leads for the high voltage secondary winding (W3) of T2 should be left unconnected.

Now mount power transformer T1 on the main board, with its 240V primary lugs towards the rear — i.e., facing away from bridge B1. Use two 12mm 4BA screws, with 'star' lock washers and nuts underneath the PCB, and a solder lug also fitted underneath the nut on the screw at the end nearer capacitors C8 and C10.

Using two lengths of insulated hookup wire about 100mm long, connect the two PCB pins on either side of bridge B1 to the 0V and 15V lugs on the top of the transformer. Which PCB pin connects to which transformer lug isn't important, but make sure you *do* connect to the 0V and 15V pins — some of these transformers have the identifying label ap-



Here is the overlay diagram for the strobe light's main PCB...

plied back-to-front(!), like that shown in the photo's. The correct lugs are the 'unmatched' end lug on the four-lug side, and the lug at the same end of the three-lug side.

The next step in fitting the transformer is to fit the mains cable. This is first prepared by removing about 70mm of the outer grey insulation from the blank end (i.e., not the plug end!), to reveal the three separately insulated wires. Then remove 5mm of the insulation from each wire, and tin each one carefully to make it easier to solder them to their corresponding lugs.

Thus prepared, the cable end is threaded first through the grommeted hole in the rear panel of the case, and then through the four 6mm holes in the PC board, as shown in the photo — passing downwards, upwards, downwards and finally upwards again just next to the transformer primary lugs. Position it so that about 10mm of the grey outer insulation protrudes from the hole. Then take the earth wire (green/yellow striped insulation) and thread it back downwards again, through the 3mm hole just to the rear of the 6mm hole from which the cable has emerged.

This earth wire can now be soldered to the solder lug underneath the transformer mounting screw, underneath the board. The two remaining mains cable wires can also be soldered carefully to the transformer primary lugs, at the bottom of the bobbin. This is a little awkward, so take care not to damage the cable insulation with the soldering iron — while still ensuring that you make solid and reliable joints.

Finally, after checking that your joints are well made, you need to cut out the protective insulating cover for the mains connections, from the sheet of 'elephant hide' paper supplied in the DSE kit. The template for both this cover and the gap spacing washer for the converter transformer T2 (cut from the same material) are shown in a diagram, actual size.

Having cut out the cover, it is then bent into shape (see photo), and mounted over the mains connections. It is attached to the main PCB by a pair of 12mm long 4BA screws, lock washers and nuts.

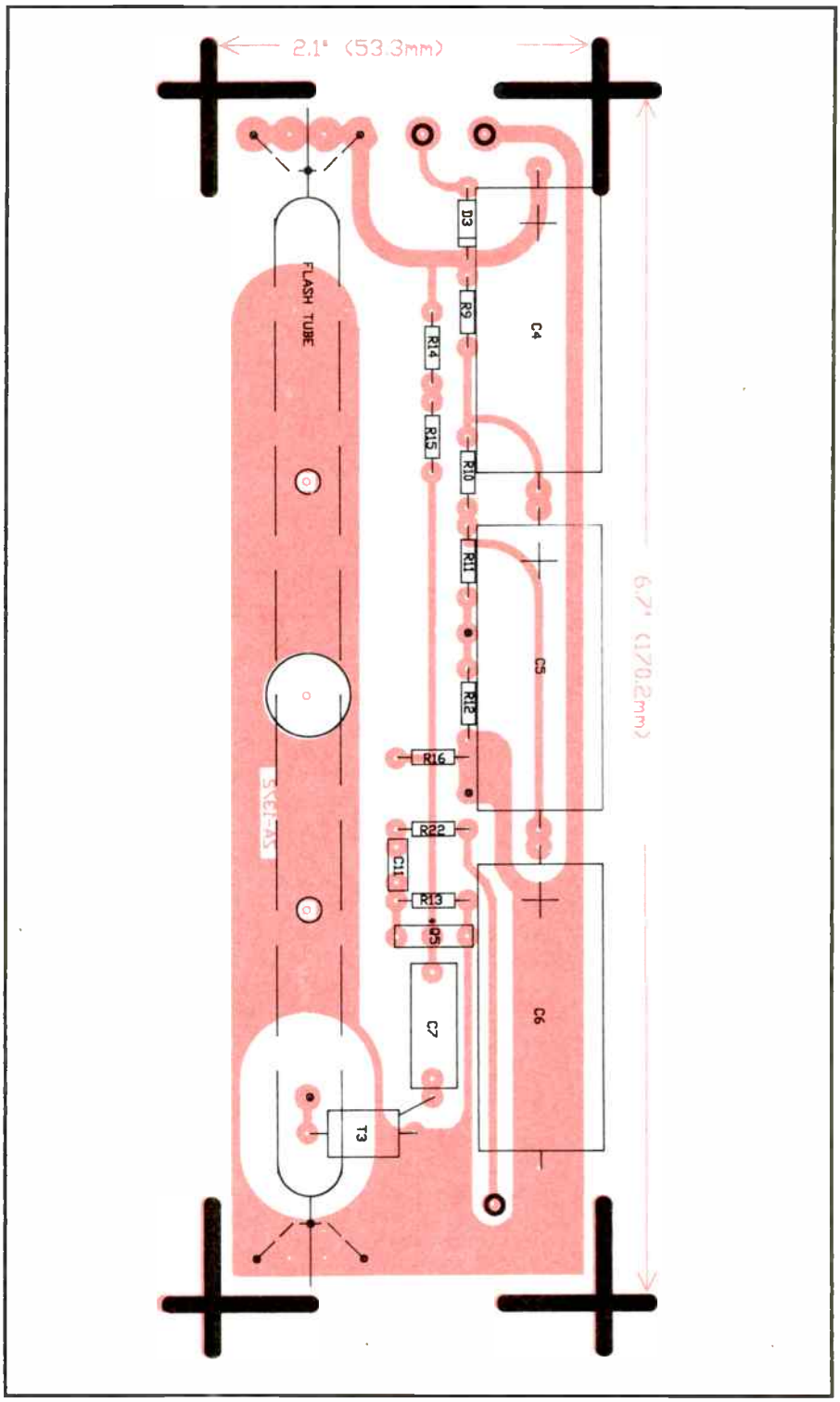
Now cut nine pieces of suitably coloured insulated hookup wire, each 160mm long ('rainbow' cable can be used).

Then remove 5mm of insulation from each end of each wire, and tin them carefully to make soldering easier. Each wire can then be soldered to a PCB connection pin on the main PCB — but NOT to the two pins alongside ZD2, at the front of the board, nor to the sixth pin from the front, along the end nearest the ICs. These pins take the wires from the HV board.

Your main PCB assembly should now be complete, and it can be placed aside while you mount pot VR1, switch SW1 and the two 5-pin DIN sockets in their positions on the rear panel. VR1 can also be fitted with its knob.

This done, the main PCB should be mounted in the lower half of the case, using four 25mm long 6BA screws and nuts (which fit inside the recessed holes, underneath). Note that the board mounts with the bridge B1 nearest the front of the case.

The final stage of construction is to lay the front panel assembly face down, next to the front of the main board, and



And here is the overlay for the smaller high voltage board.

the rear panel likewise at the rear. This will allow you to make the various connections between the boards, and to the rear panel controls.

First connect the wires attached to the HV board, to their corresponding pins on the main PCB. The wire from between R11 and R12 on the HV board connects to the pin nearest ZD2, while that from between R16 and R22 connects to the adjoining pin. The third wire, from the top corner of the HV board, connects to the sixth pin from the front of the main PCB, in the row at the end.

At this stage you can also connect the two lead wires from the high voltage secondary winding of the converter transformer, to the two PCB pins at the C4 end of the HV board.

Note that the lead for the *start* of the winding (i.e., the end nearest the other two windings, when you wound them) should connect to the *upper* pin on the HV board, as this pin is earthed and this will minimise the risk of breakdown inside the transformer.

The remaining wires from the main PCB pins are used to connect to the rear panel controls and connectors. The wires from the two pins nearest the front of the board go to the (lower) trigger out socket, with the front-most pin connecting to socket pin 5 and the other to pin 4. Similarly the wires from the pins nearest to the rear of the PCB go to the (upper) trigger input socket, with the rear-most pin connecting to pin 4 and the other to pin 5. The remaining wires go to SW1 and RV1.

At this stage your strobe unit should be complete; but before slotting the front and rear panel assemblies into place, it would be a good idea to check everything carefully.

As noted earlier, the risk of shock with this project is such that we do NOT advise checking any circuit voltages, or in fact carrying out any other tests with the case open. So if everything seems OK, and you have carefully followed the foregoing instructions, the strobe can be finished by putting the panels into position, adding the top of the case and fitting the four assembly screws which hold the covers together.

Testing it

Now for the acid test. First, turn the rate pot RV1 fully clockwise, to the minimum flash rate position, and also set switch SW1 for external triggering.

PARTS LIST

Integrated circuits

IC1	4N28 Opto coupler
IC2	555 timer

Transistors

Q1,Q2	BC549 NPN silicon
Q3	BC328 PNP silicon
Q4	MJE2955 PNP power
Q5	C106D sensitive gate SCR

Diodes

B1	WO-4 400V/1.5A bridge
D1,D2	1N4002 1A/100V
D3	1N4007 1A/1000V
D4,D5	1N4148 signal diode
ZD1	1N4742 12V/1W zener
ZD2	1N4751 30V/1W zener

Capacitors

C1	3.3uF 100V polyester film
C2	100uF 16VW PCB-mount electro
C3	0.1uF ceramic
C4,C5,C6	47uF 350VW axial electro
C7	0.1uF 630V polyester film
C8,10,11	10nF ceramic
C9	10uF 16VW PCB electro

Resistors

Note: All resistors are 1/4W 5% carbon unless otherwise indicated.

R1	100 ohms 1W
R2,18,19	100k
R3	10k
R4,13,17,22,23	1k
R5	220
R6	22 ohms
R7	5.6 ohms 1W
R8,20,21	4.7k
R9,10	330k
R11	270k
R12	68k
R14,15	180k
R16	1M
VR1	100k log pot

Miscellaneous

T1	15V/1A power transformer (M-2155)
T2	Converter transformer (see winding details)
T3	Trigger transformer, 6kV (M 0104)
X1	Xenon linear flash tube (Wanko 140mm)
SW1	DPDT miniature toggle switch

Reflector, to suit flash tube; plastic instrument case, 200 x 140 x 105mm; clear perspex front panel, to suit; pot core gap washer (12mm O/D, 4mm I/D, 0.2mm thick 'elephant hide'); protective cover for mains connectors, also cut from 0.2mm 'elephant hide'; power cable with plug; rubber grommet for mains cord entry; solder lug for power transformer earth connection; cartridge fuse, 1.25A; two PCB-mount fuse clips; two 5-pin DIN sockets; main PCB, code ZA-1371; HV PCB, code ZA-1372; T0-220 heatsink; four 25mm 6BA mounting screws for main PCB (head size 6mm dia maximum); seven 12mm 4BA screws for mounting transformer, mains cover, heatsink and HV PCB; 25mm 4BA screw for mounting pot core; four 12mm 6BA black countersunk screws for mounting reflector to front panel; eight 4BA nuts; eight 6BA nuts; four 4BA flat washers; four 6BA flat washers; 10 spring washers; two star washers.

Then plug the mains cable into the power point, and turn on the power. Nothing should happen — there should be no bangs, no smoke, no 'ffft' due to the internal fuse blowing, and no flashes either.

If everything seems OK so far, try switching SW1 to internal triggering. You should now be greeted by a regular series of flashes from the tube, at about one per second. Winding RV1 slowly anticlockwise should gradually increase the flash rate to about 10 per second, at the anticlockwise limit.

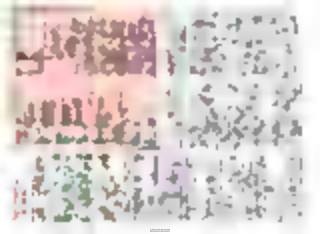
If strobe starts flashing at 10 per second, and gets slower as you turn RV1 anticlockwise, you've wired the pot backwards. Similarly if you get flashing in the 'EXT' position of SW1 but not in the 'INT' position, you've wired up the switch wrongly. If you get no flashes in either position of SW1, the most likely cause is also a mistake in the switch wiring.

If you want to check the trigger input circuitry, connect a 6V battery to a 5-pin DIN plug and a pushbutton (N/O), with the negative lead of the battery connecting directly to pin 5 of the plug, and the positive lead to pin 4 via the pushbutton. Then, with the strobe's trigger switch set to 'EXT' and the plug inserted into the TRIGGER IN socket, you should get a flash each time the button is pressed. If you don't, the odds are you've miswired either the socket connections or the wiring to SW1.

Don't forget, though, that you should turn off the power, remove the mains plug from the power point and then wait a good three minutes before opening the case, before making any corrections to your wiring. Otherwise, you risk a nasty shock.

That's about all there is to it. Your strobe should now be complete. Just don't look into the flash tube from less than a metre or two, when it's operating — your eyes could possibly be damaged from the high light intensity. Strobe lights are not designed for direct viewing, and ideally should be directed to the ceiling or a wall, for 'bounce' lighting...

Otherwise, have fun with your new strobe light. It's compact and bright, and has been designed for high reliability. It's also about as safe as you could make any such unit, despite our warnings about safety. Just treat it with respect, as you should treat any similar piece of equipment which involves potentially dangerous voltages. ❖



The Oatley Electronics 'Solar Power' Competition

They have competitions for solar-powered cars, so it's fitting for an electronics magazine to do something similar. Here's how you can win one of the 25 great prizes, provided by Oatley Electronics and worth over $5000 total!

We are looking for applications that are based around solar power. Ideally, your application should be electronic, although we're open to all kinds of ideas.

Perhaps you've developed a method of directly powering a motor with solar energy, or a way of tracking the sun so a solar panel is always exposed to the best sunlight. Maybe you have proven ideas on how to maximise the energy from a solar panel.

Whatever your idea, if it uses a solar cell, why not enter and possibly win a prize. The most original and ingenious idea/project will win, although there are lots of prizes, so at least 25 people stand to win something.

There are five major prizes and 20 runner-up prizes. Here's what you can win:

First prize:

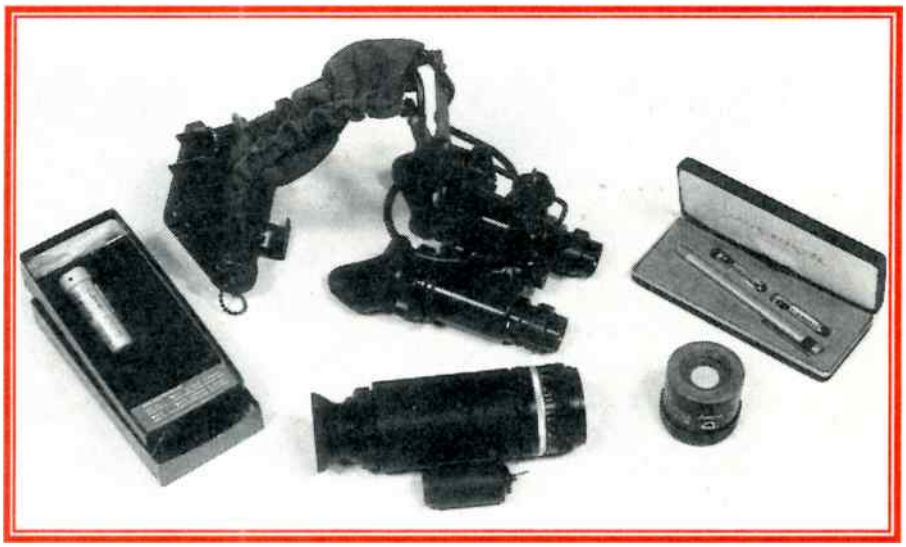
A second generation night viewer. Custom made viewer that uses an ex-military 'second generation' image intensifier tube. It can operate in starlight conditions (almost full darkness), but produces amazing images if the targetted area is lit with low power infrared (IR) light. (Value $1800)

Second prize:

A binocular IR night viewer. An ex-military helmet mount binocular-style night viewer. (Value $649)

Third prize:

An image intensifier tube. A second generation image intensifier tube with built-in electronics. Requires a 3V battery, a lens and an eyepiece to make a complete IR viewer. (Value $600)



Fourth prize:

A laser gun sight. A US made 5mW laser gun sight complete with a rifle mount. (Value $399)

Fifth prize:

A laser diode pointer — a pen-sized 5mW visible diode pointer in presentation case. (Value $199).

Prizes 6 to 15:

Solar panels. Each of these winners will receive 10, 6V/1W solar cells — enough to make a 10W solar panel. Value of each prize is $85. (Total value $850).

Prizes 16 to 25:

Electronic Keys. Each winner will receive a complete kit of parts for the Electronic Key project described in July 1992. The kit includes two keys and one receiver. Value of each prize is $59. (Total value $590).

Total prize value is over $5000 — so why not enter, even if your application seems simple to you. It may win one of the 25 prizes!

Entries will be judged on their usefulness, originality and general appeal to other readers. All diagrams and written descriptions in your entry should be presented clearly. Ideally you will have proven your application and supplied sufficient information to allow us to publish details.

To enter, send your entry to:
Solar Competition
Electronics Australia
PO Box 199
Alexandria
NSW 2015

Note that this competition closes 31st January 1993. All winners will be advised by mail and results will be published in the April 1993 issue.

All prizes have been donated by Oatley Electronics,
5 Lansdowne Parade,
Oatley West, NSW 2223.
Phone (02) 579 4985 ❖

BARGAINS GALORE

JAYCAR
MERRY FESTIVE DEALS!

X'MAS OUTDOOR GARDEN LIGHTS

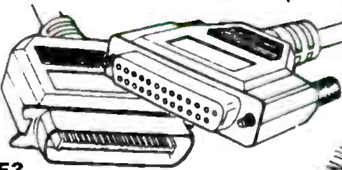
Enhance the look of your garden with Jaycar's outdoor garden lights. Simply hang them through your garden. Safe, low voltage. Comes complete with 20 metres of green cable with a lamp moulded every 250mm (total of 80 lamps) and a 240V to 24V mains adaptor. Replacement globes Pk 5 Cat. SL-2822 $2.50

Cat. SL-2820 **Normally $49.95**
X'mas SPECIAL $39.95
SAVE $10

Computer Printer Lead Madness

D25 plug to Centronics plug lead. 1.8 metres long.
Cat. PL-0854

Normally $18.95
X'mas SPECIAL $8.95 SAVE A MASSIVE $10
YOU WON'T BEAT THIS PRICE ANYWHERE?



Merry Christmas

SCOPE PROGRAMMABLE HOUSE ALARM BOARD

See catalogue for full details. (No box supplied. Sells for $199.50 with box. • 6 sectors plus 6 x 24 hour sectors. • No programming required for normal operation. Includes PC board with keyboard attached.
Catalogue price $129.50

Cat. LA-5182 **X'mas SPECIAL $79.50**
SAVE $50

REMOTE KEYPAD TO SUIT

Intelligent remote keypad to arm/disarm and program the system. 7 segment readout, use up to 3 per alarm.
Cat. LA-5183
X'mas SPECIAL $29.95
SAVE $20 Normally $49.95

BUY 10 LESS 10%

PULSE COUNT PASSIVE INFRARED DETECTOR
UNDER $50 - UNBELIEVABLE!!!

The Bellmate PIR is a high quality unit directly imported by Jaycar. The Bellmate has switchable pulse count operation with single pulse trigger and three pulse trigger (virtually eliminate false alarms).

FEATURES AND SPECIFICATIONS
• Incorporates S.S.C. (slide seal chambers) • 24 element zones in 3 layers • Wide angle 90° coverage • Coverage 15 x 15 metres • Operating voltage 9 - 16V DC • Tamper switch for 24 hour zone • Pulse count switchable, normal or 3 pulse• Sensitivity adjustment • LED indicator • Sliding PC board • Size 110(H) x 70(W) x 55(D)mm • N.C. terminals• 1 year warranty

Cat. LA-5016 **$49.95**

Installers - contact us for wholesale prices

1 YEAR WARRANTY

JAYCAR STOCKS A LARGE RANGE OF ALARMS AND ACCESSORIES

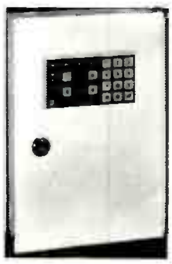
ALARM PANEL MADNESS!!!

To make room for our new 1993 models we are sacrificing our current stocks at unbelievable prices.
Protect your home and valuables this holiday season and save an absolute fortune!!
3 models to choose from. For full specifications refer to page 64 of our 1992 catalogue. **12 month warranty.**

1. LOW COST CONTROL PANEL (key switch operated)
Cat. LA-5162
WAS $129 NOW $99 SAVE $30

2. KEYLESS ALARM CONTROL PANEL
Cat. LA-5168
WAS $199 NOW $149 SAVE $50

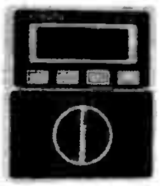
3. KEYLESS 4 SECTOR ALARM PANEL
Cat. LA-5170
WAS $249 NOW $179 SAVE $70



DELUXE WORLD TIME TRAVELLING CLOCK

Know the time in any of 24 different places in the world in moments. Simply set the local time to the place that corresponds to your home longitude and the world time automatically adjusts the time for the other zones. Also includes a travel alarm, and is supplied in an attractive wallet.
Size 62(W) x 70(H) x 14(D)mm.
Cat. QM-7212 IDEAL FOR TRAVELLERS

GREAT VALUE AT $26.95
X'mas SPECIAL $16.95
SAVE $10



DOOR ANNOUNCER

The Door Announcer gives a quick melody to announce when someone opens a door. The door can be a shop, doctors surgery, service centre, or anywhere where staff need to know when someone enters through a door that is normally closed. The unit simply mounts near the door and is supplied with a reed and magnet assembly which mounts on the door. This is connected to the unit by cable which is supplied. Unit operates on 2 C batteries (not supplied) which will last for about one year. (2 x C gold batteries Cat. SB-2342 $2.75). Full wiring instructions supplied.

Cat. LA-5011 **$18.95**

VISITOR CHIME

This visitor chime will chime "ding dong" when anybody walks past it. It's ideal for placing near the door of a shop or office to advise when someone enters. It can either sit on a shelf or mount on a wall with the aid of one screw. Controls on the unit are on/off and hi/low. Sensing distance is 5 metres (indoor, under normal light). Operates on 2 x C batteries which last about one year. (2 x C gold batteries Cat. SB-2342 $2.75). Unit size is 77(W) x 112(H) x 58(D)mm. Our previous model sold for $49.95.

Cat. LA-5010 **$27.95**

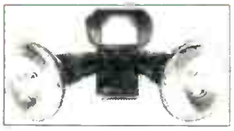
PINK HOOK-UP WIRE!

We've made a bulk purchase of pink high quality 13/.12 tinned hook-up wire. Not terribly exciting, but at this price grab a roll or two, you could even use pink instead of red. Note: extra postage may apply if several rolls are ordered on their own.
Cat. WH-3018

NORMALLY $11 per 100mt roll

NOW $3.50/100mt

OUTDOOR INFRA RED MOTION DETECTOR



This unit will automatically turn on two floodlights when someone walks within the detector range. Ideal security to protect loved ones and property. Detection range is 40 feet long by 60 feet wide. Lights will stay on for a minimum of 10 seconds and up to 15 minutes (adjustable). Works only at night. Globes not supplied but are standard portafloods available almost anywhere.
Cat. LA-5132

NORMALLY $49.95 X'mas SPECIAL $39.95 SAVE $10

3 FANTASTIC NEW SOLAR POWERED KITS FROM JAYCAR

4 in 1 SOLAR CONSTRUCTION KIT

Ideal for the young (and young at heart). With this kit you can build a windmill, airplane, helicopter and watermill. You can also create your own construction designs. Easy to assemble. Comes complete with plastic nuts and bolts, flexible interchangable lengths, wheels, solar panel, motor and spanner to assemble the kit.
Suitable for ages 5 and up.

Cat. KJ-6770 **ONLY $24.95**

SOLAR POWERED WOODEN KITS

Keep the kiddies amused over the X'mas holidays with two new solar powered wooden kits from Jaycar.
Build your own solar powered windmill or helicopter. Comes complete with sturdy plywood materials, glue, comprehensive step-by-step instructions, solar panel and motor.

Windmill Kit Cat. KJ-6750 **$26.95**

Helicopter Kit Cat. KJ-6760 **$26.95**

DIGITAL BLOOD PRESSURE METER

Keep an eye on your blood pressure at home with this easy to use digital electronic blood pressure meter. It uses a highly accurate oscillometric method to give systolic and distolic pressure as well as a pulse. Supplied complete with comprehensive instructions, case and 4 x AA batteries
Cat. QM-7250

NORMALLY $99.95 X'mas SPECIAL $79.95

BE QUICK AT THIS PRICE THEY WON'T LAST LONG **SAVE $20**

SAVE A HUGE 50% ON CELLULAR PHONE BATTERY ELIMINATORS!

When you are in your car use your car power and save your phone batteries. Simply slide the battery pack out of the phone and replace it with the eliminator. Battery comes complete with black curly cord which terminates to a cigarette lighter plug.
• Cat. MP-3110 Motorola Micro Tac • Cat. MP-3112 Novatel PTR800 • Cat. MP-3116 NEC P300 • Cat. Mp-3114 Motorola 9800/9500

Normally $59.95 X'mas SPECIAL $29.95

DON'T MISS OUT!

24V 1000W INVERTER BARGAIN

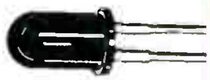
We've made a scoop purchase of a quality Powermaster 24V DC input 240V AC output 1000W inverter. These units normally sell for around $1000. The Powermaster has two panel meters on the front, one for voltage and one for the current drawn by the 240V appliance. The unit also has a 240V switched socket, Hi/Lo voltage switch and a fan to keep it all cool. Suitable for most power tools, lights, TV's, computers, fax's, refrigerators, etc., etc. Leads not supplied.
Dimensions 285(W) x 150(H) x 235(D)mm. • Idle current 750mA • Max input current 50 amps • Efficiency 85% typically • Output frequency 50Hz (modified square wave)
Warranty 12 months

Cat. MI-5060 **$549**

BLUE LEDS

These are waterclear (i.e. they look clear but light up blue), because waterclear has a higher light intensity

Size	mCd	Cat	Price
3mm	14	ZD-1751	$3.95
5mm	14	ZD-1727	$3.95



24 TO 12 VOLT REDUCER

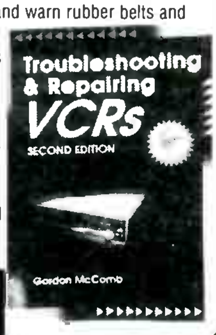
This reducer will drop 24 volts to 12 volts with continuous loads of 7 amps and peak loads of 10 amps. The Quartzline unit has features not found in other brands. These include: • output overvoltage protection guards against overvoltage surges • current foldback under overload or short circuit conditions. The unit responds to these conditions by folding back the current load to 1/2 normal output. • input overvoltage protection guards against input voltage surges due to electric motors, clutches and solenoids etc. Ideal for CB radios, UHF and small fridges. Made in Australia.

Cat. MP-3060 **ONLY $89.95**

TROUBLESHOOTING & REPAIRING VCRs - Second Edition

NEW BOOK

Most problems with VCR's are caused by things you can fix yourself - dirty video heads, old and warn rubber belts and rollers, broken wires and damaged tapes. This book shows how you can easily and affordably maintain and repair your VCR with a minimum of tools and time. It explains how to care for and repair all types of VCR's including over 100 different brands of VHS, Beta and 8mm as well as camcorders.
Softcover 413 pages 187 x 233mm.
Cat. BT-1368



OVER 100 000 COPIES SOLD

WOOFER SENSATION

NEW

Stock up now on these amazing speaker bargains. They are quality woofers with foam roll surrounds, silver dust cover and ribbed grey cardboard cones.

Brief specifications - 10" and 12"

Impedance 8Ω • power handling 10" 60 watts 12" 80 watts • resonant frequency (approx.) 10" 38Hz, 12" 35Hz • frequency response 10" 38 - 3000Hz, 12" 35 - 2000Hz • suitable enclosure size (sealed cabinets) 10" 25 litre or more, 12" 40 litre or more.

Please note - these are the only specifications we have available.

10" SPEAKER Cat. CW-2117 **ONLY $20 ea**

12" SPEAKER Cat. CW-2123 **ONLY $27.50 ea**

BELOW 1/2 PRICE

NEW 100 WATT 12 - 240 VOLT INVERTER

If you don't need 300 watts then this brand new 100 watt version may just do the job. Made by the same company that makes our 300 watt and 500 watt units, we found this inverter to work exceptionally well. It has good overload protection and the circuit breakers will trip if 110 watts is exceeded over a long time. It has a Hi/Lo voltage switch, efficiency is 82% Hi and 86% Lo. It is not suitable for - refrigeration, motor, compressor, phase shift control equipment (e.g. electric blanket).

Supplied with lead and cigarette lighter plug. SAVE $60 OVER PREVIOUS MODELS.

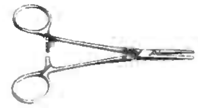
Cat. MI-5035 **ONLY $129.50**

SCISSOR CLAMPS

NEW

These clamps are made of stainless steel and can be locked on to the item they are holding. They are 130mm long, so are ideal to reach into hard-to-get-at places. Also great for holding components etc., whilst soldering.

Cat. TH-1755 **ONLY $8.95**



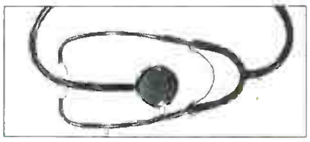
STETHOSCOPE

NEW

Yes, that's right Jaycar now stocks a high quality stethoscope!! Its acoustic response is remarkable. Unlimited uses, listen to your heart!! Use with our blood pressure meter, even listen for nasty knocks in your cars engine. Japanese made.

Cat. QM-7255

$19.95



UHF TV ANTENNAS

Cheapest in Australia?

23 Element Cat. LT-3178 **$38.95**

43 Element Cat. LT-3181 **$54.95**

91 Element Cat. LT-3182 **$89.50**

Sub C NiCad

Repair your battery pack for RC cars and power tools with Sub C's. Has solder tabs & rated at 1.2Ah.

Cat. SB-2456 **$6.95**

BUILD THIS NICAD BATTERY DIS-CHARGER KIT

REF: SC JULY 92. This battery discharger is specifically designed for video camera or mobile telephone batteries. It can be set for different types of batteries from 6-12V and will save you money by reviving that dud battery. This circuit is powered by the battery under discharge and, therefore, doesn't require a plugpack, making it completely portable. The Jaycar kit is supplied with diecast box, PCB and all specified components.

Cat KC-5120

$27.95

BARGAIN - ONE PIECE PHONE

Did you know that you can return your old Telecom phone to any Telecom office and receive $30 off your phone bill "EVERY" year! So, this phone will pay for itself in four months. We've made a huge purchase of one piece phones and can sell them for 1/2 of what other companies sell them for. This phone is black, has last number redial, mute button, on/off ringer, pulse dialling system, easy push button operation and a wall bracket supplied. Grab one today - and save.

Cat. YT-7050 **AN AMAZING $9.95**

NEW

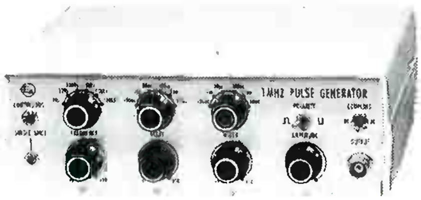
Low Cost 1MHz Pulse Generator Kit

Ref: EA June 1992. This project is an updated and improved design that has many features found on expensive commercial generators, but at a fraction of their cost. It can be used for fast evaluation of widebond amplifiers and filters, adjusting the frequency compensation of scope probes and other attenuators. It is a must for troubleshooting and developing digital circuits. The project provides BNC o/puts for CROs with single-shot and continuous pulses. The Jaycar kit comes complete with case, front panel label, PCB and components.

Cat KA-1743 **NORMALLY $89.50**

NOW $75

SAVE $14.50



8" "MAX SOUND" SUBWOOFER

Back in stock! Featured in the subwoofer enclosure article Ref: EA June 1992

This subwoofer has a massive magnet and power handling to suit, butyl rubber cone suspension and rigid frame.

Rated power 80 watts rms • impedance 8Ω • voice coil dia. 35mm • free air resonance 41Hz • magnet weight 0.852kg • Dimensions 205 x 197 x 187mm.

Suitable vented enclosure volume 38L.

Cat. CW-2150

$99.50

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RHODES	6 Leeds St (02) 743 5222 Mon-Fri 9 - 5.30

Construction Project:

LOW COST ADAPTER MEASURES INDUCTANCE

Measuring the inductance of wire-wound components has not been easy until now, but here's a handy adapter unit which allows the job to be done with a standard digital multimeter. It employs sound and accurate circuit techniques, but doesn't involve any costly or expensive components. It operates from a single 9V battery and provides two direct-reading measurement ranges.

by DALE SIVER

The low cost inductance meter adapter to be described is intended for use with a standard digital multimeter having an accurate DC voltage range, but it can be used with pretty much any high impedance meter you have, with a little thought.

It will measure virtually any of the inductances used in audio and similar circuitry, with values in the microhenry-millihenry range. RF coils (with values down in the nanohenries) will have too small an impedance to give an accurate reading, and should be measured using a bridge, Q meter or other L-C tuned circuit type meter.

The principle of operation is to have a sinewave generator in the audio range, which has a constant amplitude, low distortion and known frequency. A 'state variable' oscillator is employed here, similar to that used in Phil Allison's Ultra Low Distortion Oscillator published in *Electronics Australia* for February/March 1989.

The oscillator has a measuring circuit which monitors the main output level and feeds back a control signal to insure that the sinewave amplitude stays constant.

The main output is then fed to a voltage to current converter, and the converter output attempts to drive the external impedance (the inductor under test) with this known current waveform.

As the current waveform in the inductor will be in phase with the main output signal, the voltage waveform across it will *lead* the current waveform by 90°. The second stage output of the state-variable oscillator also leads the main output signal by 90°, and this output is used to control a rectifier circuit synchronised to the voltage waveform across the inductor.

The output of the rectifier is thus a DC voltage proportional to the unknown inductance, and this becomes the output signal fed to your DMM.

Even if the inductor has a large resistive component, this will not be included in the measurement, since the rectifier only responds to the component of coil voltage drop that leads the driving current waveform by 90°. As the voltage drop due to the coil's resistance is not 'in step', being *in phase* with the driving current, it is ignored.

It may make things a little clearer if we take a quick look at basic AC circuit theory. The relationship between voltage and current for a sinewave AC signal of frequency **f** applied to a real inductor is:

$$v = z.i$$
$$\text{where } z = r + j.x$$
$$= r + j.(2\pi.f.L)$$

In other words, the voltage drop is given by the product of the current **i** and the inductor's impedance **z**, but **z** is itself complex, being made up of the DC resistance **r** and the reactance **x**. The reactance **x** in turn depends upon both the inductance **L** and the frequency **f**.

For all intents and purposes the operator **j** represents a 90° phase shift, meaning that there are two distinct components of the inductor's voltage drop **v**: a component that is *in phase* with the current **i**, produced by its resistance **r**, and a component that is 90° *out of phase* (and

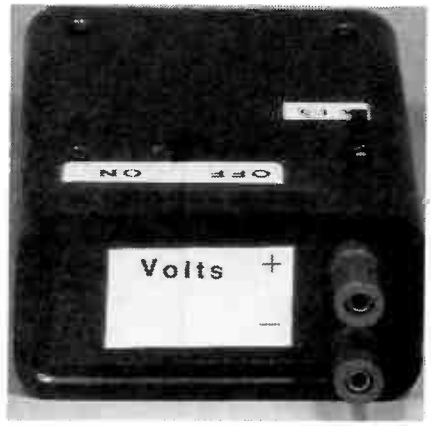
leading), produced by the reactance x of its inductance L. Of course you can measure a coil's *resistance* directly, with your DMM's ohms ranges. And now, thanks to this adapter, you can also measure its inductance as well. It's actually a lot easier to build and use the adapter than to immediately visualize the way it works.

You'll find the inductance adapter extremely useful when you're working with wound components in things like switchmode power supplies, RF interference filters and audio crossover networks. Not only will you be able to check the inductance of coils, but you'll also be able to find shorts in motor and transformer windings — where a DC resistance measurement can be inconclusive. (A shorted turn will dramatically lower inductance, without having much effect on resistance.)

Circuit description

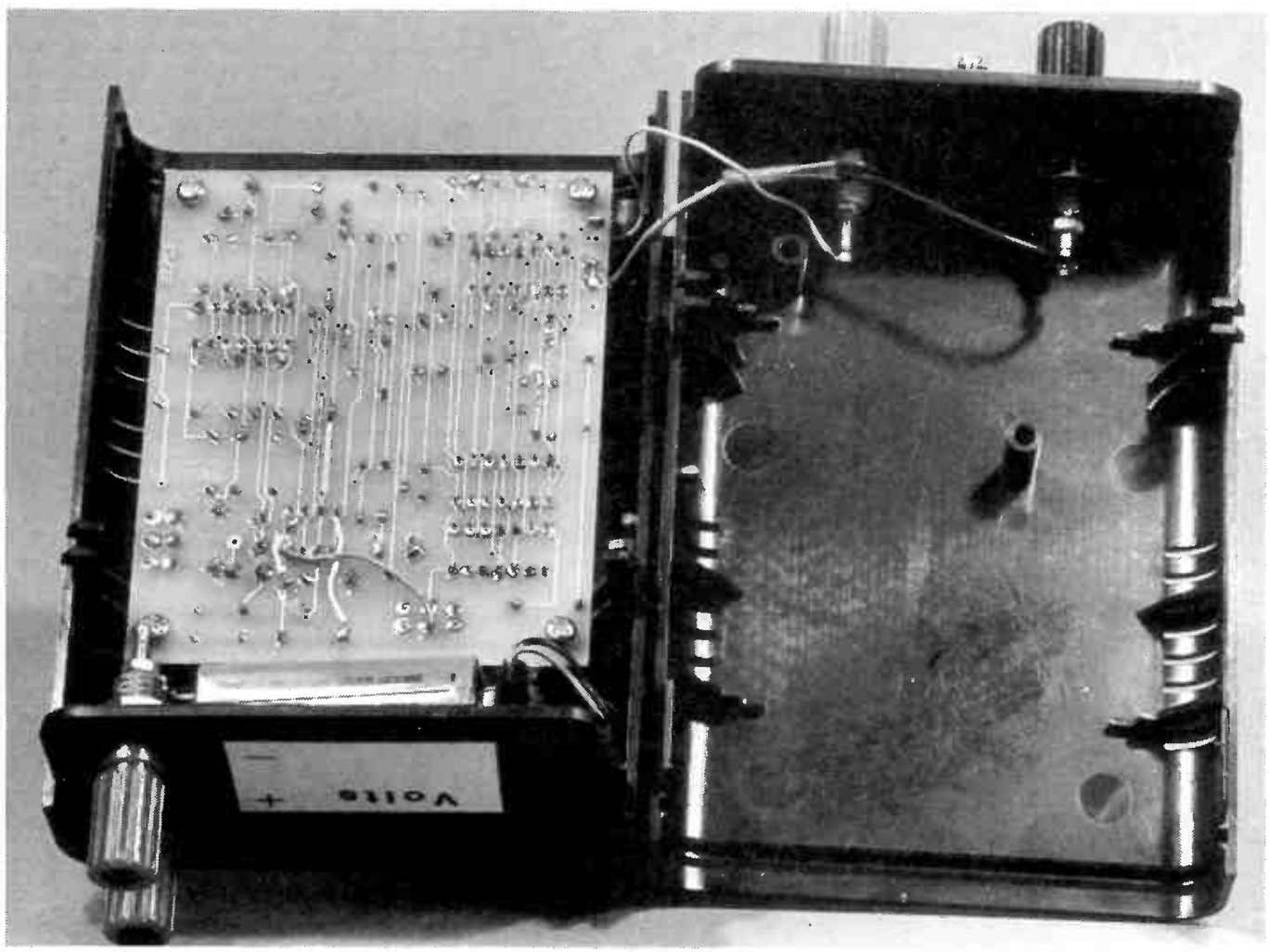
Now let's refer to the full schematic of the adapter, to see exactly how the circuit operates. The oscillator's main loop comprises op-amps IC2:A, D and C, and its main output appears at test point A (TPA). At the frequency of oscillation (nominally 10kHz), each of the two stages IC2:D and IC2:A provides 90° phase lag from input to output.

IC2:C is a summing amplifier, which combines a direct feedback from TPA with the output from IC2:B — which is a DC voltage controlled multiplier. JFET Q1 and resistors R18-24 also help to make up the multiplier, which controls the amount and sign of signal fed back from the output of stage two (IC2:D, pin 14). If only IC2 was installed and the power supply section was working, then the circuit would oscillate but its amplitude would build up until distortion occurred. To prevent this we have a level control. The section of circuit above IC2 on the schematic is a synchronous rectifier, which measures the amplitude of the voltage at TPA. IC3:C acts as a comparator, turning the sinewave into a square wave. The square wave is fed to IC5:A and then

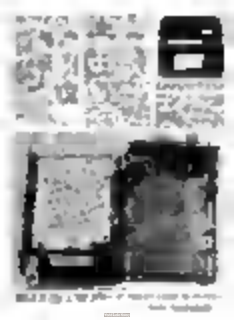


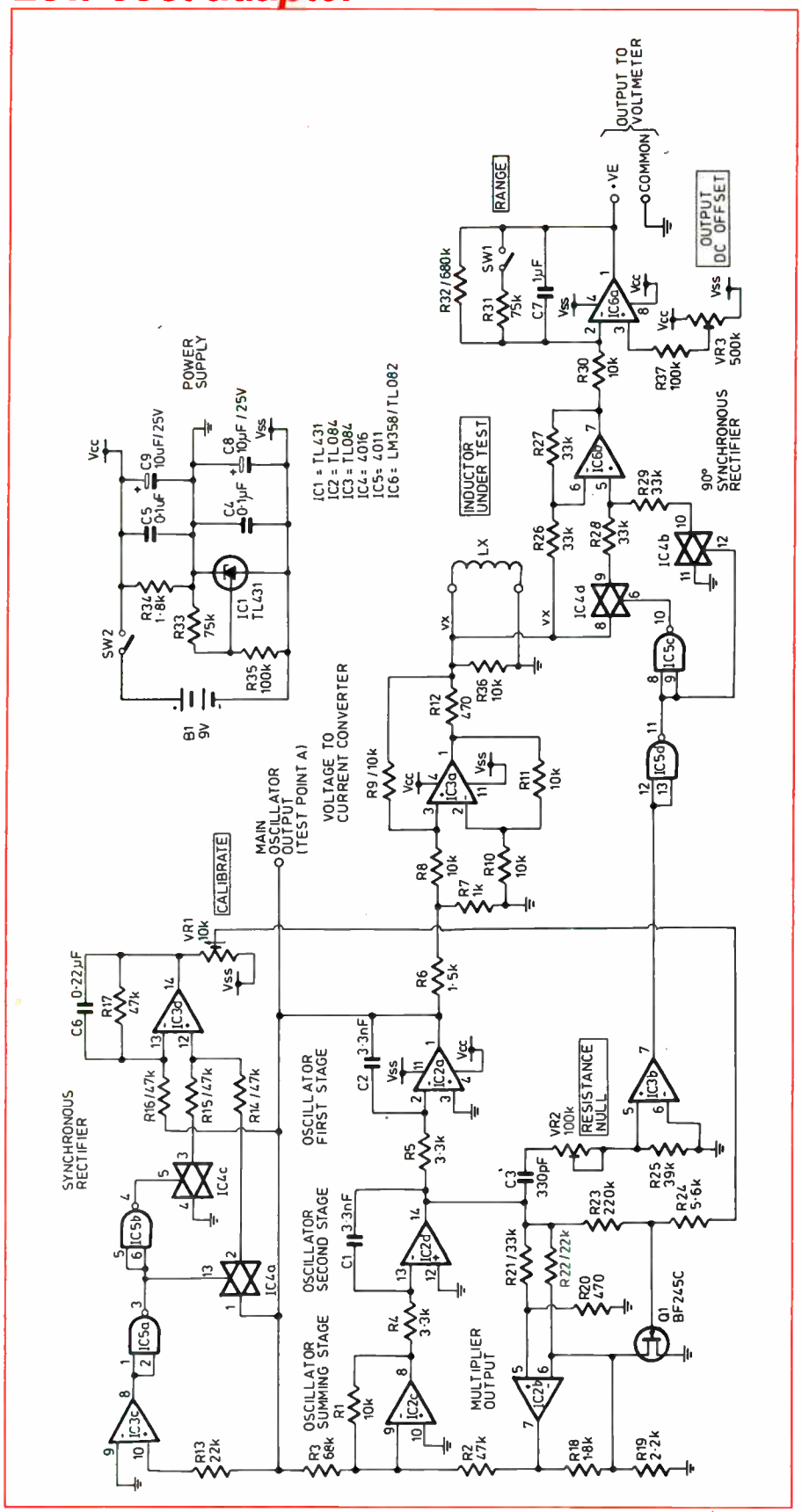
At the rear of the case are the output terminals, for connection to your DMM.

to IC5:B, producing switching control signals which are in phase and 180° out of phase with the signal at TPA. Op-amp IC3:D could amplify the voltage at TPA by a factor of either 1 or -1, depending on the state of the two switch control signals, except for the effect of C6. This capacitor filters the rectified sinewave, to produce a



Inside the author's prototype of the adapter. The PC board visible here is an earlier version, which differs slightly from the final design as shown elsewhere in this article.





Here is the full schematic for the adapter, which uses a novel current drive and synchronous detector system to provide a DC output voltage which is directly proportional to the value of the inducter under test.

DC voltage proportional to the amplitude of the sinewave at TPA. This is then fed back via preset control VR1 to the gate circuit of Q1, to control the multiplier stage and hence the oscillator's output amplitude.

VR1 is used to adjust the amplitude of the oscillator to a known value (nominally 0.5V p-p), as part of the calibration procedure.

The voltage to current converter is made up of op-amp IC3:A and resistors R8-12. The output of the converter is connected to the test sockets, where it drives current through the unknown external inductor Lx.

Vx, the voltage drop produced across the inductor, is passed to a second synchronous rectifier which appears at the bottom right of the schematic. The synchronous rectifier is made up of IC6:B, switches IC4:B and D, and resistors R26-29. This time the switching control signals come from the output of the oscillator's second stage (IC2:D pin 14), which is 90° ahead of the oscillator output waveform at TPA.

Preset pot VR2 is used to compensate for propagation delays in the comparator and inverter sections. This adjustment allows cancellation of the response to any resistance component, in the measurement circuit (see calibration section).

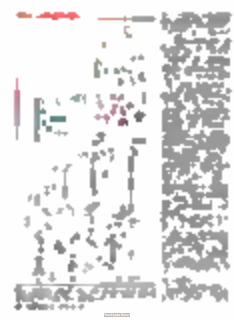
The switching control signals for the second synchronous rectifier are derived from the output of comparator IC3:B (pin 7), and appear at the output of IC5:D (pin 11) and IC5:C (pin 10). The output of the second synchronous rectifier is amplified and filtered by op-amp IC6:A before being fed to the adapter's output terminals, for connection to the external DMM. Switch SW1 is a range switch which gives a 10:1 jump in final stage gain, to cope with small inductance values.

Preset trim pot VR3 is used to set the output DC offset voltage to zero, to give zero output voltage for zero test inductance.

The power supply section uses a single 9 volt battery, with IC1 (a TL431 shunt regulator) used to establish the ground potential roughly halfway between the Vcc and Vss rails. SW2 is the power switch, which should be clearly labelled ON and OFF to aid in saving battery power. A good alternative would be to use a mains voltage adapter which delivers 9 volts DC.

Construction

The prototype of the inductance adapter is housed in a small plastic utility case, measuring 135 x 94 x 47mm. It's the one sold in Dick Smith Electronics stores as



Cat. No. H-2503. Everything fits quite neatly in this case, but you could probably fit it into a smaller or different box if you wish.

Apart from the battery and terminals for connection to the DMM and inductor being tested, everything fits on a small double-sided PC board which measures 93 x 77mm and is coded 92ima12. This mounts up inside the top of the case, with the two slide switches SW1 and SW2 protruding through small rectangular holes for convenient access. The inductor test terminals are mounted on one end panel of the case, with the DMM terminals on the other. The battery fits inside the case, near the DMM terminals.

Assembling the adapter PCB should be straightforward, if you use the overlay diagram as a guide. The main thing to watch is that if you use a PCB *without* plated-through holes, all of the 'via' connections will have to be made by passing short wire links through the holes, and soldering them on both sides.

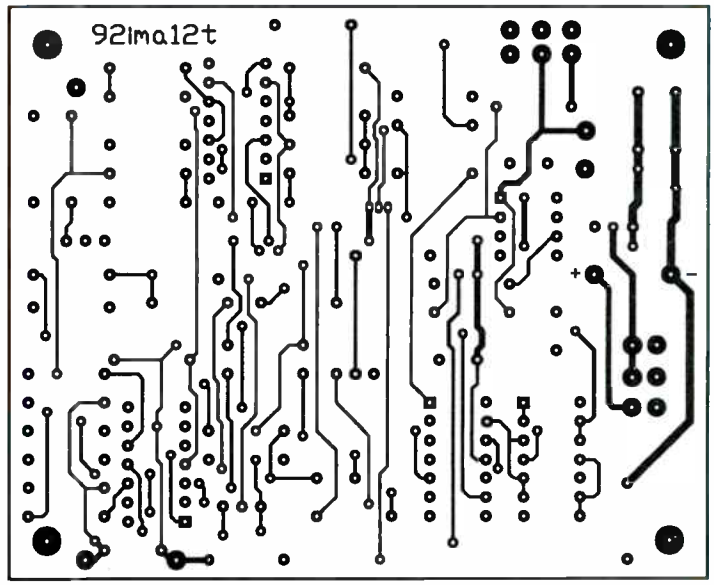
I suggest you follow the usual procedure of fitting the low-profile resistors and capacitors first, followed by the trimpots, switches and finally the FET and the ICs. Take care to make sure that all of the polarised parts are fitted with the correct orientation — including the ICs, FET and electrolytic caps.

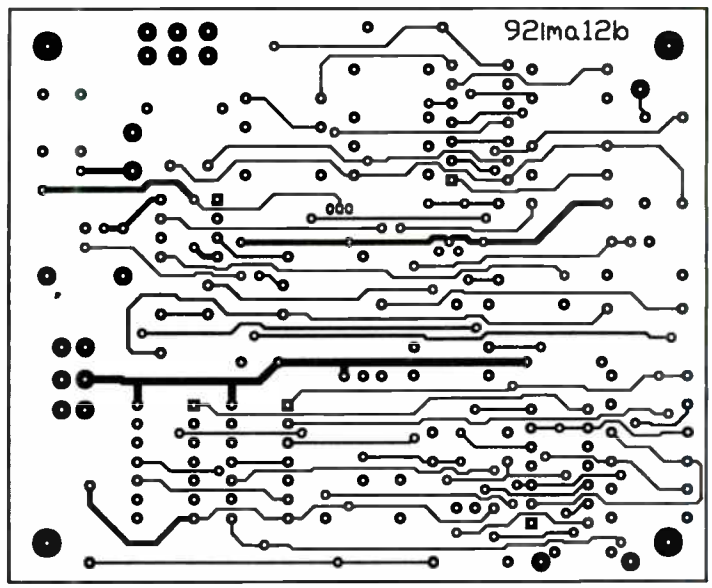
The only wiring away from the board is to the inductor test terminals, the DMM output terminals and the battery. So when all of the components are mounted on the board, you should fit both the battery snap lead and four short lengths of colour-coded hookup wire, for the terminal connections.

The PCB can then be mounted inside the case lid — assuming of course that you have previously cut out the two small rectangular holes for the slider switches. These each measure 9 x 4mm, and you may wish to wait until the PCB assembly is completed before you cut them, to ensure that everything will fit together properly.

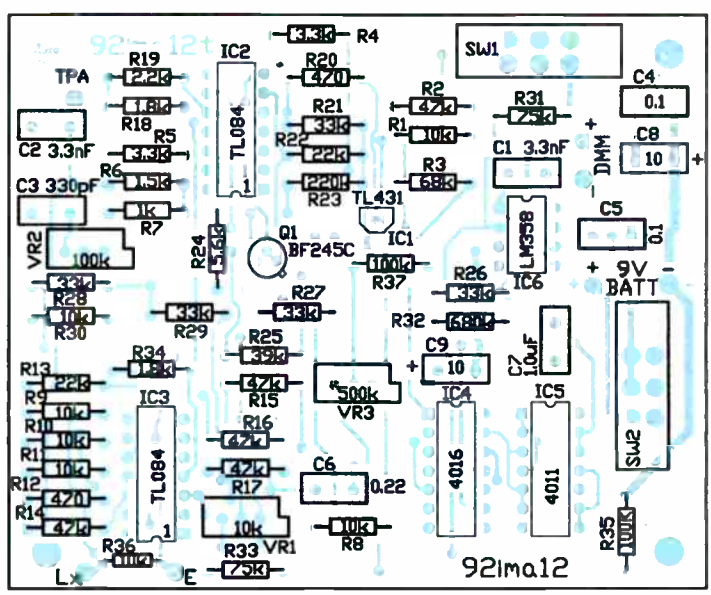
The mounting holes in the PCB don't align with the moulded spigots provided inside the case, unfortunately, so it's easiest to mount it using four 18mm-long 3mm screws, with countersunk heads so that they give a better finish. Four matching holes are cut in the lid, and countersunk to match. Extra nuts are then used on the screws inside, to allow the PCB to be spaced at the right distance inside the lid for convenient switch operation.

A pair of holes are then cut in both the front and rear panels, to take the terminals. With these mounted, the leads from the PCB can be connected to the various terminals. Then it's simply a mat-





Here are the patterns for the top and bottom of the Inductance adapter PCB, reproduced actual size as usual. Ideally, it should have plated-through holes.



Here is the PCB overlay diagram to guide you in wiring it up. The connections to the 9V battery and DMM output terminals are at upper right, while those for the inductor under test (Lx) are at lower left.

Low cost inductance adapter

PARTS LIST

Semiconductors

Q1	BF245C junction FET
IC1	TL431 regulator
IC2,3	TL084 quad op-amp
IC4	4016 quad bilateral switch
IC5	4011 quad 2-input NAND gate
IC6	LM358 dual op-amp

Capacitors

C1,2	3.3nF metallised polyester
C3	330pF ceramic
C4,5	0.1uF metallised polyester
C6	0.22uF metallised polyester
C7	1.0uF metallised polyester
C8,9	10uF 25VW PCB-mount electrolytic

Resistors

(All fixed resistors 1/4W 1%)

R1,8,9,10,11,30,36	10k
R2,14,15,16,17	47k
R3	68k
R4,5	3.3k
R6	1.5k
R7	1k
R12,20	470 ohms
R13,22	22k
R18,34	1.8k
R19	2.2k
R21,26,27,28,29	33k
R23	220k
R24	5.6k
R25	39k
R31,33	75k
R32	680k
R35,37	100k
VR1	10k linear preset pot
VR2	100k linear preset pot
VR3	500k linear preset pot

Miscellaneous

SW1,2 DPDT miniature slider switch
Plastic utility case, 134 x 94 x 47mm; four screw terminals (two red, two black); double-sided PC board, 93 x 77mm, coded 92ima12; 9V battery and snap cable; four 18mm x 3mm countersink-head screws, with 12 nuts to allow positioning and spacing PCB inside case; solder, etc.

ter of fitting the battery (perhaps held down by a small strip of Velcro), to complete the adapter.

I suggest that you don't snap the case together until you've tested and calibrated the adapter, though — this type of case is held together with plastic clips, and these don't take too kindly to repeated opening and re-closing...

Calibration

Calibration is fairly easy, as there are only three preset controls. VR1 controls the oscillator's main output level and thus the current going through the inductor under test.

Use this control to adjust the voltage reading on your meter, to read correctly for an inductor of known value.

You can get a 1mH inductor (or thereabouts) and either find its exact value using a bridge, or use the marked value.

Then on the 'Low' range of SW1 (R31 in circuit), adjust VR1 until the output voltage reads 1 volt, or the correct reading to suit your inductor. You may have to subtract some offset.

The second control, VR2 is used to balance out any resistance sensitivity. Use a 1k resistor across the unknown terminals and use this control to get a zero voltage output reading. (Actually any resistor in the range from 100 ohms to 2k will work fine.)

The third adjustment will allow you to zero out the voltage reading when the inductance is zero. This should be set up before and after the other two adjustments.

Connect a short wire between the test input terminals and use VR3 to zero the output volts.

That's all there is to it. Your inductance adapter should now be ready to use. ❖

THE SERVICEMAN

Continued from page 49

yoke, around the neck of the tube to add a further degree of mechanical support to the whole assembly. The purity rings went back without any trouble and at switch on, up came a perfect picture.

There was just one still unexplained feature of this story — tilting the yoke should have displaced the picture. But as far as I could tell, the picture was still more or less centrally located on the screen.

I can see how the fore and aft movement of the yoke caused the coloured rings. But for the life of me I can't see why the picture remained centred, when the yoke was tilted quite a few degrees downward.

From start to finish, this job had taken no more than half an hour, and had cost half a tube of Super Glue.

Yet when I first saw the set, I would have given nothing for its chances of ever being restored. It was the nearest thing to an apparent writeoff that's ever entered my workshop!

I hope you'll join me again next month. ❖

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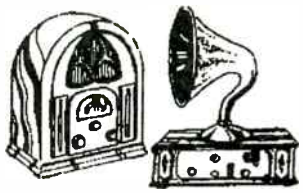


The advent of American metal valves

Sixty years ago, there was a lot of covert research going on in a laboratory of America's General Electric Company. The ultimate outcome was a revolutionary family of octal-based metal valves which were to have a considerable influence on valve development for more than a decade.

During 1930, in a major restructuring resulting from both internal pressures and the threat of US Government anti-trust litigation, RCA, which had previously been only an operating and marketing organisation, took over from two of its principals — General Electric and Westinghouse — the manufacture of its own receiving valves and radio equipment. An outcome of the legal negotiations, which were not resolved until the end of 1932, was that GE agreed to provide a measure of competition by resuming radio manufacture by mid-1935.

GE had disbanded its valve and radio manufacturing facilities in 1930 and now, at the beginning of 1933, had to reinstate these organisations in readiness for the new venture. One thing was clear right from the start. To succeed in the by-now very competitive market, the new GE receivers would need to offer something radically different.

The aspect decided on was valve development, and initially a lot of research was carried out on what was to become the beam tetrode. But it soon became clear that this was not going to be novel enough to base a new venture on.

While this work was under way, an associate company in the UK, British General Electric (Osram) introduced in May 1933 their 'Catkin' metal valves, described in this column for November 1988. Also, since 1931, the industrial section of American GE had been studying the possibility of making thyratrons (gas-filled valves) in metal envelopes. There were many detail problems to be solved, especially welding and seals, but by late 1933 GE had, based on this research, produced a practical design. Metal valves could, it seemed, work — and they might provide the novelty for the new venture.

Meanwhile RCA, by now a major valve manufacturer, had been busy with their own research and development. Early in 1933 they had produced the 'Acorn' valve, which could be used for much higher frequencies than conventional valves. This led to the developmental forerunner of what became the button base — familiar in the later 'all glass' miniature and noval based valves.

'Flat press' base

As an offspring of the electric lamp, early valves had evolved with the same method of electrode support. As can be seen in the left of Fig.1, a glass sleeve had one end flattened and embedded in this were the electrode support and lead out wires. The other end of the sleeve was fused to the bottom of the envelope.

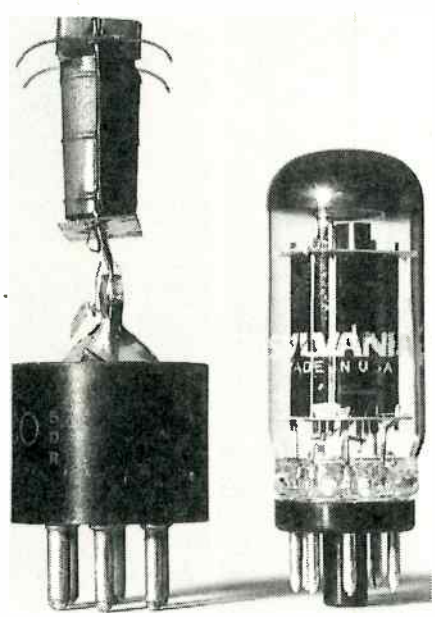


Fig.1: The internals of a traditional type 42 (left) show clearly how the 'press' with in-line element supports gave poor support. At right is a late-model Sylvania 6V6GTA, showing the 'button' type base which was first developed by RCA for the 'bullet' tube, and then used in the metal octal valves.

This form of construction had several shortcomings. It produced an undesirably tall assembly, with the extra length of the leads degrading high frequency performance. With electrode support in only one plane, mechanical stability was also poor. A further weakness was the separate base, cemented to the glass, which frequently became loose.

By mounting the supports in a circle in a flat button of glass, RCA solved all these problems in one move. Not only was the new assembly more rigid, but the lead length was significantly reduced and it was even possible to eliminate the base by embedding the contact pins in the glass button.

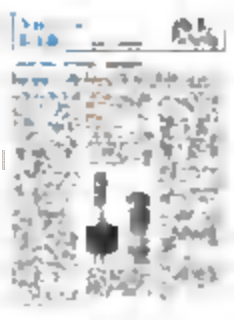
RCA had heard rumours of mysterious goings-on with metal valves at GE, and so embarked on a programme of development of an alternative valve to be filed away 'just in case'. The outcome was the 'bullet tube', incorporating the button base and fitted with a metal shield. Significantly, the final version had a revolutionary new eight-pin base with a locating spigot.

The bullet tube/valve was never put into production, although as can be seen from the right-hand side of Fig.1, the button base and the octal socket ultimately came together in a late form of the GT valve, to produce something very similar. Not until 1939 did the all-glass button base appear in production valves, the first being the miniature 1.4 volt battery series.

'Wired in' valves

Meanwhile, by early 1934 the basic design and manufacturing procedures for what was to become the metal series had been completed by General Electric. The proposal was that rather than using sockets, these valves should be wired in permanently; and samples were made accordingly.

Having dismantled their receiving



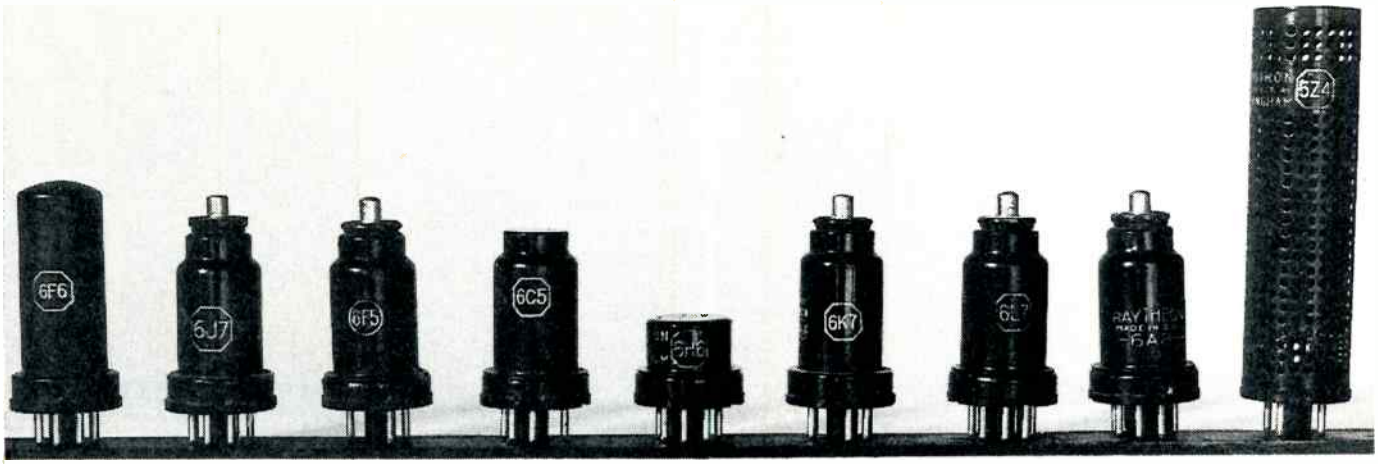
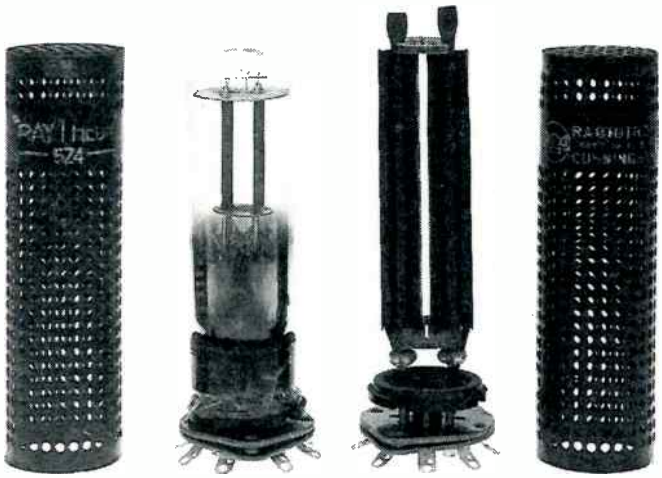


Fig.2: The original nine GE/RCA metal octal valves, as listed in the table at lower right. The 'bird cage' construction used for the 5Z4 rectifier (far right) proved unreliable, and was soon changed into that used for the 6F6 (far left).



THE ORIGINAL NINE METAL VALVES

TYPE	FUNCTION	CHARACTERISITICS
5Z4	RECTIFIER	SIMILAR TO 83V
6A8	PENTAGRID OSCILLATOR/MIXER	REPACKAGED 6A7
6C5	GENERAL PURPOSE TRIODE	MODIFIED 6C6/77
6F5	HI MU AUDIO AMPLIFIER	NEW DESIGN
6F6	OUTPUT PENTODE	REPACKAGED 42
6H6	DOUBLE DIODE	NEW DESIGN
6J7	SHARP CUTOFF PENTODE	REPACKAGED 6C6/77
6K7	VARIABLE MU PENTODE	REPACKAGED 78
6L7	PENTAGRID MIXER/AMPLIFIER	NEW DESIGN

Fig.3 (left): The internal structure of the 5Z4 'bird cage' rectifier (right) resembled the earlier English Marconi-Osram Catkins, with their vacuum-tight anodes. Raytheon's first version of the 5Z4 (left) retained the traditional glass technology, and should strictly have been called a 5Z4MG.

valve manufacturing division four years previously, GE must have been unsure of their ability, in the time available, to undertake the massive tooling and establishment necessary for the mass production of a radically new type of valve. Instead, approaches were made to RCA to undertake the manufacture of the metal valves. RCA agreed and towards the end of 1934, in great secrecy began to set up the necessary machinery.

The octal base

One aspect of the GE design that RCA was unhappy about was the elimination of the valve socket. GE agreed that the metal valves should have plug-in capability, and accordingly they were fitted with the same octal base that RCA had developed for the bullet valve.

That this was a good choice has been confirmed by history. The octal socket has proved to be one of the most successful, versatile and reliable of the numerous types that appeared during the long history of the thermionic valve. At the practical level, the spigot makes accurate location in the socket much easier than does most other types and, significantly, the octal socket has been adopted for other purposes such as plug-in relays.

On April 1st 1935, RCA and GE unveiled the revolutionary new all-metal valves, to be featured in their new season's receivers due for release in September. This move put the rest of the industry, who were already committed to production of their new season's models, into shock. There followed a high powered advertising and publicity campaign, and RCA and GE made a killing with the 1936 models.

The technical press had a field day, some writers even implying that technicians would have to learn a new advanced technology! In Australia, AWV gave full details of the series in the October 30th 1935, issue of *Radiotronics*.

Family of nine

Unlike the English Catkins, which never had a frequency converter, diode or rectifier, the American metal valves entered with a full range. This was a strong selling point, as metal valved receivers could use completely new types.

As shown in the table, there were nine different types in the initial RCA release, but only three were completely new designs. Five were based on currently popular valves, and the rectifier was a derated version of an existing type.

Of the new types, the 6L7 was the most revolutionary, being effectively an RF pentode with two control grids. Its chief function was as a frequency converter, with a separate oscillator valve. This combination, intended for more elaborate receivers, was superior to that of the 6A8 pentagrid oscillator/mixer whose performance fell off seriously above about 15MHz.

The 6H6 was the first double diode, apart from rectifiers, in the 'main stream' American range. With independent cathodes, it had a potential versatility that was rarely used fully. The 6H6 was often used in combination with the third of the new designs, the high-mu 'resistance coupled' 6F5 triode — which was more or less the equivalent of the

triode section of the popular double-diode-triode type 75.

Two puzzling features of the original metal range have often been debated. First was the use of existing designs in what was supposed to be a revolutionary new type of valve. One argument is that development time ran out.

The other mystery was the absence of a combined diode/triode or diode/pentode. This meant that if a receiver was to have AGC, by now standard on all but the cheapest of models, an additional valve socket was required. This may have been a ploy to foil last minute changes to the new valves, by manufacturers already tooled up for the new season's models.

An unconvincing argument was that too many difficulties were encountered in initial attempts to make such a combination valve. But after all, there were several such valves in the RMA range by that stage.

Now, after more than half a century, complete answers to these questions are unlikely ever to be found.

The missing tenth

One strange aspect of the metal valve saga was the existence in the initial series of a tenth valve. Early pre-release advertisements list nine valve types, but instead of the 6F5 high-mu resistance coupled triode there is a 6D5, using the same shell as the 6F6.

The *Australian Radio Trade Annual* for 1936 includes all 10, but RCA valve manuals have never acknowledged the 6D5. There is little evidence of its ever having been used in a receiver, but specimens exist. The 6D5 was an indirectly heated output triode, with characteristics intermediate between the old 45 and those of a triode connected 6F6. Apparently it was realised that there would not be be much demand for such a valve, and by the release date, the 6F5 had taken its place in the RCA list.

There were initially three envelope patterns, plus a short lived 'bird cage'. The 6H6 was unique with a very squat shell, whilst the high-dissipation output and rectifier valves had the plain taller cylindrical envelope. More shapely, with stepped tops, were the 6C5 and those with grid caps.

The original 5Z4 was anomalous, in that its appearance and construction were unlike the rest of the metal family. In fact with its perforated protective cover and internal construction, it closely resembled the Marconi/Osram 'Catkins' of 1933. Inside were two pencil-thin vacuum tight anodes, surrounding indirectly heated cathodes.

Some manufacturers, when they got into the metal valve business, used the traditional glass envelope inside the perforated 5Z4 shell.

The smaller pioneer metal valves proved to be very successful, and were the progenitors of what was to become a large family. Initially there were some teething troubles with the 6F6, to be later rectified, but a major concern was the 5Z4 which in its original form proved to be unreliable. It was soon redesigned to eliminate the breakdown problems and to fit in the 6F6 type shell, but receiver manufacturers remained suspicious and thereafter favoured the proven glass-shell 80 — resurrected with an octal base as the 5Y3G.

Hybrids

By the end of 1935, five major US valve manufacturers had joined RCA as metal valve makers, leaving the second-ranking makers with a problem. Machinery for the new processes was extremely expensive, but they had somehow to be in the market.

The initial solution was the hybrid 'metal glass' valve. Existing facilities were adapted to produce glass valves with slightly narrower than normal, straight-sided envelopes. These were fitted with an octal base and a black painted thin metal shield. The result was quite a bit taller than the true metal type, but the metal glass valves, with an 'MG' name suffix, served until the industry sorted itself out a year or so later.

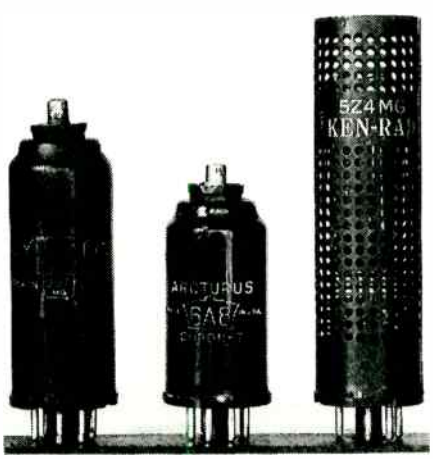


Fig.4: The 'metal glass' construction was the easy way out, for some makers faced with massive re-tooling costs. Hytron's 6Q7MG (left) used a tubular glass envelope with a metal shield; the Arcturus 'Coronet' series (6A8,centre) looked less traditional, but still had an internal glass envelope; while Ken-Rad (right) only progressed to metal valves in 1935, making the MG type until then.

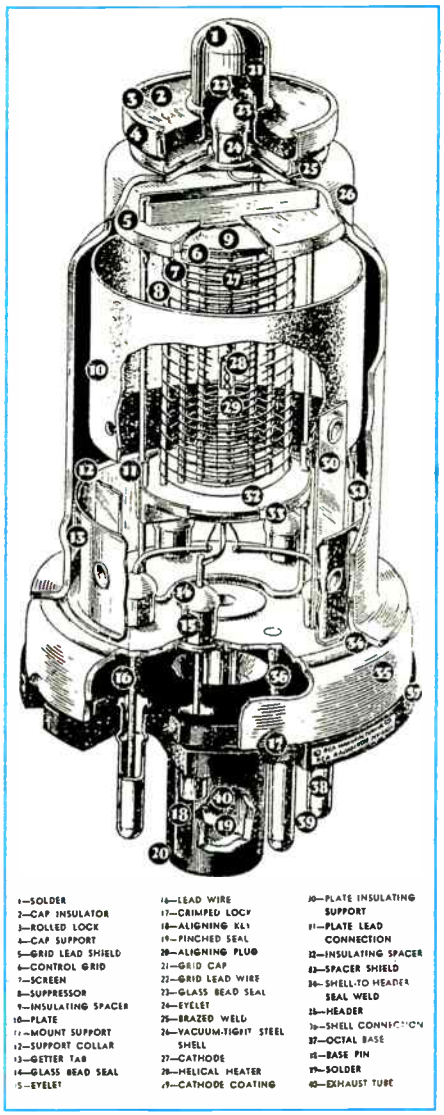


Fig.5: A cutaway drawing of the inside of a 6K7 metal octal valve, as shown in early RCA (and AWV) data books. The various components are identified; note the exhaust tube inside the octal base's central spigot.

One variety of metal glass valve deserves special mention. Arcturus, notable earlier for their blue glass envelopes, produced their 'Coronet' metal clad series. The stem, instead of ending in a flat press, had a circular crown of support wires — hence the name.

This construction permitted the Coronets to be shorter than the other makes of MG valves, and Arcturus even made earlier valve types with the MG construction and including the octal base! This led to the slightly ridiculous situation of early 2.5-volt filament types like the 27 being available in Coronet form, but needing octal conversion adaptors to fit the receiver sockets.

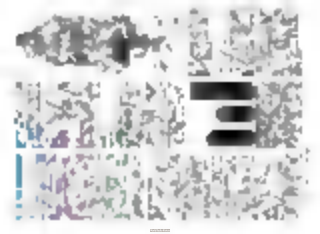


Fig.6: With the metal valves appeared the reliable octal base, which proved to be very successful and long-lived.

Metal valves were not made in Australia, and those with the Philips brand were probably made by RCA. A 1936 *Australian Philips Technical Communication* treads a narrow path between enthusiasm and damning with faint praise, in promoting their American metal valve range. Philips was about to launch its 6.3-volt Red Series, and they stated bluntly that the metal series was, for commercial reasons, released in a 'somewhat imperfect state of development'. This statement reinforces the theory of insufficient time for the design of a full range of new types.

We've only been able to cover the birth of the octal valve, in this article. The subsequent story occupies a significant place in valve history, but will have to wait for a future column.

Several Australian receiver manufacturers were quick to use the new valves, but as time went on, fewer metal valves were used in locally made sets. Next month we will describe one of the early Australian-made receivers using metal octal valves. ❖

Collector's Corner

Where readers display prized items of radios and other equipment from their collections, and/or seek information from other collectors...

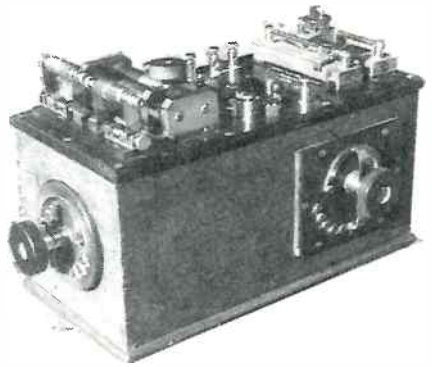
Early RAN set

I noted your new 'Collector's Corner' feature, and decided to write in. Hopefully someone may be able to identify a receiver in my possession; I have been unable to locate any information other than the place of manufacture and a rough estimate of the date. The case is of mahogany, with a top panel of ebonite. All fittings are of brass and ebonite.

The circuit is a loose coupler with two fixed crystal detectors, one acting as a backup. A crystal bias voltage is present, suggesting the original use of carborundum detectors. There are two variable resistors, mounted on slate blocks, to vary the bias supply. Fine tuning is achieved with a sliding air capacitor of the type used in some of the early Marconi equipment.

Two brass brackets are attached to each end of the receiver, to bolt the unit to a table for use at sea. Markings on the top of the set read 'Royal Australian Navy', 'Randwick' and 'N13/25'.

From general wireless history I know that the Navy purchased Father Shaw's Randwick Wireless Factory (the first in Australia) in 1917, and production ceased in 1922. I suspect this receiver was built between 1919 and 1921, but am not exactly sure.



I would be most grateful if anyone can supply more information on this receiver. By the way, thanks for Peter Lankshear's excellent Vintage Radio column. **(M.F., East Bentleigh Vic.)**

Replica specialist

My hobby is not collecting and restoring old radios, but building replicas of sets I originally built in the period from 1921 to 1941. So far, I have built three crystal sets, four one-valve sets, a short wave set and others. I enclose a couple of photographs. The Ultra Audion one-valve set is my pride and joy.

It gives me great pleasure to listen to these old sets and marvel at their efficiency.

The main difficulty is in finding vintage variable condensers, variable grid leaks, dials, rheostats and valve sockets.

Back in 1921 we had to be satisfied to listen to Morse code, as the only broadcasting stations were over 1000 miles away, and of low power. Boys with only pennies to spend had to make most of their own parts, as well. We even made our own crystals.

By the way, I still have a pair of Stromberg-Carlson headphones as shown on page 30 of the September issue. They still work, too. **(K.J., Nelly Bay, Qld.)**

Need some information on a piece of old equipment? Or perhaps you'd merely like to brag about a prized item in your collection. Either way, write to Collector's Corner, c/- Electronics Australia, PO Box 199, Alexandria 2205. Enclose a photo if possible.

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We guarantee our Jetservice Courier will deliver to your door faster than any other Australian supplier (including that local supplier just up the road). If we fail, I'll give you your money back plus $5.00 for your inconvenience.

Mini Home PABX Telephone Exchange Kit (SC Aug/Sept '92) NEW KIT

This great unit allows you to place calls on hold, intercom other extensions, answer calls from any extension and transfer calls. It is expandable up to 10 extensions, and is compatible with all DTMF (touch tone) telephones. Operation is as simple as pressing '*' to place a call on hold, press the extension number (0-9) and the respective station rings. Once answered, you have a two way intercom, with which you can announce a call. To pick up the incoming call from hold press '#'. A neat feature is that all extensions will ring when an incoming call is placed on hold for 30 seconds so that it won't be forgotten. The Basic kit is complete with power supply, case and facilities for 3 extensions. Extra extension boards allow expansion in multiples of 3. Simple operation, fantastic for home or small office. No more shouting from room to room. Not Austel Approved.

K 1430 Basic Kit **$189.00** K 1435 Expansion Board **$79.95**

Multi-Station Headset Intercom Kit

(SC June/July '92) NEW KIT!

This multi-station headset intercom is designed to provide clear communication in high noise environments such as at race tracks and rock concerts. It is designed to operate with a headphone and mic combination. Each headset requires a station module. Stations are simply connected in a daisy-chain fashion. Up to 12 units (stations) can operate from the power supply. Features low noise circuitry and compares favourably to many commercial equivalents. Mics can be switched on continuously at one time for hands free operation of all stations. Also includes visual and audio call function. Ideally suited to our C 9055 headset/mic and the C 9070 noise attenuating Aviation Headset.

Compares to Commercial Units as Used in Industry Costing $$$ More!

K 5250 Station Module **$74.95**, K 5255 Power Supply **$64.95**

3½ Digit LCD Panel Meter Kit (S.C. Sept '92)

Ideal addition to power supplies, voltage meters, current meters etc. It can be calibrated to accurately read 2mV, 2V, 200V. Requires 9 volt power supply. Programmable decimal point. NEW KIT!

K 2528 **$34.95**

Ni-Cad Battery Discharger Kit

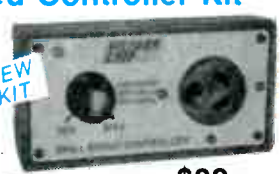
Designed to rid your nicad batteries of the 'memory effect' and regain full recharge potential. It discharges your nicads correctly to enable a full recharge. Suits most battery packs. Great for mobile phones, battery drills, toys etc.

K 1640 **$24.95**

Drill Speed Controller Kit

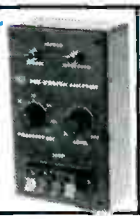
(S.C. Sept '92) NEW KIT

Variable speed controller for 240V power tools including drills, power saws, engravers etc. suitable for brush-type tools up to 5A. Not suitable for globes or radiator heaters.



K 6010 **$39.95**

Sub-Woofer Adaptor Kit (EA May '89)

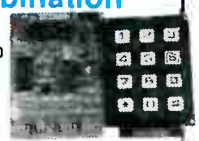


Get an amazing bass improvement from your stereo system. This fantastic adaptor simply "samples" your stereo amp output and provides a single channel output to feed a separate sub-woofer amp. Requires 12V AC or M 9020 plugpack.

K 5560 **$29.95**

Four Digit Combination Lock Kit

(SC Dec '90) K 1925 **$44.50**



This 4 Digit Combination Lock is bound to prove useful in many applications. Such as accessing alarm systems, electronic doors, ignition killers or just about anything that comes to mind Momentary or latched relay output.

Door Strike

Ideal for security access areas, this high quality lock will fit most door jams. Operates from 12V AC or DC. Ideally suited to K 1925 Combo Lock Kit.

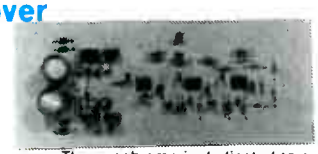
S 4390 **$39.95**

Apologies

In September & October ads we incorectly advertised a K 3301 Power Supply Option for $4.50. This should read $29.50. *ALTRONICS* apologises for the inconvenience.

2 Way Active Crossover

(E.A. Jan '92)



This great new kit enables you to customize your sound system in your car or at home. The circuit simply connects between the audio source and the amplifiers. There are two outputs, one for bass and another provides signal for the upper range. Thus each amp is dedicated to a frequency range (i.e. one for bass, one for midrange and treble). Because no passive crossover is required in the speaker one per channel is required. Operates on + and -15V rails. The result is a much better sound with less distortion.

K 5570 **$19.95**

High Power Amplifier Modules Kit

(SC Dec '87)

All components, including output transistors mount on a single PCB. Suitable for high quality guitar amp, public address or in a high fidelity stereo amplifier. Kit includes angled heatsink bracket, main heatsink and a in-built polyswitch for loudspeaker protection. Full specs available on request.

K 5140 100W Version ~~$69.95~~ NOW ONLY **$55.00**

K 5150 150W Version ~~$99.95~~ NOW ONLY **$85.00**

Digital Altimeter for Gliders

This compact digital altimeter can display altitude up to 19,990 feet with 10 feet resolution. Accurate to better than 3.5 percent. A must for hang-gliders, ultralights etc. Operated on 9V battery.

K 2580 **$299.00**

Megohm Meter Kit (EA May '89)

Checks electrical wiring and appliances for insulation breakdown by passing high voltage (selectable 500 or 1000V) at low current through the test appliance. Includes calibrated megohms scale. Great for checking transformers, wiring etc Requires 6 AA batteries (not included).

Our Biggest Selling Kit!

K 2555 **$79.00**

LED Digital Tacho Kit

(SC Aug '91)

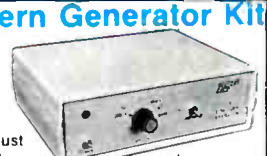
This digital tachometer will tell you how many revs your car's engine is doing. It works with all ignition systems and 4, 6 and 8 cylinder cars. Indicates that 0-9900 RPM with a resolution of 100 RPM. PCB only.

K 4320 **$31.00**

Colour TV Pattern Generator Kit

(S.C. Nov '91)

This great kit makes servicing and aligning TV sets much simpler. Patterns include • Checkerboard • Crosshatch • Red Raster • Dot • Colour Bars • Greyscale. A must for any serious service person. Requires M 9020 12V AC plugpack.



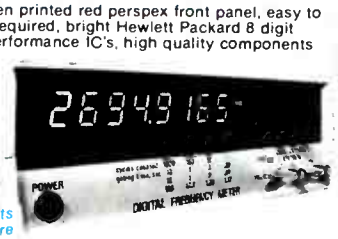
K 2710 **$115.00**

1GHz Digital Frequency Meter Kit

(S.C. Nov '87 to Jan '88)

Features: Professional machined and screen printed red perspex front panel, easy to assemble and construct, no special tools required, bright Hewlett Packard 8 digit display, electronic switch latching, high performance IC's, high quality components

Specifications Operational Modes: Period, freq to 10MHz, freq to 1GHz. **Freq. Range:** 10Hz-1GHz (1.7GHz typical) in frequency mode; 10Hz-2.5MHz (5MHz type) in period mode. **Gating Times:** 0.01, 0.1, 1 and 10 seconds (10MHz and 100MHz); 0.128, 1.28, 12.8 and 128 sec (1GHz range).



K 2515 **$299.00** Compares Favourably to Commercial Units Costing $$$ More

Low Cost Dual Tracking Supply Kit (SC Jan '88)

Ideal for experimenting and prototyping with Memory, Logic and Op Amps **Features:** Adjustable + or - 18.5V at 1.7A, volt meter, floating ground, dropout indicator, load switch, compact sturdy "ABS" instrument case

K 3325 **$89.00**

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Any model an absolute necessity where 240V isn't available. Call **Altronics** today for more information on freecall **008 999 007**.

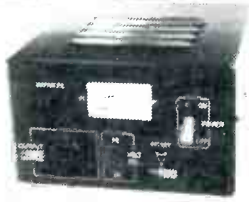
300 Watt
K 6750 Kit Version **$279**
K 6755 Built-up **$379**

600 Watt
K 6770 Kit Version **$499**
K 6774 Built-up 12V Input
K 6775 Built-up 24V Input **$625**

1200 Watt
K 6790 Kit Version **$799**
K 6792 Built-up 12V Input
K 6793 Built-up 24V Input **$999**

New Improved Models
These fantastic inverters now offer even better performance and reliability by utilizing new multiple Mosfet technology and circuit design.

300 Watt Economy Inverter



Turn **12V DC to 240V AC**. This fantastic inverter will power lights, TV's tools, electric shavers and a whole host of other appliances. Great for camping, out in the bush and any place where 240V is not available. **Features:** Complete with over current circuit breaker • Fused 240V output • Built in panel meter to monitor output voltage • panel meter to monitor output voltage • Strong steel case and chassis

M 8120 **$249.00**

NIMROD Gas Soldering Iron

T 2449 **$39.95**

Now you can solder anywhere with this new gas soldering iron. **Features:** See through gas chamber (no more guessing how much gas is left) • Built in ignition cap • Uses standard butane gas • Comes with safety bench stand • Supplied with 2mm soldering tip and blow torch tip • Adjustable temperature from 400°C to 1200°C • Can be easily refilled with standard butane lighter gas • Replacement tips are less than half price of some other brands.

REPLACEMENT TIPS — ALL $6.00 ea

T 2451 Replacement 1mm Conical Tip
T 2452 Replacement 2mm Conical Tip
T 2453 Replacement 3mm Conical Tip
T 2454 Replacement 3mm Chisel Tip
T 2455 Exhaust Port $6.50
T 2456 Hot Knife Tip $6.00
T 2457 Hot Blower Tip $12.50
T 2458 Blow Torch Tip $12.50
T 2448 Butane Gas Refill $6.95

Car Voltage Adaptor

This handy unit simply plugs into your car's cigarette lighter socket and presto! Gives you switchable 3, 4.5, 6, 7.5, 9 and 12V DC at up to 800mA. Includes a range of output plugs. Reversable polarity. Great for pocket TV's, radios, portable CDs etc.

M 8150 **$16.95**

Sealed Lead Acid Batteries

As used in security systems, battery backup for computers, solar power systems etc.
Premium Grade Long Life

S 5065	12V/1.2AH	$29.95	S 5069	12V/4AH	$49.95
S 5067	12V/3AH	$44.95	S 5070	12V/6.5AH	$54.95

Over 30[illegible] now in service throughout Australia — Our customers include Universities, Research Establishments and Industry

Famous Labtech 20MHz Dual Trace Oscilloscope

Includes Free Freight anywhere in Australia

This model is a dual trace 20MHz oscilloscope using a high brightness CRT. The vertical amplifiers have high sensitivity of 5mV/div and a frequency characteristic response with smooth roll off exceeding 20MHz. The TV sync signal operator circuit is provided to ensure stable observation of video signals. Triggering is obtained by sampling the AC power waveform, external waveform or internally generated trigger.

Q 0156 This Month Only **$649.00**

Cro Probes

Ideally suited to Q 0156 (2 required). Superb quality DC to 80 MHz Max 600 Volts DC Lead length approx 1.5m.

Q 0175 **$49.95** ea

Logic Probes

Q 1280
Illustrated

Two models available. Both feature audio and visual 'hi' and 'low' indication, and TTL/CMOS compatibility. Deluxe version includes a logic pulser function making it even more versatile for fault finding, and a 50Hz logic probe. Economy version includes 20MHz logic probe only.

Q 1272 20MHz Logic Probe **$37.50**
Q 1280 50MHz Logic Probe Pulser **$54.95**

Digital Engineering Multimeter

This fully featured meter offers performance and facilities which are normally only found on far more expensive meters. Features include DC and AC V, DC and AC current (up to 10A), transistor check, capacitance check (up to 20uF), resistance and continuity, frequency count, temperature via optional thermocouple (°C or °F) and high impact case just to mention a few.

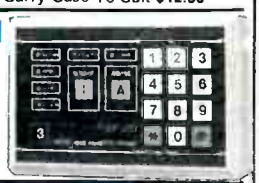
Q 1064 **$149.50**
Q 1065 Carry Case to Suit **$12.50**
Q 1067 Thermocouple to Suit **$29.95**

Our Top Selling Digital Multimeter

With quality and features you would expect only on expensive meters the Q 1056 represents excellent value for money. 17 Ranges include DC and AC volts, resistance, diode check, DC current with 1.5V and 9V battery check.

Q 1056 **$49.95**
Q 1057 Carry Case To Suit **$12.50**

Flush/Surface Mount Alarm Panel



With stylish compact good looks this alarm blends smoothly into any residential or office decor by either flush mounting into the wall, or surface mount. 3 sectors include 24 hour panic/fire, perimeter and internal which can be isolated enabling the alarm to be armed at night with occupants inside whilst still protecting entries. Simple 4 digit access code for operation. See Altronics '92 catalogue for full details.

S 5490 **$119.00**

Alarm Power Supply

This UPS (Uninterruptable Power Supply) will supply 12V at 1.2 Amps via its internal inbuilt sealed lead acid battery even when the mains has failed. Ideal for use with alarm system power supplies monitoring systems, warning systems etc.

M 9090 **$69.95**

Super Small PIR

Incredibly Small! Only 55 x 31 x 73mm

Incorporates Pulse Count Triggering which virtually eliminates false alarms. Operates on 8-16V DC. Features: walk test LED, wide 12x12m detection, N.C. tamper switch, interfaces with most alarm panels. See *ALTRONICS* '92 catalogue for full details.

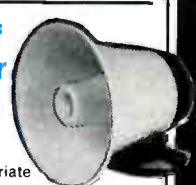
S 5302 Normally ~~$79~~.00
This Month **$69.00**

Siren Cover

Protects external siren from tampering, weather etc. Also ideal for mounting strobe. Suits C 2015 horn speaker. Tamper switch available.

S 5460 **$28.95** S 5160 Tamper Switch $1.85

Weatherproof Horn Speaker



10 watt, 8 ohm. Ideally suited to S 5460 siren cover and our alarm panels. This horn can deliver in excess of 120dB when driven by an appropriate driver circuit.

C 2015 Normally ~~$15.95~~
This Month **$12.95**

High Energy Siren

Absolutely ear splitting SPL 120dB. Handy bracket for wall mounting etc. 12V 300mA. Ideal for industrial applications or alarm systems. **Dimensions:** 100mm Diam. 125mm L.

S 5177 Normally ~~$28.95~~ **$25.00**

Alarm Strobes

Uses Xenon Strobe tube for high energy flash. Output rate approx 1 per second. 12V DC, 320mA. Dimensions: 97mm diam, 50mm High.

S 5455 Blue
S 5450 Red ~~$27.95~~ Now **$20.00**

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ALTRONIC COMPONENTS

Amazing Nicad Battery Bargain from $2.00

At full specification premium quality. Good for up to 1000 re-charges.

		1-9	10-24	25+
S 5020	AA 500 MAH	$2.95	$2.50	$2.00
S 5022	'C' 1.8 AH	$8.00	$7.00	$6.00
S 5023	'D' 4 AH	$14.00	$13.00	$12.00

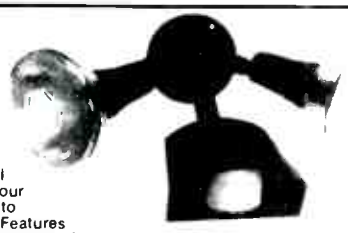
AC-DC Power Packs

These multi-purpose AC-DC adapters are just great for toys, calculators, radios, etc etc. Both include a range of output voltages, a range of plugs reversible polarity and are energy authority approved.

M 9000 3, 4.5, 6, 7.5, 9, 12V @ 300mA ~~$18.95~~ $17.95

M 9005 6, 9, 12V @ 500mA ~~$22.50~~ $19.95

Passive Infra-Red Flood Light Control



Just arrived, this new model PIR floodlight activates when it detects movement of a person or car approaching. Great to welcome visitors, ward off intruders or even to find the keys in the dark! Features daylight sensing circuit which means unit will not activate during daylight hours (save on your power bill). Includes manual override facility to turn lights on continuously or automatically. Features movement sensitivity adjustment, and turn on period. Great for the driveway or backyard. Complete with two screw in type sockets for standard 150W floodlight globes (not included).

S 5350 $49.95

Telephone Answering Machine

Telecom approved

Features: Variable length outgoing message (maximum 30 seconds • Security code access for remote • Call screening • 12 month replacement guarantee • Optional Full function DTMF Remote Control for Playback, Reset, Save, Outgoing Message change.

A 0492 $119.95

A 0493 Optional Remote $24.95

Altronics Aviation Headset

High performance Series II. Features • Noise attenuating earphones • Noise cancelling mic • Sturdy construction • Cushioned head pad • Includes standard aircraft jacks • Over 4000 sold Australia wide • Don't pay $400 or more!

C 9070 Headset $189.00

C 9075 Carry Case To Suit $19.50

Universal Remote Control

This universal infra-red remote control makes all other remote units superfluous. Will control CD players, videos, TV's and stereos etc. Controls up to 6 different appliances. Easy to use and programme from an existing functional remote

A 1000 $69.95

Telephone Double Adaptor

Ideal for answering machine and phone

Converts sockets into a double socket to allow you to plug in two phones.

P 0995 $4.95

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Mr Keating, Mr Hanratty

WHY PENALISE US FOR LIVING IN THE COUNTRY?

SHORTWAVE LISTENING

by Arthur Cushen, MBE

International broadcasters using Russian transmitters

It started off with several small stations hiring time on four of Radio Moscow's outlets, but in the last few weeks, three international broadcasters — the BBC, Radio Nederland and Deutsche Welle — have announced a major use of transmitters located in the Commonwealth of Independent States.

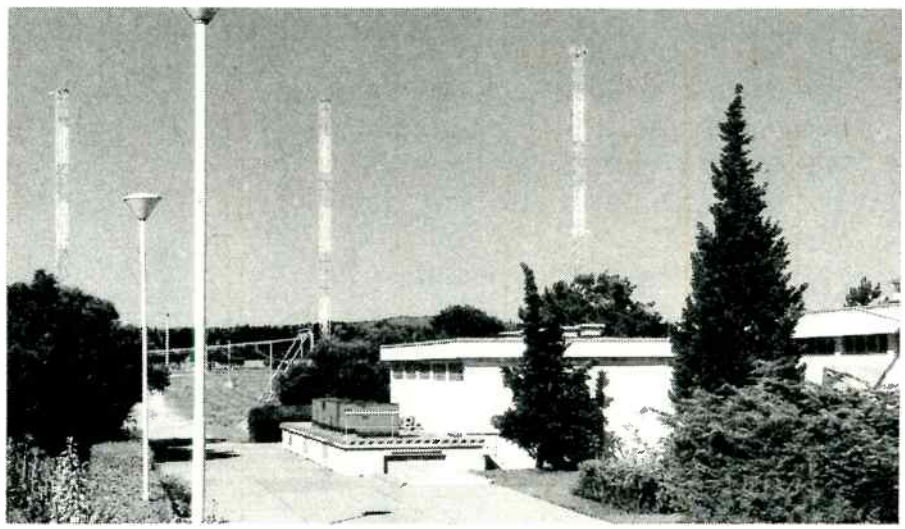
Following extensive research, Radio Nederland presented a plan to the Dutch Government to build a relay base, in cooperation with the BBC, in Thailand. But this plan was rejected by the government, even though the BBC is still continuing with the base.

Since surveys had shown that transmissions from Flevoland (in the Nederlands) and Madagascar are not of sufficient strength to reach South East Asia, Radio Nederland is without a base in Asia and has a growing reception problem in that area.

To cover this, a delegation visited Moscow and made an agreement to hire transmitters in the former Soviet Union. Radio Nederland has already commenced broadcasting from these transmitters, and it is expected that additional frequencies will be added to its schedule in the near future.

The BBC has announced that it is also to hire air time on Russian transmitters. Two sites in the Russian Far East will be used to improve reception of the BBC Mandarin language service beamed to mainland China.

These broadcasts are currently carried from the BBC relay base in Hong Kong and Singapore, but both suffer intense jamming from the Chinese authorities. The BBC will also get air time on a transmitter in Tashkent, Uzbekistan to beam programmes into the Indian sub-continent.



Deutsche Welle transmitting station at Sines, Portugal.

Deutsche Welle, the German external service has also been using former jamming transmitters, with programmes beamed to Asia for some time. It has been happy with the arrangement, because the signal is closer to the target area. Deutsche Welle is also upgrading some of its relay facilities and the one in Sines, Portugal is to have two rotatable antennas which will be used for transmissions into Europe and Africa.

Better allocations

Frequent shortwave listeners will have noted that over the past few months, with the collaboration between Western and Eastern Europe, there is now less interference on shortwave transmissions.

In the past, the Western countries met to determine the frequencies they wished to use, while in Eastern Europe, a separate group was meeting for the same purpose. With the ending of the Cold War, it became obvious that clashes of frequency could be overcome — when more than one broadcaster was using the same frequency at the same time to reach the same target area.

A recent meeting in Britain allowed stations to compare notes, and according to Media Network the conference was well worthwhile.

A list showed that there are 1570 frequencies shared by two broadcasters, with stations operating on the same frequency at the same time or on adjacent frequencies which could cause severe sideband interference. Holland itself had 48 frequencies which were incompatible, in which 10 were co-channel and 38 adjacent channel. A solution was found to most of these problems, so during our summer, listeners should find an improvement in the clarity of shortwave signals emanating from Europe.

The group at the moment includes all East European and all West European broadcasters, with the Voice of America present as an observer. Since the meeting, Radio Free Europe, Radio Liberty and

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KAS	Kazakhstan	TJK	Tadzhikistan
		TJM	Turkmenia
		UKR	Ukraine
		UZB	Uzbekistan

AROUND THE WORLD

ARGENTINA: Radio Nacional Buenos Aires has returned to 6060kHz after being off the air for some months. Broadcasts are noted around 0900 in Spanish, with frequency identification announcements.

Another station that has been off the air since last December is LRA36, located in Argentine Antarctic. This is expected to commence regular operation shortly on 15,476kHz. Using the slogan 'Radio Nacional Arcangel San Gabriel', the schedule is expected to be at 2130 - 0030.

AUSTRIA: ORF Vienna has a new schedule effective to March 28, 1993, with English broadcasts to the Pacific areas at 0830 - 0900 on 15,450 and 21,490kHz; and 1030 - 1100 on the same frequencies. Austrian Shortwave Panorama is a special programme for shortwave listeners, and is broadcast on Mondays at 0330 on 9870 and 13,730kHz.

GERMANY: Deutsche Welle, Cologne has altered two frequencies for its transmission to the Pacific, 2100 - 2150 is now using 6185 and 9690kHz as well as the former channels of 9670, 9765 and 11,785kHz. The transmission to this area at 0900 - 0950 remains on 6160, 11,915, 17,780 and 21,465kHz.

ISRAEL: KOL broadcasts in English as follows: 0500 - 0530 on 11,588kHz; 1100 - 1200 on 17,543kHz; 1400 - 1425 on 15,640 and 17,590kHz; 1800 - 1815 and 2000 - 2030 on 15,640kHz; and 2230 - 2300 on 9435, 11,587, 11,675 and 17,575kHz.

UNITED KINGDOM: The BBC World Service to the Pacific area is now operating at 1800 - 0030 on 11,955kHz, 2000 - 2300 on 15,340kHz; 0600 - 0815 on 7150 and 9640kHz; 0600 - 0915 on 11,955kHz; and 0600 - 0930 on 17,830kHz. From 0900 onwards, the service on 11,750kHz and from 1030 onwards that on of 9740kHz, are being used to carry programmes to this area from the Singapore transmitter.

USA: A programme for shortwave listeners is the World of Radio compered by Glen Hauser, and heard now in the South Pacific on Tuesdays at 0630 on 7435kHz. A transmission on Friday at 2115 on WWCR is received on 15,690kHz. Both of these should give good reception during the summer months.

Radio Canada International have filed applications to join the group.

Kiribati moves to 17,440kHz

Radio Kiribati at Tarawa, after many years of operation on 14,917kHz, has made a frequency change, caused by the rhombic aerial on that frequency being taken down by Telecom. In order to maintain a service, the frequency of 17,440kHz is now being used with a log periodic antenna.

In a telephone discussion Bill Reiher, Chief Technician of Radio Kiribati said that the power was now 500W. The station would like to extend its schedule, but this is not possible as the transmitter is used by Telecom for commercial traffic.

The station's full schedule is: Monday - Saturday, 1730 - 1900UTC, 2300 - 0030 and 0500 - 0830; Sunday, 2300 - 0030 and 0500 - 0830. The address of Radio Kiribati is PO Box 78, Bairiki, Tarawa.

Norway may end English broadcasts

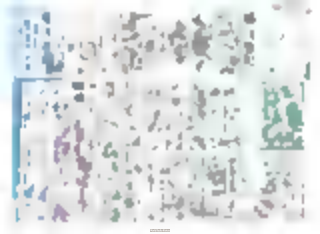
This month will determine whether Radio Norway will continue its English broadcasts on Saturdays and Sundays. A change of policy at Oslo could mean that the English programmes are replaced by a Norwegian Service, seven days a week.

It has been noted that the financial support from the Foreign Office to the English language broadcasts would be withdrawn in 1993, and despite the fact that the station has an incoming mail of around 10,000 letters, it seems only concerns expressed from the listeners could maintain the English Service.

The first broadcast in English took place from Norway in 1952, for the Olympics. Since then, it has been broadcasting ever since in English, once a week on Sundays. Two years ago, the English output was doubled with broadcasts on Saturdays and Sundays. The whole question of broadcasting in foreign languages from Norway is under discussion, but in the meantime it would seem that all broadcasts from Norway next year could be in Norwegian.

The schedule, effective through to March 27th, shows the English broadcasts being transmitted to this area are at 1200 on 17,860 and 21,705kHz; 1900 on 17,730kHz, and at 2100 on 15,180kHz. ❖

This item was contributed by Arthur Cushen, 212 Earn St. Invercargill, New Zealand who would be pleased to supply additional information on medium and shortwave listening. All times are quoted in UTC (GMT) which is 11 hours behind Australian Eastern Daylight Time and 13 hours behind NZ Daylight Time.



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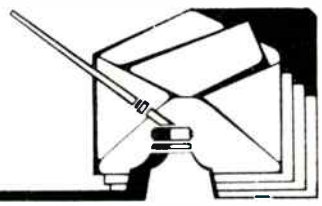


Conducted by Peter Phillips

Confronting technological change

A fast-changing technology like electronics has both its 'up side' and its 'down side', as the letters this month illustrate. What's going to happen with Pay TV? Can mere mortals fix microwave ovens? There's all this and more, for you to digest over Christmas.

The hot topic these days is Pay TV. What will we get? When will we get it? The answers seem to be further away than ever, as politicians and the major players lobby their cause. And I suppose there's good reason to spend a bit of time researching the best system.

Unfortunately, if we look back to the introduction of TV in Australia, history tells a different story. You might recall that TV was introduced into Australia many years after the rest of the world. The experts of the day opted for TV channel frequency allocations that turned out to be smack in the middle of the FM radio band.

At the time it seemed a good idea, but for years after TV channel frequencies were being altered to clear the band so FM radio could be introduced. I remember a quaint story about Channel 5A (in Wollongong) being received by astronauts during a moonwalk! Apparently at the time we were the only people in the world — apart from NASA — using that particular frequency for an AM transmission.

As a serviceman, I made quite a good income changing 'biscuits' in TV channel changers so the new frequencies could be received by viewers on the NSW south coast. These days, servicemen in the same area are busy with the change from VHF to UHF.

In other words, despite the debates and discussions taking place in Canberra, there's no guarantee history won't be repeated. For instance, if an analog system is chosen, existing equipment will probably not need a great deal of change, especially if the B-MAC encoding is continued. A digital system will require changes to current equipment, disadvantaging the thousands of country viewers who already have satellite TV.

However, the analog system is now technically exhausted, with digital TV holding great promise. What's the answer? Do we 'go analog', realising its lifetime is not more than about five years, or wait a few years for a digital system?

These are questions that many people are pondering, including our first correspondent...

Pay TV

Your article 'Asia Embraces Satellite TV' in the September issue has prompted me to seek more information on our Pay TV system.

Here in WA, Perth and possibly several of the cities to the south enjoy at least four channels, but out in the country we only get two: ABC and GWN.

Apart from the coast, WA is regarded as remote and comprising mainly desert — remote places, but not entirely unpopulated! The whole area east of the coast has quite a few farms, sheep stations and cattle stations. Most of these have a satellite dish, usually ACESAT or HomeSat, costing around $2500. I have a HomeSat system which I used when I worked out in the scrub.

My question is, with Pay TV becoming likely, will we all have to scrap our systems and invest in new equipment? Is the B-MAC transmission likely to continue? (D.H., Talgoo WA).

My guess, D.H., is that you'll still be able to use the dish and its LNC, but the decoder at the other end may not be suitable. I say guess, as who knows? But as my introduction suggests, no matter what happens someone will be disadvantaged. If I was making the decision, I'd opt for an analog system for the short term, but designed to accommodate changes to a digital system. During the changeover, both systems could operate in parallel, much the same as VHF and UHF transmissions ran concurrently for NSW south coast viewers.

By the time VHF transmission was ended, virtually everyone on the south coast had a set suitable for receiving UHF. Most people accepted that their old TV antenna needed updating anyway, and didn't object too heartily when the time came to fit a UHF aerial.

So, because we are all getting conditioned to 'technological redundancy' (ask any computer owner!) if we get around five years use from the equipment, most people don't mind updating. In the meantime, we can only wait and wonder...

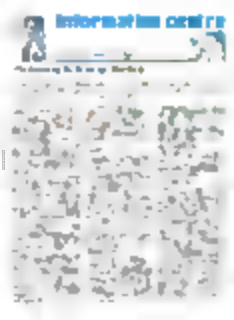
Radar detectors

The next letter describes the technology behind radar detectors, in answer to a letter in October about detecting these devices. While it's all rather academic, I think you'll find this letter interesting, as it's obvious that these devices were very sophisticated.

In reply to your correspondent B.R. of Calwell ACT, concerning radar detector detectors, as mentioned in the October 1992 issue, I offer the following:

While I agree with your position on the ethics of radar detectors, I had quite a bit of experience with these devices some years ago while employed as Service Manager of a company who had quite a high profile in the sales of these devices.

Some of the earliest radar detectors were 'passive' in the sense that the detection circuitry was, as you described, simply a microwave detector diode housed in a resonant cavity. These were about as sensitive as a microwave oven leakage detector, and soon gave way to more sophisticated units which operated on the superheterodyne principle. These


Information centre

devices were much more sensitive and were the basis of most radar detectors.

In these units, the detector diode is mounted in a resonant cavity adjacent to a cavity housing a Gunn diode. The Gunn diode oscillator energy is coupled into the cavity containing the detector diode, where it mixes with the incoming radar signal. Thus the Gunn diode is the first local oscillator of the superhet, and the difference between the incoming radar signal and the Gunn diode oscillator is the first intermediate frequency. This IF was generally in the order of 1GHz, and was usually converted down to a second IF of 10.7MHz. Thereafter it was processed in a manner similar to a conventional receiver.

Many of these radar detectors used multiple cavities and 'dirty' local oscillators, to provide detection of both the X band (10.52GHz) and K band (24.15GHz) radar systems.

I strongly suspect that radar detector detectors rely on sensing the energy of the first local oscillator, a considerable amount of which leaks from the cavity of superhet-type radar detectors, making them quite easy to detect.

This of course relies on the radar detector being switched on at the time. If the unit is off, it would be most difficult to detect, as would the passive first generation devices. The only method I can think of to detect these devices is sensing the absorption of microwave energy caused by the detector's resonant cavity — most unlikely, given the numerous little metallic crevices in the modern car!

It would appear that any claims to being able to detect ALL radar detectors should be qualified 'only if they are superhet types and then only if they are switched on'.

A couple of points to ponder: If the radar detector detector also uses the superhet principle, it should be possible to contrive a 'radar detector detector detector'! Where would it end?

But as a resident of the Mid North Coast, who lives only one kilometre from the infamous Pacific Highway, forget radar detectors et al...DON'T SPEED! (A.K., Barraganyatti NSW)

Thanks A.K., for sending this information. I didn't keep up with the technology behind radar detectors, and I'm rather amazed at the lengths designers went to so they could get the best performance. Perhaps it's no wonder they were finally declared illegal, as their sensitivity must have made them quite reliable.

So apparently it is possible to detect them, given the conditions described by A.K.

Project problems

Confronting project problems is the main function of this column, so the next letter is very appropriate...

I have just read Mr. Phillips' comments on the NiCad discharger, in the September issue of your long running and interesting magazine. But no longer can I contain myself. My subject is EA Kits.

In July '84 I purchased from the Smiling Face the UHF transceiver kit based on the September '83 articles. I have never succeeded in making it operational.

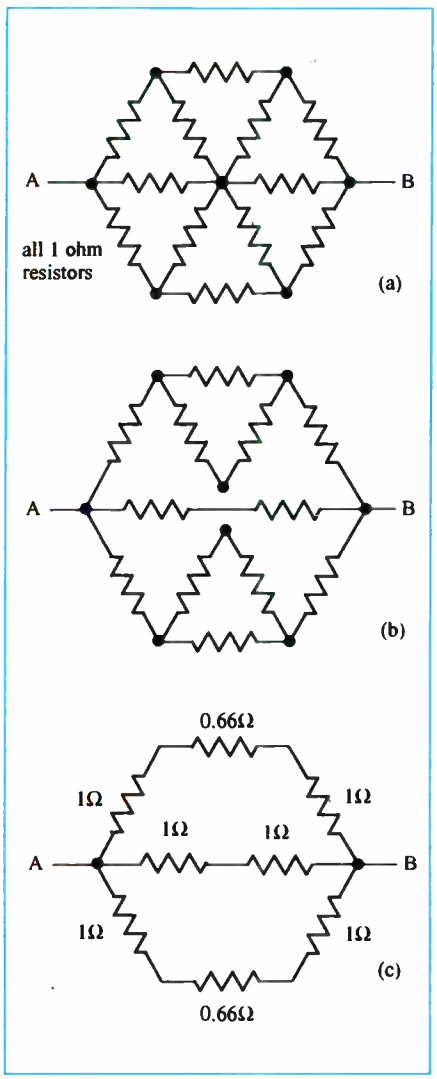


Fig.1

In May '92 I purchased a kit for the Automatic Charger for NiCads. My reason was to slow charge the 1Ah and 1.7Ah nicad batteries for my video camera. (I am very critical of fast charging!) It didn't take long to modify S1a positions 4 and 5 to provide the 1/10 and 1/20 rates for the above NiCads. The circuit is very satisfactory for charging, BUT there is no way the timing intervals as per the article can be achieved.

It turns out that the duty cycle of the 4040 counter is 50%. Switch S2 position two times out after 22 minutes, not the specified 44 minutes. The remaining positions also run for HALF the intended design interval.

Comparing the technical data for the 4040 against the circuit diagram and the actual printed board, disclosed a glaring anomaly. On the circuit, the pin numbers of IC5 correspond with the printed board. However, the Q outputs shown are fallacious. To achieve the design time intervals, 44 minutes must start with the Q8 output, followed by Q9 to Q12 for 11.7 hours.

In desperation, I have lifted one end of R17 to inhibit IC4 and IC5. Connecting the external power supply for the charger to a Kambrook digital timer set to 14 hours worked very nicely, thank you. Doing this negates the purpose of the internal timer. I hope eventually to find a circuit that will give a 14-hour period that can be incorporated in the charger's case.

Also, Mr Rowe, on page 72 in the September issue you explain why four 33uF electrolytic capacitors were selected in lieu of one 120uF capacitor. The 1992 Rod Irving catalog page 67 shows 100uF and 220uF 35V capacitors at 60 cents, either of which would provide the filtering at less than half the cost of four 33uF, 35V capacitors at 40 cents each. Other catalogues also show a price advantage. (J.H., Para Hills SA)

I can't help much with the UHF transceiver you couldn't get going, J.H., because it was not an *EA* design anyway (it came from Dick Smith Electronics, whose Service Department may be able to help). But I can certainly comment on the rest of your letter.

Regarding the charger, you obviously haven't seen the errata published in January 1990 page 174, then in May 1990 page 127 and also in July 1990 page 159. The solution to the problem is very simple; add a 0.1uF bypass capacitor from the anode of D1 to ground. This bypasses 'spikes' that cause double clocking of the counter. The circuit is correct; it just needs just one capacitor that wasn't found necessary on the three prototypes I built before presenting this project.

However, if you are charging the batteries at 10% to 20% of the normal charge current, then two things come to mind. The first is the 14-hour charge time. At this rate of charge, it will take a lot longer than 14 hours to charge the cells. As well, the trickle charge output of the charger is already set to 20% of the normal charge current, so why did you need to modify the circuit? Perhaps I've

misunderstood your letter, but somehow it doesn't add up.

Regarding the capacitors for the Spectrum Analyser, Jim Rowe tells me that at the time of development, the 100uF and 220uF types didn't seem to be available — despite what may have been listed in catalogs. But if you can find a cheaper alternative to using four 33uF electros, Jim agrees that you should by all means use it!

The cartwheel

In October 1992 I included a resistor network problem, sent to me by a reader who has been agonising over it for 30 years. Well, perhaps not agonising, but certainly interested in seeing a solution to the problem. I've now had a large number of letters offering an answer. In fact, after the deadline for October passed and time was not quite so pressing, I discussed the question with several colleagues and the answer is really very simple.

In Fig.1 the original network is shown in (a), with the clue to its solution shown in (b). Because of the symmetry of the circuit, the junction at the hub of the 'wheel' can be disconnected, as these points are all at the same potential. Therefore, the circuit in (b) is the same as (a), as no current flows between these junctions when they are connected. This immediately makes the circuit far easier to solve, as shown in (c). The total resistance of the circuit boils down to 0.8 ohms.

My thanks to the many readers who sent letters offering a solution, although not all were quite as simple as the one I've shown. Quite a few readers opted for the delta-star transformation method, another solved the problem on the bus while travelling to work, and a reader from the National University got it wrong! But most readers used the method I've shown here. Incidentally, this problem is different to the cube of 1-ohm resistors — it has a resistance of 0.833 ohms.

Microwave ovens

The next letter wants information on repairing microwave ovens:

I recently read your interesting article 'What's Inside the Latest Microwave Ovens' in the May 1988 edition. Now that our microwave has gone on the blink, I would like to purchase a book that covers the theory, repair and troubleshooting of these appliances.

Could you recommend a book? I found one called 'The Complete Microwave Oven Service Manual', by J. Gallawa, published by Prentice Hall, which although highly recommended, is too expensive at $60.

On another topic, at the moment I am building the Zap 'Em With The Pest Off described in November 1985. My question here is, if the piezoelectric tweeter has a frequency response of 20 - 30kHz, how does it emit a 64kHz signal? Would a piezo transducer (Dick Smith catalog item L-7022) operate in this circuit? (D.C., Narangba Qld)

Regarding a book describing microwave ovens, I'm sorry D.C., but we don't know of one. However you may be surprised if you take the covers off your microwave oven. There's usually not a lot inside them, and most of the components (diodes, capacitors etc) can be tested with the usual range of test equipment.

However, it's important to replace a faulty component with one having identical specifications to the original, which usually means getting it from the manufacturer. If the timer is faulty, the usual thing is to replace the complete unit, as these are often very integrated and impossible to troubleshoot. Still, you may be lucky, so don't be put off by the technology.

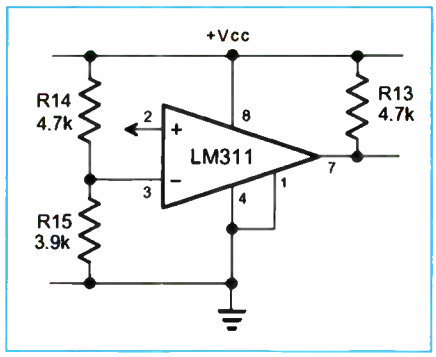


Fig.2

The other important thing to note is that the power supply inside a microwave oven can deliver a LETHAL shock. Always remove the oven's power cable from the mains outlet, and make sure you discharge the big electrolytic with a 'discharger' lead (a 100k/1W resistor, well insulated and fitted with insulated clip leads), before you do anything else. In fact it's a good idea to leave the discharger lead connected across the cap while you're working on the circuitry — just remember to remove it before you put the oven's cover back on.

I don't have a copy of the original article about the Zap 'Em, but I suggest that while the tweeter you mention has a -3dB cutoff frequency of 30kHz, it will still produce a useful output at 64kHz. An ultrasonic transducer won't work in this application as these operate at a resonant frequency, usually around 40kHz. This frequency apparently doesn't have the right effect on mosquitoes, which as I recall was to turn the female mossie off her feed (your blood!).

Dolby surround

It seems the Dolby decoder we presented in January is being well received, as the next letter demonstrates...

I recently constructed and demonstrated your Surround Sound Decoder kit to the Audio and Video Society of WA. For what it is, there is no doubt it performs extremely well. But it does need an external balance pot to null out the mono signal (dialogue) from the rear channel, as TV channels don't all have the same channel balance. Hired movies are not much better. Incidentally, did you mean to use linear instead of logarithmic pots for the volume?

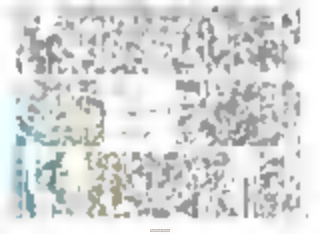
Have you considered designing a full Dolby Pro Logic Surround Sound Decoder, possibly using one of the Dolby chips which are now available? Surround sound is now the 'in thing', especially with the increasing interest in laser video discs, super VHS, large screen TV and so on. I'm sure such a project would be well received.

By the way, I have just finished constructing your low cost audio oscillator. In its standard form (no extra shielding etc) it gives 0.04% distortion, which is an excellent result. The only alteration was the obvious change to an RCA socket for the output. (C.B., Dianella WA).

Unless things have changed C.B., Dolby Pro Logic ICs are not readily available, unless you're prepared to pay a hefty licence fee. For this reason, such a project would be far too expensive. However, if these ICs do become available at a reasonable price, then certainly this would be a great project.

But because of the interest in the January Surround Sound decoder, we intend producing an audio delay unit that could be used with it. This will improve its performance, although there's no doubt the Pro Logic system is better. I had the prototype at home for some months (I didn't want to give it back!) and I've since purchased a Pro Logic decoder. The separation and overall effects are certainly better, and otherwise mediocre movies come to life. Oh yes, the volume control is meant to be linear.

I assume the oscillator you refer to is either the one described in March 1989, or that in March 1992. Either way, I could say we told you they were good, but I won't! Thanks for the nice comments,



anyway — it's good to hear from satisfied readers about projects.

However I'm not sure about the *obvious* change of the output connector to an RCA type. All commercial oscillators use either a BNC connector or are fitted with two 4mm terminal posts separated by 19mm (3/4"); our earlier design used the latter approach, while the most recent unit had a BNC socket. If you decided to fit an RCA socket that's fine, but it's really not an 'obvious' change at all.

LM311 error

In September I described the operation of the LM311 as used in the Logic Pulser presented in May 1991. It seems I might be in error...

I believe there's a mistake in your description of the operation of the LM311, in the Logic Pulser. You say that if the probe tip is open-circuit, the voltage at pin 2 (inverting input) will be 0V and the output will therefore be low.

This is incorrect. The LM311, like all practical comparators, draws an input bias current from each of its inputs. The bias currents are sufficiently small to be ignored in most circuits. This, however, is not true when the probe is open circuit, in the the circuit as shown in your article.

The LM311 uses PNP transistors, so the input bias currents will flow out of the device into whatever resistance might be connected to the inputs. In the case of the circuit as shown, the bias current from pin 3 input finds a low resistance path to ground via the input biasing resistors and, because this resistance is comparatively low, the effective pin 3 voltage will be very close to the expected value.

Unfortunately, there is no path for the pin 2 bias current, other than an external circuit to which the probe might be connected. If the probe is open-circuit, there is an imbalance in the input biasing currents — zero current for the (+) input and a small but certainly not negligible current for the (-) input.

Another way of looking at the problem is to suppose that pin 2 was connected via a very high resistance (say 100M) to ground. Bias current flowing out of pin 2 into this resistance would generate a positive voltage proportional to the input bias current. The data books tell us that the input bias currents for the LM311 are typically 0.1uA. Assuming this current, the input voltage would be 100M x 0.1uA = 10V.

Whichever way you look at it, the positive voltage measured by your correspondent is the natural consequence of the open-circuit condition at the probe input and not, as suggested in your reply, due to a fault in the wiring of the circuit. (H.N., Gulgong NSW)

When I read your letter H.N., I decided the easiest way to test this was to hook up an LM311 as shown in Fig.2 and have a look. And you're right. With pin 2 open-circuit, the output is high. Connect a resistor from pin 2 to ground and the output goes low. All due to the bias currents, as you say.

These days, we tend to forget about bias currents, as most of the common variety op-amps have a FET input stage. As well, it's easy to forget the practical aspects of op-amps, as their characteristics are often close enough to the ideal. So thanks, H.N., for putting us straight.

What??

This month's question involves relays. Timely perhaps, as we've had mainly resistor type questions over the last few issues. The question was sent by Graham Leadbeater of Ringwood, Victoria, who asks:

Five relays labelled A, B, C, D and E are connected as shown in Fig.3, so that each one breaks the circuit of another one. When power is applied, the circuit will settle down to a regular repeating sequence (after some initial chaos). The question is, in what order do the relays operate?

Answer to November's What??

The answer is either 238 ohms or 42 ohms. The solution is rather mathematical, and is shown at upper right. ❖

$$P_T = \frac{V^2}{R2+100} = 30 + P_{R1}$$

$$P_{R1} = 100 \times I^2 = \frac{100V^2}{(R2+100)^2}$$

$$P_T = \frac{100V^2}{(R2+100)^2} + 30$$

$$\frac{V^2}{R2+100} = \frac{100V^2}{(R2+100)^2} + 30$$

$$V^2(R2+100) = 100V^2 + 30(R2+100)^2$$

$$V^2R2 = 30(R2^2 + 10,000 + 200R2)$$

$$V^2R2 = 30R2^2 + 300,000 + 6000R2$$

$$30R2^2 + (6000 - V^2)R2 + 300,000 = 0$$

Substituting 120 for V:

$$30R2^2 - 8400R2 + 300,000 = 0$$

$$R2^2 - 280R2 + 10,000 = 0$$

Solving to find the roots:

$$R2 = \frac{280 \pm \sqrt{280^2 - (4 \times 10,000)}}{2}$$

$R2 = 238\Omega$ or 42Ω

NOTES AND ERRATA

Basic Guide to Colour TV & VCR's: On page 9 of this publication, recently published, the proportion of red signal information R used in producing the luminance signal V is incorrectly shown as 33% (0.33), when it should be shown as 30% (0.30). The figure is shown correctly elsewhere in the book.

In the Opto-electronics section of the September issue (p.139), the item on the Tektronix J17 LumaColor photometer/colourimeter stated that two plug-in luminance and chromaticity heads are provided with the J17. It should have read that these heads are optional extras. ❖

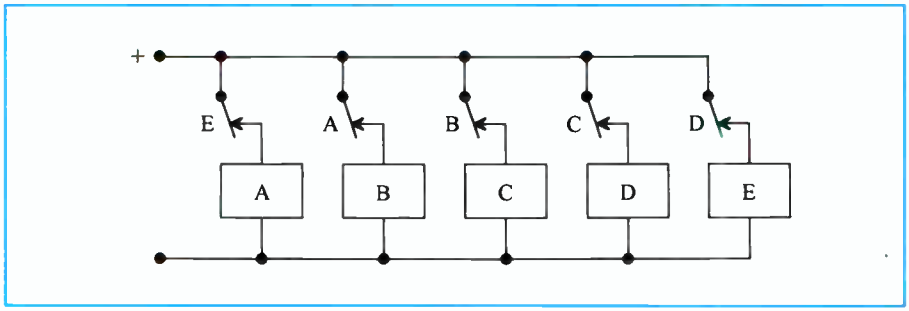
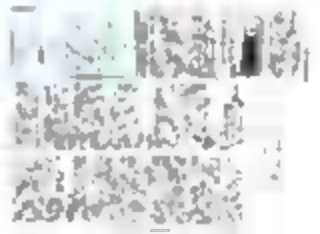


Fig.3

Jaycar's Sweeper Kit

Jaycar Electronics has carefully restyled the front panel for Arthur Spring's Vernus Audio Sweeper (*EA* - August/September 1992), as this picture shows, to give its kit a very professional appearance. The kit has the catalog number KA1744, and is priced at $99.00. ❖



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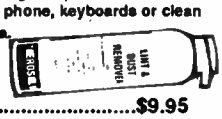

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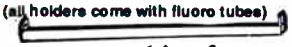

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1W ZENER DIODE

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1N4747 20V	$0.35
1N4748 22V	$0.35
1N4749 24V	$0.35
1N4750 27V	$0.35
1N4751 30V	$0.35
1N4752 33V	$0.35
1N4753 36V	$0.35
1N4761 75V	$0.60

5W ZENER DIODES

5W ZENER DIODE

Description	$
1N5339B 5V6	$1.20
1N5342B 6V8	$1.20
1N5349B 12V	$1.20
1N5358B 15V	$1.20
1N5361 27V	$1.20
1N5359 24V	$1.20
1N5363 30V	$1.20
1N5372 62V	$1.20

CRYSTALS

Description	$
1MHz	$6.00
1.8432MHz	$7.50
2MHz	$3.00
2.4576 MHz	$2.00
3MHz	$4.90
3.57954MHz	$3.00
4.00 MHz	$3.00
4.19430MHz	$3.00
4.433618MHz	$2.00
4.44 MHz	$2.00
4.9662 MHz	$3.00
5MHz	$2.00
6 MHz	$2.00
6.144 MHz	$3.00
8.00 MHz	$3.00
8.86723MHz	$3.00
10 MHz	$2.00
11 MHz	$3.00
12.00 MHz	$3.00
14.318 MHz	$2.00
15 MHz	$2.00
16.00 MHz	$3.00
20.00 MHz	$2.00
24 MHz	$3.00
48MHz	$2.00
32.768KHz	$2.00

IC's - H, HC

Description	$
74HC00	$0.75
74HC02	$0.75
74HC04	$0.75
74HC08	$0.75
74HC10	$0.75
74HC11	$0.75
74HC14	$1.60
74HC30	$0.60
74HC32	$0.60
74HC42	$0.90
74HC74	$1.10
74HC85	$1.40
74HC86	$1.10
74HC123	$1.40
74HC132	$1.25
74HC138	$1.40
74HC157	$1.25
74HC161	$2.25
74HC164	$2.25
74HC174	$1.40
74HC244	$2.00
74HC245	$2.50
74HC273	$2.75
74HC367	$1.85
74HC373	$1.80
74HC393	$2.75
74HC4040	$1.65
74HC4060	$3.95
74HC4066	$1.70

SERIES 4000

Description	$
4000	$0.75
4001	$0.45
4002	$0.55
4006	$1.55
4007	$0.45
4008	$1.70
4009	$0.90
4010	$0.90
4011	$0.45
4012	$0.45
4013	$0.70
4014	$1.00
4015	$0.90
4016	$0.70
4017	$1.35
4018	$0.50
4019	$0.80
4020	$1.40
4021	$1.50
4022	$1.45
4023	$0.45
4024	$1.60
4025	$0.45
4026	$1.10
4027	$0.85
4028	$1.15
4029	$1.50
4030	$0.50
4033	$2.75
4038	$2.25
4040	$1.20
4042	$1.50
4043	$1.20
4044	$1.25
4045	$4.90
4046	$1.00
4047	$1.90
4049	$0.60
4050	$0.60
4051	$1.20
4052	$1.20
4053	$1.20
4060	$2.50
4066	$0.80
4068	$0.80
4069	$0.80
4070	$0.60
4071	$0.50
4073	$0.50
4075	$0.80
4076	$1.90
4077	$0.80
4078	$0.50
4081	$0.50
4082	$0.50
4093	$0.80
4098	$1.90
40104	$7.25
4503	$1.30
4510	$1.40
4511	$1.45
4512	$1.40
4514	$2.60
4515	$1.90
4516	$1.80
4518	$1.60
4520	$1.00
4522	$1.90
4526	$1.00
4528	$1.96
4532	$2.65
4536	$6.50
4538	$1.20
4543	$2.60
4556	$1.25
4584	$1.00
40014	$1.60
40175	$2.00

74C SERIES

Description	$
74C00	$1.00
74C04	$1.00
74C08	$1.00
74C14	$1.75
74C74	$1.00
74C86	$1.50
74C90	$2.50
74C192	$3.60
74C221	$3.96
74C244	$3.96
74C373	$6.96
74C906	$2.90
74C922	$14.96
74C926	$13.96
74C946	$24.80

74S SERIES

Description	$
74S04	$1.20
74S08	$1.50
74S30	$1.00
74S32	$1.00
74S132	$3.50
74S133	$1.20
74S138	$2.50
74S139	$3.30
74S174	$3.50

74F SERIES

Description	$
74F00	$0.25
74F04	$0.25
74F32	$0.25
74F74	$0.26
74F109	$0.50
74F138	$1.00
74F151	$1.20
74F153	$1.20
74F157	$1.20
74F194	$2.41
74F244	$3.72

74LS SERIES

Description	$
74LS00	$0.30
74LS01	$0.60
74LS02	$0.60
74LS03	$0.60
74LS04	$0.75
74LS05	$0.75
74LS08	$0.60
74LS10	$0.30
74LS11	$0.75
74LS13	$0.90
74LS14	$0.75
74LS15	$0.80
74LS20	$0.90
74LS21	$0.90
74LS27	$0.90
74LS30	$0.30
74LS32	$0.60
74LS379	$0.70
74LS38	$0.80
74LS42	$1.20
74LS47	$1.80
74LS48	$1.80
74LS74	$0.40
74LS75	$1.20
74LS76	$1.00
74LS85	$0.85
74LS86	$0.60
74LS90	$1.20
74LS92	$1.20
74LS93	$1.50
74LS96	$1.20
74LS107	$0.90
74LS109	$0.90
74LS112	$0.70
74LS123	$1.30
74LS125	$1.00
74LS126	$1.00
74LS132	$1.00
74LS138	$0.80
74LS139	$0.80
74LS145	$1.50
74LS147	$2.60
74LS151	$1.20
74LS153	$1.00
74LS155	$0.80
74LS156	$1.60
74LS157	$1.20
74LS158	$1.00
74LS160	$1.80
74LS161	$1.00
74LS162	$0.60
74LS163	$1.10
74LS164	$1.40
74LS165	$1.20
74LS166	$1.25
74LS168	$2.10
74LS174	$1.20
74LS175	$0.70
74LS181	$4.00
74LS191	$1.20
74LS193	$1.20
74LS196	$0.80
74LS196	$1.20
74LS221	$2.00
74LS240	$1.40
74LS241	$0.96
74LS243	$1.10
74LS244	$2.20
74LS245	$2.96
74LS257	$1.20
74LS258	$1.20
74LS259	$2.25
74LS266	$0.70
74LS273	$1.00
74LS323	$6.80
74LS352	$2.20
74LS365	$1.00
74LS366	$1.00
74LS367	$1.00
74LS373	$2.00
74LS374	$2.00
74LS378	$1.00
74LS393	$1.00
74LS629	$5.95
74LS640	$1.00

74 SERIES

Description	$
7400	$0.80
7402	$1.00
7403	$1.00
7404	$0.30
7406	$0.40
7407	$0.50
7408	$1.00
7409	$1.00
7410	$1.20
7414	$1.50
7415	$0.50
7430	$1.00
7432	$1.00
7438	$0.80
7442	$1.50
7445	$1.00
7448	$1.20
7447	$1.75
7473	$1.20
7474	$0.40
7475	$1.20
7476	$1.80
7483	$1.10
7490	$1.20
7493	$1.25
74121	$1.55
74123	$0.50
74125	$1.00
74126	$1.00
74150	$1.90
74154	$2.50
74157	$1.30
74161	$1.20
74164	$1.20
74177	$1.95
74193	$1.50
74195	$1.00
74197	$1.20
74283	$2.45
74290	$0.90

IC - D/A, A/D

Description	$
DAC0800	$4.95
DAC0805	$4.90
ADC0800CN	$29.95
ADC0803	$13.50
ADC0804	$7.95
ADC0808	$13.00
ADC0820LCN	$27.95
DAC0832	$7.95
DAC1020	$16.28
11C90	$16.50
DAC1220	$22.95
DAC1408	$1.00
AD590J	$12.95

IC LINEAR

Description	$
AY-3-1015	$11.95
AY-3-8910	$19.95
AY-5-6116	$14.50
CA3026	$3.95
CA3086	$1.20
CA3130E	$2.90
CA3130T	$3.95
CA3140E	$1.30
CA3140T	$2.95
CTS256A	$45.50
DM2602	$13.50
LF347	$1.40
LF351N	$1.20
LF353	$1.50
LF356N	$1.50
LF357	$2.98
LF398	$5.90
LM301H	$1.50
LM301N	$0.50
LM302H	$6.50
LM305H	$1.50
LM307CN	$1.80
LM308	$0.50
LM309K	$2.85
LM310N	$4.95
LM311	$1.00
LM324	$1.20
LM331	$6.00
LM339	$0.60
LM348	$1.00
LM349	$2.95
LM358	$1.40
LM361	$4.95
LM360N-14	$1.95
LM360N-8	$1.50
LM381	$4.95
LM382	$3.50
LM383	$4.95
LM384	$3.50
LM386-1	$1.40
LM387	$2.75
LM390	$2.95
LM392	$1.80
LM393	$0.80
LM394CH	$7.95
LM395T	$9.96
LM395K	$7.95
LM396K	$16.80
LM399H	$7.50
LM711	$1.20
LM725	$7.50
LM733	$1.50
LM741	$0.60
LM747	$1.50
LM748	$1.10
LM759	$3.90
LM833	$2.10
LM1830	$4.90
LM1871N	$7.50
LM1872N	$8.60
LM1886	$9.10
LM2907-14	$3.80
LM2907-8	$5.10
LM2917-14	$2.50
LM2917-8	$4.80
LM3900	$0.80
LM3909	$2.50
LM3911	$3.95
LM3914	$2.90
LM3915	$2.90
LM3999Z	$5.95
LM 4250	$2.45
LM11CN	$4.95
LM13600	$2.70
LMC555	$1.25
MAX232/ICC232	
HMC232	$11.96
OM350	$21.00
MC1408L8	$7.50
MC1458	$1.20
MC1488	$0.60
MC1489	$0.60
MC1496	$2.50
MC3334P	$6.95
MC34018P	$8.95
MOC3021	$1.95
NE555	$0.50
NE556	$0.95
NE558	$6.50
NE564	$7.00
NE566	$2.90
NE567	$2.00
NE570	$8.96
NE571	$6.96
NE572	$11.20
INS8250N	$18.10
TA7205P	$2.95
TDA1024	$3.90
TEA1002	$17.50
TL064	$2.10
TL071/ LF351	$1.20
TL072/ LF353	$1.80
TL074/ LF347	$1.40
TL081	$1.90
TL082	$2.20
TL084	$1.50
UA710CN	$1.00
UA739	$2.75
UPD8288	$16.50
XR2206	$9.95
XR2209	$6.90
XR2211	$7.95
XR2215	$5.90
XR2240	$6.96
XR2243	$5.95
26LS30	$2.00
26LS31	$2.00
26LS32	$2.00
8534AN	$3.95
8155	$8.95
8156	$8.50
81LS95	$1.00
81LS96	$2.75
8216	$3.00
8237	$14.50
8255	$8.90
8279	$8.50
8830	$8.95
95H90	$10.50
9667	$0.90
9668	$2.95

MEMORY

Description	$
2114	$5.20
2715	$12.50
2732-200	$8.25
2764-250	$8.95
27128	$8.00
27256-250	$9.50
27512-250	$14.95
27-1MEG	$29.50
27C64-200NS	$8.95
27C128	$12.50
27C256/ 250NS	$18.50
27C512	$22.80
27C 1MEG	$34.80
4118 16K	$3.95
4164-10	$4.96
4464-10	$5.50
4464-08	$5.90
41256-10	$4.96
41256-08	$5.50
44256-10	$13.96
44256-08	$14.95
44256-07	$15.96
6116	$5.80
6264LP-10	$19.96
62256LP-10	$39.96
1M-10	$13.96
1M-08	$14.96

SIPPS

Description	$
256 x 9-80	$24.00
1M x 9-70	$55.00
1M x 9-60	$59.00

SIMMS

Description	$
1M x 9-70	$51.00
1M x 9-60	$71.00
256K-60	$35.00
256K-70	$28.00
256K-80	$25.00
4M x 9-70	$230.00

I.C-COMPUTER

Description	$
6502A	$18.96
6522A	$18.96
6802	$7.00
6809	$17.00
6821	$5.50
6845	$9.96
6850	$3.80
7910	$29.96
8035N-8	$6.90
8039	$9.90
8080	$8.00
8085A	$16.50
8086	$12.50
ICL7106	$15.96
ICM7216B	$59.80
LF13741	$0.80
NS16450	$26.96
S3530	$24.95
SP0256	$21.96
TR1863	$8.90
V20A	$35.95
V20	$29.96
WD2123	$29.96
XR8038	$7.80
Z80A CTC	$8.50
Z80B CPU	$13.50
Z80A CPU	$5.75
Z80A PIO	$4.80
Z80A SIO	$14.80

8087

8087-3	$189.00
8087-2	$279.00
8087-1	$379.00
80267-6	$249.00
80267-8	$379.00
80267-10	$459.00
80367-16	$596.80
80367-20	$796.00
80367-25	$896.00
80367-39	$995.00

VOLT REGULATORS

Description	$
LM317T	$2.50
LM317KC	$5.50
LM320K12	$1.40
LM320K-05	$3.00
LM320T-5	$1.40
LM323K	$9.50
LM326	$5.50
LM329DZ	$0.90
LM334Z	$1.70
LM335Z	$2.50
LM336Z-2.5V	$2.95
LM336Z5.0V	$2.95
LM337T	$2.90
LM337KC	$12.50
LM338K	$9.45
LM340T-5	$0.90
LM340KC-5	$2.95
LM340T-5	$0.90
LM340KC-5	$2.95
LM340T-12	$0.90
LM340T-18	$2.00
LM340T-18	$0.90
LM340KC-12	$4.96
LM350T	$8.40
LM350K	$11.50
LM378	$6.98
TL494	$4.90
LM723CH	$1.50
LM723CN	$0.95
78HGK	$9.50
78P05GC	$14.50
7805	$0.75
78L12	$0.75
78L15	$0.75
79L05	$1.20
79L12	$1.20
79L15	$1.20
LM396K	$16.50

SPECIAL FUNCTION

Description	$
76489	$12.80
ICL7660	$6.90
VN88AF	$5.95
MM5369	$4.95

LEDS

Description	$
3 mm LEDS	
Red	$0.20
Green	$0.30
Yellow	$0.30
Orange	$0.30
5mm LEDS	
Red	$0.20
Green	$0.30
Yellow	$0.30
Orange	$0.30
10mm JUMBO LEADS	
Red	$0.96
Green	$1.00
Orange	$1.00
SUPER BRIGHT LEDS	
Red	$1.00
Green	$1.00
Yellow	$1.00
8mm FLASHING LEDS	
Red	$1.25
RECTANGLE LEDS	
Red	$0.25
Green	$0.30
Yellow	$0.30
Orange	$0.30
5mm RED/GREEN DUAL LED	$1.05

Prices are 1-9.
10-99 less 10%.
100+ less 20%.

ROD IRVING ELECTRONICS

SYDNEY: 74 Parramatta Rd, Stanmore - (02) 519 3134
MELBOURNE: 48 A'Beckett St. Ph: (03) 663 6151
NORTHCOTE: 425 High St. Ph: (03) 489 8866
OAKLEIGH: 240C Huntingdale Rd, Ph: (03) 562 8939
ADELAIDE; 241-243 Wright St, Ph: (08) 211 7200
TOLL FREE MAILORDER HOTLINE - 008 33 5757
MAIL ORDER - P.O BOX 620, CLAYTON 3168

POSTAGE RATES:

$1 - $9.99 ..... $3.00	$100 - $199 ..... $7.00
$10 - $24.00 ..... $3.50	$200 - $500 ..... $FREE
$25 - $49.99 ..... $4.50	$500 PLUS ..... $ FREE
$50 - $99.99 ..... $6.00	

The above postage rates are basic postage only up to 3 Kg. Road freight, bulky & fragile items will be charged at different rates.

Errors & omissions excepted. Prices & specifications subject to change.

DISCOUNT COMPONENTS

XENON/STROBE TUBES

As used in projects or as replacement.
S14050.....$3.95

CHROME LED BEZELS

9 mm hole, available 3 colours
S14030 Red.....$1.20
S14032 Green.....$1.45
S14034 Yellow....$1.45

GREY FLAT RIBBON CABLE

cat no.		$/Mtr
W12614	14way	$1.90
W12616	16way	$2.20
W12620	20way	$2.50
W12624	24way	$2.90
W12625	25way	$3.20
W12626	26way	$3.60
W12634	34way	$3.90
W12636	36way	$3.90
W12640	40way	$4.90
W12650	50way	$5.90
W12660	60way	$6.90

10 TURN WIRE WOUND POTENTIOMETER

Spectrol Model 5341/4" shaft.
Equivalent (Bourns 3540S Beckman 7256)
Dials to suit 16-1-11, 18-1-11, 21-1-11.
R14050 50R R14100 5K
R14055 100R R14110 10K
R14060 200R R14120 20K
R14070 500R R14080 1K
R14090 2K

1-9	10+
$12.95	$10.90

R14130 50K.....$16.95
R14140 100K.....$15.95

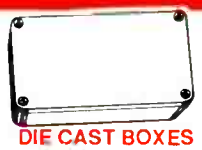
NUMERIC KEYPAD

Unencoded keypad, 10 digit keys plus two utility keys. Light grey in colour.
OUTPUT ARRANGEMENT:

Output Pin No.	Symbol
1	N.A.
2	Shield plate
3	Column 2
4	Row 1
5	Column 3
6	Row 1
7	Column 1
8	Row 2
9	Row 3
10	N.A.

Cat. C19030

1-9	10+	100+
$2.95	$2.50	$1.95



DIE CAST BOXES

Diecast boxes are excellent for RF sheildingand strength.
Screws are provided with each box.
H11451
100 x 50 x 25mm.....$8.95
H11452
110 x 60 x 30mm.....$9.50
H11453
120 x 65 x 40mm.....$10.50
H11461
120 x 94 x 53mm.....$13.95
H11462
188 x 120 x 78mm....$15.95
H11464
188 x 188 x 64mm....$29.50

GENERAL PURPOSE TRANSISTORS

PN100: a NPN general purpose medium power amp and switch with continuous collector current up to 500mA.
PN200: a PNP general purpose amp at collector currents to 1 AMP.
Both are TO-82 plastic package.

PN100 REPLACES:

PN2221, PN2222, PN2222A, PN3585, PN3568, PN3569, PN3643, PN5133, 2N2219A, 2N2222A, 2N3414, 2N3415, 2N3416, 2N3417, 2N3700, 2N3704, 2N3904, 2N4123, 2N4124, 2N4401, 2N5088, 2N5210.

PN200 REPLACES:

PN2907, PN2907A, PN3638, PN3638A, PN3640, PN3644, PN4121, PN4143, PN4248, PN4249, PN4250, PN4355, PN4916, PN4917, PN5910, 2N2905A, 2N3467, 2N3702, 2N3906, 2N4125, 2N4126, 2N4291, 2N4402, 2N4403, 2N5086, 2N5087, 2N5447.

PN100.....T90001
PN200.....T90002

1-9	10+	100+
$0.20	$0.18	$0.15

SUPER BRIGHT LEDS

- RED.....Z10146
- GREEN.....Z10147
- YELLOW.....Z10148

1-9	10+
$1.00	$0.90

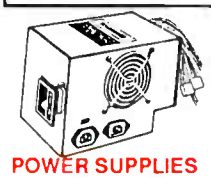
CARD EDGE CONNECTORS

1" SPACING

P12060	10pin	$3.95	$3.50
P12062	20pin	$4.25	$3.75
P12064	26pin	$4.50	$3.95
P12066	34pin	$4.95	$3.95
P12068	40pin	$5.95	$4.95
P12070	50pin	$6.95	$5.95

DIODES - BUY IN BULK & SAVE!

Cat No.		10+	100+	1000+	10K
Z10135	IN4148	$0.05	$0.04	$0.03	$0.02
Z10105	IN4002	$0.06	$0.05	$0.04	$0.03
Z10107	IN4004	$0.08	$0.06	$0.05	$0.04
Z10110	IN4007	$0.10	$0.07	$0.06	$0.05
Z10115	IN5404	$0.18	$0.14	$0.13	$0.11
Z10119	IN5408	$0.20	$0.16	$0.15	$0.14



POWER SUPPLIES

XT P.S 200W.....$139.00
FULL TOWER
220W P.S.....$149.00
MINI TOWER
200W P.S.....$89.00
BABY AT
P.S 200W.....$89.00
SLIMLINE BABY AT
P.S. 200W.....$89.00

BREAD BOARDS

This inexpensive range of modular interlocking units enables a quick easy way of experimenting with new circiuts and ideas. There are two main units consisting of a terminal strip or distribution and a central plug in unit.
• 100 holes.
P11000.....$2.75
•840 + 100 holes
P11007.....$14.95
• 1280 +100 holes
• P11010.....$26.95
•2560 + 700 holes
• P11018.....$69.95

COMPUTER CABLES

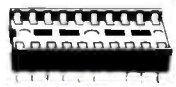
• Six conductor shielded computer interface cable.

	1-9M	10M+	100M+
W12670 • CIC6 6 con.	$1.30M	$1.10M	$1.00M
W12672 • CIC9 9 con.	$1.60M	$1.50M	$1.20M
W12674 • CIC12 12 con.	$2.50M	$2.20M	$1.90M
W12676 • CIC16 16 con.	$3.50M	$3.20M	$2.50M
W12678 • CIC25 25 con.	$3.90M	$3.40M	$3.00M

NICADS

Save a fortune on expensive throw away batteries with these quality Nicads and Rechargers!

Size AA 450mAH			
	1-9	10+	100+
	$2.95	$2.75	$2.50
Size C 1 2 A H	$9.95	$9.50	$8.95
Size D 1 2 A H	$9.95	$9.50	$8.95



LOW PROFILE IC SOCKETS

Save a small fortune on these "Direct import" low profile IC sockets! PCB mounting solder tail. All tin plated phosphor bronze or berryllium and dual wipe for reliability.

	1-9	10+	100+
P10550	8 pin	15¢	12¢	10¢
P10560	14pin	20¢	18¢	15¢
P10565	16pin	20¢	18¢	16¢
P10567	18pin	30¢	25¢	22¢
P10568	20pin	35¢	30¢	25¢
P10569	22pin	35¢	30¢	26¢
P10570	24pin	35¢	30¢	26¢
P10572	28pin	45¢	35¢	30¢

WIRE WRAP IC SOCKETS

These quality 3 level wire wrap sockets are tin plated phosphor bronze.

		1-9	10+
P10579	8pin	$1.50	$1.40
P10580	14pin	$1.85	$1.70
P10585	16pin	$1.95	$1.80
P10587	18pin	$1.95	$1.80
P10590	20pin	$2.95	$2.75
P10592	22pin	$2.95	$2.70
P10594	24pin	$3.95	$3.50
P10596	28pin	$3.95	$3.50
P10598	40pin	$4.95	$4.50

WOW! WHAT PRICES!

IDC PLUGS & SOCKETS

WOW ! FROM $1.00

D TYPE IDC PLUGS

	1-9	10+	100+
• DE9P 9pin plug P12166	$1.50	$1.20	$1.00
• DA15P 15pin plug P12168	$1.50	$1.20	$1.00
• DB25P 25 pin plug P12170	$4.50	$3.95	$3.50

D TYPE IDC SOCKETS

	1-9	10+	100+
• DE9S 9 pin socket P12167	$1.50	$1.20	$1.00
• DA15S 15 pin socket P12169	$1.50	$1.20	$1.00
• DB25S 15 pin socket P12171	$4.50	$3.95	$3.50

IDC CENTRONICS 36 WAY PLUG & SOCKET

	1-9	10+	100+
• Plug P12200	$3.95	$3.00	$2.95
• Socket P12201			

ECONOMY TRANSFORMERS

	1-9	10+
2155 240V 6-15V 1A M12155	$8.95	$7.95
2156 240V 6-15V A2 M12156	$13.95	$12.95
2851 240V 12-6V CT 250mA M12851	$4.95 ..	$4.50
6672 240V 15 30vc 1A tapped M16672	$12.95	$11.95

12V DC FANS

80 x 80 x 25.4mm
12V DC. 1.7 Watt 0.14 Amp
T12469.....$18.95
10+ fans, only $17.95

FANS

Quality fans for use in power amps, computer hotspot cooling etc. Anywhere you need plenty of air.
240V 4 5/8" T12461..$16.95
115V 4 5/8" T12463..$16.95
240V 3 1/2" T12465..$16.95
115V 3 1/2" T12467..$16.95

TOGGLE SWITCHES

	1-9	10+
S11010 S.P.D.T	$1.20	$1.10
S11020 D.P.D.T	$1.30	$1.20

ICB VOLTAGE REGULATORS BARGAINS

Description	1-9	10+	100+
7805UC	$0.50	$0.45	$0.40
7812UC	$0.50	$0.45	$0.40
7815UC	$0.50	$0.45	$0.40
7905UC	$0.60	$0.55	$0.50
7912UC	$0.60	$0.55	$0.50
7915UC	$0.60	$0.55	$0.50
78L05	$0.40	$0.30	$0.28
78L12	$0.40	$0.30	$0.28
LM324	$1.00	$0.90	$0.80
555	$0.40	$0.38	$0.33
741	$0.50	$0.45	$0.39

9 PIN D SWITCH BOXES

2 WAY.....$59.95
4 WAY.....$69.95
MONITOR & KEYBOARD SWITCH BOXES $69.50

MINIATURE HOBBY VICE

• Lever operated suction base grip for instant mounting & portability.
• Mounts on smooth non-porous surfaces
• Ideal for holding & other small objects .
T12458.....$6.95

PC BOARD HOLDER

Better than of hands
A must for all PCB work.
T12444.....$9.95

QUALITY 3mm LEDS

	1-9	10-99	100+	1K 1000+
Z10140(R)	$0.15	$0.12	$0.10	$0.08
Z10141(G)..	$0.20	$0.18	$0.15	$0.12
Z10143(Y)..	$0.20	$0.18	$0.15	$0.12
Z10145(O)..	$0.20	$0.18	$0.15	$0.12

QUALITY 5mm LEDS

Z10150(R).	$0.15	$0.12	$0.10	$0.08
Z10151(G).	$0.25	$0.20	$0.18	$0.12
Z10152(Y)..	$0.25	$0.20	$0.18	$0.12

FLASHING LEDS

RED 5mm	1-9	10+	100+
Z10159	$1.10	$1.00	$0.80

RECTANGULAR LEDS

	1-9	10+	100+	1K
RED	20¢	15¢	12¢	10¢
GREEN	20¢	15¢	12¢	10¢
YELLOW	20¢	15¢	12¢	10¢

DB25 CONNECTOR SPECIALS

	1-9	10+	100+
P10880 DE9P	$1.00	$0.80	$0.60
P10885 DE9S	$1.00	$0.70	$0.60
P10891 DA15S	$1.00	$0.70	$0.60
P10892 DA15C	$1.00	$0.90	$0.60
P10895 DA15S	$1.00	$0.80	$0.60
P10902 DB25C	$1.00	$0.80	$0.60
P10904 DB25P	$1.00	$0.80	$0.60
P10905 DB25S	$1.00	$0.80	$0.60

MOSFET SPECIALS

	1-9	10+	100+
2SJ49	$9.50	$8.00	$7.00
2SJ56	$10.00	$9.50	$8.50
2SK134	$8.50	$8.00	$7.00
2SK176	$9.50	$8.90	$ 6.90
2SJ50	$9.50	$8.50	$7.00
2SK135	$9.50	$8.50	$7.00

ELECTRET MIC INSERTS

With pins for easy board insertion. C10170

1-9	10-99	100+	1000+
$1.20	$1.00	$0.90	$0.70

TRANSISTORS BUY IN BULK & SAVE!

	1-9	10+	100+
BC 547	$0.15	$0.10	$0.07
BC 548	$0.15	$0.10	$0.07
BC 549	$0.15	$0.10	$0.07
BC 557	$0.15	$0.10	$0.07
BC 558	$0.15	$0.10	$0.07
BC 559	$0.15	$0.10	$0.07
BC 327	$0.20	$0.15	$0.12
BC 337	$0.20	$0.15	$0.12
BD 139	$0.75	$0.60	$0.50
BD 140	$0.75	$0.60	$0.50

PCB MOUNTING SCREW TERMINALS

(INTERLOCKING ENDS)
These terminals feature interlocking ends to form any number of connections. Standard 5mm spacing pins.

P10520	2way		
	1-9	10+	100+
	$0.75	$0.70	$0.60
P10521	3 way		
	$1.00	$0.90	$0.80

YES! WE ARE NOW OPEN IN ADELAIDE!
241-243 WRIGHT STREET.
Come on in & check out our opening specials!

MONITOR HOLDER

MONITOR MOVER ARM

Position your monitor exactly where yuo want int Maximize desk space.
- Solid steel structure
- Height Adjustment
- Span 33cm
- Maximum load 50kg

C21079.....$199.00

- Sturdy Steel construction
- Can rotate 360°
- Lifts monitors up to 22Kg.
- Locks in place with monitor on tray.

C21082.....$199.00

DISK NOTCHER

Converts 5 1/4" single sided floppy disks to double sided, by placing an appropriate notch in the floppy disk jacket.

C21070.....$7.95

IC MEMORY

EPROM

Cat No.	Type	Price
U20550	2716	$11.75
U20560	2732	$9.00
U20590	2764	$6.95
U20540	27128	$7.50
U20542	27256	$9.00
U20544	27512	$12.50

CMOS EPROM

Cat. No.	Type	Price
U20591	27C32	$14.95
U20592	27C64	$5.50
U20593	27C128	$7.50
U20594	27C256	$9.00
U20595	27C512	$11.50
U20546	27C010	$22.50

NEW PRINTER RIBBONS

LQ100 / ACTION PRINTER.....$12.00
NEC PINWRITER P3.$17.95
NEC PINWRITER P5.$19.95
SEIKOSHA BP5420..$19.95
CITIZEN 120D.....$10.95
EPSON ERC23.....$18.95
EPSON DFX 5000.....$39.95
EPSON EX800.....$18.95
BROTHER 1824L.....$25.95
BJ CARTRIDGE
BC-01.....$55.00
FUJITSU DL330.....$18.95
TOSHIBA P321/341..$18.95
OKI MICROLINE.....$39.95

DISK HOLDERS

3 /12" PLASTIC DISK HOLDER
- Holds 5 disks

Comes in 6 different colours
C16050 Red
C16054 Yellow
C16052 Orange
C16056 Green
C16058 Blue
C16060 Grey
Only .....$3.50 Each.

5 1/4" PLASTIC DISK HOLDER
- Holds 6 floppy disks

C16030.....$3.50

5 1/4" DISK STORAGE CASES
- Made of Sturdy black flexible plastic.
- Holds 10 or more 5 1/4" disks.
- Display positions

1-9	10+	100+
C12020..$3.95	$3.50	$3.00

MEMOREX
3.5"Plastic disk holder
- Holds 10 Disks

C12840.....$3.95

3 1/2" DISK STORAGE
- 40 x 3 1/2" disk capacity
- High impact plastic lid & base

C16040.....$6.95

COPY HOLDERS

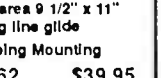
COPY HOLDER YU-H33
- Copy area 9 1/2" x 11"
- Sliding line glide
- Flat metal base

C21060.....$39.95

COPY HOLDER YU-H32

Adjustable arms allows easy positioning
- Copy area 9 1/2" x 11"
- Sliding line glide
- Clamping Mounting

C21062.....$39.95



GRIP CLIP COPY HOLDER
- Attaches to the top your monitor • Spring clip to hold paper • Velcro at mount for easy removal

C21065.....$14.95

NEW GENIUS SCANNER 4500

Black, White & Grey-Emulation scanner with powerful Photo/Image Editor & Multilingual Omnifont OCR.

Three grey emulation modes allows you to bring excellent reproductions of pictures into your reports, brochures, etc.Perfect for scanning line art. Scan objects in resolutions from 100 to 400 dpi.

GO-CR

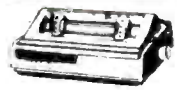
This package includes the GO-CR Optical Character Recognition (OCR) program.
GO-CR scans text images into computer readable text files. The multilingual capabilities allows you to recognize documents in any one of 80 languages.
GO-CR is the supreme PC typist!
Edit, enhance and design professional-quality images with iPhoto Deluxe.
Combine images from several scans. It can even convert your black & white photos to true greyscale format. The ease of it's Windows based operation makes the power of this professional utility accessible to everyone.

.....$299.

PRO POWER SPEAKERS

Ideal for Sound Blaster Cards
35 Powerful Watts RMS of great sound
Impedance 4OHM

C10776.....$99.95 pair



SAVE $100.00 off the OKI MICROLINE 172 Only $199.00
Plus a FREE priter cable!
- 9 Pin
- 180CPS
- NLQ30 CPS
- Compact Reliable Economical

BE QUICK
ONLY 25 LEFT!

JAPANESE DRIVES

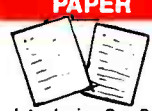
1.44MB 3.5" F.D.D $89.00
1.2MB 5.25"F.D.D $99.00

DR DOS 6.00

DOUBLE YOUR DISK STORAGE WITH NOVELL'S DR DOS 6.0

.....only $75.00

COMPUTER PAPER



Introducing ComPstat!
High quality 70 gsm, convienienty packed continuous fan- fold computer paper.
Comes in packs of 250 or 500 sheets in two sizes. 279mm x 241mm and true A4. Very useful for photocopying computer print-outs without having white space on the top or bottom of the page.

279mm x 241mm
250 sheets
C21006.....$9.95
279mm x 241mm
500 sheets
C21007.....$16.95
True A4
296mm x 210mm
250 sheets
C21008.....$14.95
True A4
296mm x 210mm
500 sheets
C21009.....$19.95

MEMOREX RECYCLED COMPUTER PAPER
2000 SHEETS
C21002.....$29.95

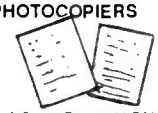
BULK COMPUTER PAPER

Quality paper at a low price!
- 60 gms bond paper
- 11 x 9 1/2" 2000 sheets

C21001.....$39.95
- 15 x 11" 2000 Sheets

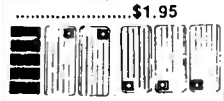
C21011.....$64.95

COPY PAPER FOR LASER PRINTER & PHOTOCOPIERS



A-4 Copy Paper 80GMS white recommended for high speed copiers/Laser printer. Also available in recycled paper
.....$7.95

DISK LABLES
(To fit 3.5" disks)
C21022 Qty. 25
.....$1.95



DISK LABELS & WRITE PROTECTS
(To fit 5.25"disk)
C21021 Qty. 25 labels & 25 write protects.....$1.95

DUST COVER

Keep your computer and accessories free of dust and grime while not in use.

XT* Cover Set
C21066.....$14.95
AT* Cover Set
C21068.....$16.95

HEAD CLEANER DISK

It takes only a minute amount of dust, dirt, or magnetic oxide particles on your drive heads to cause problems, errors downtime or expensive service call. Regular use of a head cleaner will keep your drive free of trouble causing dirt and help keep your system up and running. These disk cleaner are simple to use and include cleaning solution and instructions.
- 3 1/2" C12560.....$6.95
- 5 1/4" C12555.....$4.95

MICE

Z-NIX BUS MOUSE
Great for saving a serial port. 2 Free telepaint disks.Save $30 ONLY
X19951.....$89.00

QUICK MOUSE
Microsoft compatible.
Free mouse house & mat plus free pop up software.
X19955 .....$59.95

NEW BUDGET MOUSE
Microsoft compatible steamline design an amazing
X19953.....$29.95

MICROSOFT MOUSE
The top of the range!
Supports 100's of applications. FREE paintbrush software
X19958.....$199

KEYBOARDS

IBM COMPATIBLE EXTENDED KEYBOARD
X12022.....$45.00

101 KEY TRACKBALL KEYBOARD Keyboard & Mouse in one
X12020.....$199.95

KEYBOARD STORAGE DRAWER
C21083.....$84.95

MINI VACUUM CLEANER
C21087.....$14.95

KEYBOARDS COVERS
C21089 84 KEY.....$4.50
C21088 101 KEY.....$5.95

CO-PROCESSORS

Cat No.	Type	Price
U21841	287XL	$210
U21851	387DX	$459
U21854	387SX-16	$310
U21855	387SX-25	$335

ROD IRVING ELECTRONICS

MELBOURNE: 48 A'Beckett St. Ph: (03) 663 6151.
Computer sales: Ph 639 1640. FAX: (03) 639 1641
NORTHCOTE : 425 High St. Ph: (03) 489 8866
OAKLEIGH: 240C Huntingdale Rd, Ph: (03) 562 8939
SYDNEY: 74 Parramatta Rd. Stanmore. N.S.W.
Ph: (02) 519 3134 or (02) 565 1458. FAX: (02) 516 5024
ADELAIDE: 241-243 Wright St. Adelaide Ph: (08) 211 7200
MAIL ORDER: 56 Renver Rd, Clayton Vic, 3168.
Ph: (03) 543 7877
Mail Order Hotline: Ph: 008 33 5757.

DEALERS: BLUESTAR COMPUTERS
(Computer Products only)
MELBOURNE: 271 Maroondah Hwy, Ringwood.
Ph: (03) 870 1800 or (03) 879 5162. FAX: (03) 879 3027
SYDNEY: 115-117 Parramatta Rd, Concord.
Ph: (02) 744 5526

MAIL ORDER & CORRESPONDENCE
P.O BOX 620, CLAYTON, VICTORIA, 3168.

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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.

December 1942

Canada's new shortwave: Canada's first powerful shortwave broadcasting station is to be erected at Sackville, New Brunswick.

It will be owned by the Government and operated by the Canadian Broadcasting Corporation, working in consultation with the Department of External Affairs.

The cost is estimated at A£225,000 and maintenance at A£140,000 annually.

Photo-sensitised metals: The Lockheed Aircraft Corporation has stated that a process for printing blueprints direct on to metals, developed by Eastman Kodak, saves it $20,000 on each aero model produced.

By this invention, engineering drawings can be printed by projection or by contact on to the metal, so enabling the latter to be cut straight away in the template department. Drilling, punching and filing can also be carried out, straight from the drawing.

The film is glued to the metal by a lacquer, and the sensitised surface is then ready to take any photo-image, while, being matter, it can be altered by pencil.

December 1967

Wind-powered radio telephone: The PMG has installed the first wind-powered radio telephone system in NSW between Wanaaring and Thoulcanna, and uses fully transistorised radio-telephone equipment housed in sun-shaded huts.

Constant voltage output is obtained with the aid of the transistor regulator. Automatic pitch control of the propeller reduces the rise in propeller revolutions with increase in wind velocity and keeps the rpm within safe limits. The 200AH batteries installed will maintain the system for 14 days in 'no wind' conditions.

Electronic teleprinter: An electronic teleprinter for use in data communications, the first of its kind to be produced in Europe, has been developed in the UK.

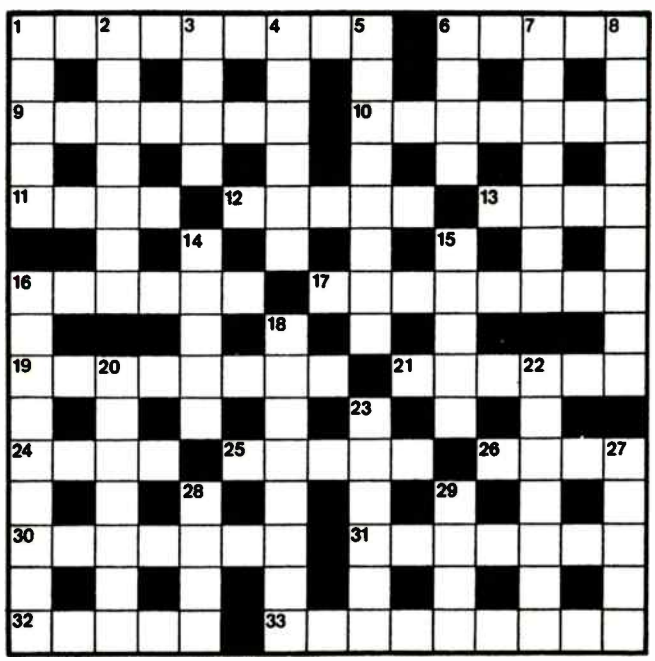
The new machine prints 96 characters, including upper and lower-case letters, and operates at up to 10 characters per second. It has been designed for on-line use as a data communication set, or for off-line 8-track tape preparation, interpretation, duplication and editing.

Second generation weather satellites: A new series of weather-watching satellites — designated TIROS-M — will be placed in orbit beginning in 1969, to provide more extensive coverage of earth weather conditions.

Pictures taken by its cameras will be stored on recorders aboard the spacecraft for subsequent transmission to earth station in Alaska and Virginia.

The automatic picture transmission system will allow simple, inexpensive stations to receive pictures of local area weather conditions from the satellite as it passes overhead. The infrared radiometers will provide night time views of cloud cover by detecting slight differences in heat emitted by the earth and clouds. ❖

EA CROSSWORD



ACROSS

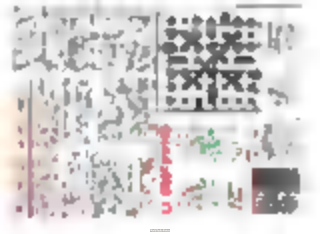
1. Said of a range of frequencies. (9)
6. New name in Australian communiations. (5)
9. This ship sank when marine radio was a novelty. (7)
10. Power lines. (7)
11. Assigned characteristic of an electron. (4)
12. Famous British astronomer, Patrick ——. (5)
13. Space vacated by an electron. (4)
16. United Nations scientific group. (6)
17. Blocked from view. (8)
19. Laboratory measuring instruments with taps. (8)
21. Reduced an oscillation. (6)
24. Electric appliances. (4)
25. Photographic tone. (5)
26. Activate a switch. (4)
30. Economical (like EA projects). (3-4)
31. Deflect photons, electrons, etc. (7)
32. Laundry appliance. (5)
33. Serviceman's considered opinion. (9)

SOLUTION FOR NOVEMBER 1992

S	U	B	M	E	N	U		M	E	S	S	A	G	E
P		A		C		T		E		O		R		A
E	A	R	T	H	L	I	N	G		F	O	C	U	S
E		C		O		L		A		T		H		T
C	O	O	L		B	U	L	B	S		V	I	E	W
H		D		W		X		Y		L		V		E
	X	E	R	O	X		S	T	R	O	K	E		S
I			U		C		E		C					T
S		W	I	N	D	O	W		C	A	N	A	L	
O		A		D		L		S		L		N		V
T	Y	R	E		B	L	O	W	S		L	O	C	I
O		G		B		A		I		S		D		O
P	L	A	T	E		P	O	T	E	N	T	I	A	L
E		M		A		S		C		O		S		E
S	H	E	A	T	H	E		H	E	W	L	E	T	T

DOWN

1. Groups of data. (5)
2. Where OB transmissions are initiated. (7)
3. Former metric unit of force. (4)
4. An electric winch could have this. (6)
5. Diverge as a wavefront can. (8)
6. Domestic appliance. (4)
7. What are recorded on a seismograph? (7)
8. Supported like a pendulum. (9)
14. The —— connection is used in certain transformer windings.(5)
15. Type of battery. (5)
16. Said of simple speaker enclosures. (9)
18. Received a signal. (8)
20. Uncontrolled effect, sometimes thermal. (7)
22. Unauthorised sellers of recordings. (7)
23. An EPIRB could initiate an —— rescue. (3-3)
27. Where was the Curie's Radium Institute founded? (5)
28. Cardinal number. (4)
29. Amplification. (4)



EA with ETI marketplace

ADVERTISING RATES FOR THIS PAGE

SMALL ADS: The minimum acceptable size of 2 centimetres x one column costs only $50. Other sizes up to a maximum of 10 centimetres are rated at $30 a centimetre. **CLASSIFIEDS:** $4 for 40 letters. Just count the letters divide by 40 and multiply by $4, ROUND UP TO THE NEAREST WHOLE NUMBER. **CLOSING DATE:** Ads may be accepted up to the tenth of the month two months prior to issue date. **PAYMENT:** Please enclose payment with your advertisement. Adress your letter to: **THE ADVERTISING PRODUCTION MANAGER, ELECTRONICS AUSTRALIA, P.O. BOX 199, ALEXANDRIA NSW 2015**

FOR SALE

8051 MICRO-COMPUTER /PROTOTYPING PCB $30: Similar to my ROMLoader EA Jan 92. Provisions for 8255 PPI, 9346 EEPROM, 2k - 32k SRAM, 2k-32k EPROM, MAX232, DIP switches & expansion header. Send A4 SAE for article. Tantau PO Box 206 Gordon 2072.

WEATHER FAX PROGRAMS: For IBM XT/AT's *** "RADFAX2" $35, is a high resolution, shortwave weather fax, morse & RTTY receiving program. Suitable for CGA, EGA, VGA & Hercules cards (state which). Needs SSBhf radio & RADFAX decoder. *** "SATFAX" $45, is a NOAA, Meteor & GMS weather satellite picture receiving program. Needs EGA or VGA, & "WEATHER FAX" PC card. *** "MAXISAT" $75 is similar to SATFAX but needs 2mb of expanded memory (EMS 3.6 or 4.0) & 1024 x 768 SVGA card. All programs are on 5.25" or 3.5" disks (state which) + documentation, add $3 postage. ONLY from M. Delahunty, 42 Villiers St, New Farm 4005, Qld. Ph (07) 358 2785.

ALL THINGS FOR SALE: New & used CRO TUBES many types, VIDEO CAMERAS B&W $75, zoom lense to suit 12.5 - 75mm $100, COLOUR CAMERAS Power Zoom $200, BWD 539D CRO 25Mhz Dual Trace in Alum Case $350, BWD 521 CRO 20MHz DUAL BEAM Delay $500, Phillips PM3200 CRO 10Mhz Portable needs repair $150, BWD 845 CRO 30Mhz dual-trace storage & delay variable-persistance $600, CRO Polaroid Cameras $50. (09) 349 9413.

LOUDSPEAKER REPAIRS, ALL BRANDS: Don't discard old favourites. Foam surrounds replaced at a fraction of new driver cost. Price list available. AMP-K Electronics P.O. Box 327 N.Ryde 2113 Ph. or Fax (02) 878 2291.

LASER TUBES: Ex laser optics stock NEC GLT 2080 brand new 4MW will sell quick at half price $175ea includes postage (08) 296 7464 A.H.

UNUSUAL BOOKS: Electronic devices, fireworks, locksmithing, radar invisibility, surveillance, self-protection, unusual chemistry and more. For a complete catalogue, send 95¢ in stamps to: VECTOR PRESS, Dept E, PO Box 434 Brighton SA 5048

SELL VERY OLD RADIOS: rare valves, transformers, old radio books and manuals etc will pack and despatch (07) 356 6052

KENWOOD AUDIO-VISUAL CONTROLLER: with manuals, Model KVC-570 used for dubbing & mixing, includes enhancer & fade-in. Cost $465 reasonable offer considered (02) 949 3570

COAXIAL SWITCHES AND LOADS: 3 x 4 port 3" $1 x 4 port 2.125" with interlocks 50ohm 2kw & 5kw air cooled
Phone (079) 515 791

AUDIO TV VIDEO REPAIR BUSINESS: for sale. Eastern suburbs Est. 10 years. good stock of manuals. rent for flat and shop $400 a week long lease price $35,000
Tel (02) 664 1804

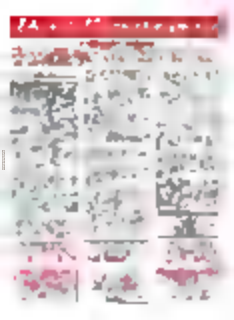
SSTV RECEIVE SCANCOVERTER KITS: Tired of hearing but not seeing? New easy to build single PCB design can decode B/W and colour pics. Simply connects between radio and monitor. High resolution monochrome display, 256 lines x 256 pix x 4 shades. KIT1- PCB and full instructions $80 incl. postage. KIT2- PCB and all components (except case) and full instructions $200 incl. postage. Send cheque or SASE for more info to: L.M.Williams 14 Powell St. Bungendmore NSW 2621.

RECENTLY RECIEVED: a load of obsolete non working industrial range detectors with a desoldering tool and 1C puller, you should be able to liberate a large LCD, 27512 ROM, 8031 Micro controller leds, trimpots, transformers 240-24V and many otheer components. Also available: PC's, printers, monitors, keyboards and test equipment and much, much more.

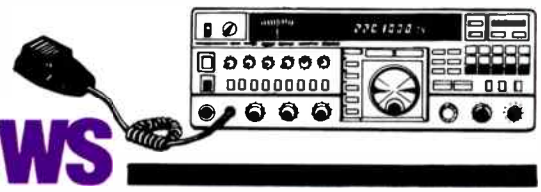
ELECTRONIC COMPONENT PACK: $150.00 RRP value for $25.00 + $8.00pp consists of :- Resistors, capacitors, transistors, intergrated circuits, pots PC boards etc All new components. Available from Secondtronics, 143 Grays Rd Enoggera 4051 Brisbane QLD Phone (07) 355 1314 Fax: (07) 855 1014. Mail order to P.O. Box 2215 Brookside 4053. Credit card or Mail Order. Also large stock of valves components computer bits new and second hand.

ELECTRONIC TECHNICAL DATA SHEET: Library, filed alpha/numeriacal, dating from pre 1938-1975 (a history of the Industry). 155 vols. page thickness 39ft (12m) + 9ft unsorted. Also valve data and other books, valves etc. phone (02) 502 4016

NEW NOTEPAD: Computer by Amstrad as advertised on tv. Z80B micro, built-in standard Parallel, Serial, Basic, Word Processor, Dictionary, Calendar, Diary, Address/ Telephone book, World time clock/alarms, Calculator, PC File transfer. $390 inc. post & ins. For more info send a 45¢ stamp to Don McKenzie 29 Ellesmere Cres Tullamarine 3043.



Amateur Radio News



Nigerian club appeals for help

The APLE DX-Hams Club in Cross River State, Nigeria has sent us a letter appealing to *EA*'s amateur radio readers for donations of surplus receivers and other amateur gear, components, accessories and books. According to the Club's secretary John Ushie, it is virtually impossible to obtain *any* of these items in Nigeria — a fact which is greatly frustrating its would-be radio amateurs and DX enthusiasts. Currently they feel 'totally locked out' from the world of amateur radio, John reports. He continues:

Please — we want to be able to hear hams chat, and we want to be on air so we can be heard by other hams. We want to be able to enjoy the world of ham radio, especially those of us who are physically handicapped.

What we ask is that Australian amateurs dig out their surplus ham equipment, antennas, accessories, spare parts, amateur radio books, etc., and mail them to us so we can get started. Please send them to the APLE DX-Hams Club, 41 Anderson Street, Box 154 Obudu, Cross River State, Nigeria.

We look forward to the day when we can chat between our continents, by means of amateur radio.

It sounds like a very worthy cause, for many of our amateur radio clubs.

FCC planning visitor's licences

The WIA's *Amateur Radio* reports that the ARRL has released a proposal for visitors to the US to be permitted to operate for 60 days, on the basis of a home country licence and a pass in a short examination on local rules applying to the proposed type of operation. This is to apply even to visitors from countries with which no reciprocal agreement is in place.

The examination of credentials, determination of appropriate privileges, and administration of the 20-question examination is proposed to be carried out by Volunteer Examiners already accredited within the US system. This proposal should greatly streamline the issuing of licences to qualified amateurs visiting the US.

Canadian amateur bodies merging

According to a recent *ARRL Newsletter*, the Canadian Radio Relay League and the Canadian Amateur Radio Federation have voted to merge. The respective societies will be dissolved, and the new combined body, the 'Radio Amateurs of Canada' will be incorporated.

Russian amateurs have problems

The *ARRL Newsletter* of 30th August 1992 reports an interview by US amateur Robert Howe K1MZB, with the first President and Vice-president of the newly formed Union of Russian Radio Amateurs.

The interview took place in St Petersberg, at the third annual International Ham Convention. This 1-1/2 page article, the first of a series, notes the problems being encountered by the Russian amateurs under the new administration, in that most of their financial support has been withdrawn — including the free postage of QSL cards, and access to surplus military equipment.

In the last year, 40% of Russian club stations have been forced to close for lack of funds. Russian amateurs are anxious to maintain links with other countries, including the USA which has provided strong support over the years.

New ARRL Handbook

The ARRL has just published the 70th edition of its world famous *Handbook for Radio Amateurs*, first published in November 1926. Now with hard covers and spanning no less than 1216 pages, the latest Handbook has 39 chapters covering virtually every aspect of modern amateur radio and communications technology.

New items include an expanded discussion of colour and computer slow-scan TV, a voice 'memory keyer' project, an on-glass VHF/UHF antenna project and a comparison of propagation prediction programs.

Although stocked by many local bookstores, the Handbook can also be purchased direct from the ARRL at 225 Main Street, Newington, Connecticut 06111, USA. The cost is US$25 plus US$4 for shipping. ❖

Electronics Australia's

Professional Electronics

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TELECOM 'UNLOCKS' HISTORIC RECORDINGS

AWA'S FORMER FACTORY IN ASHFIELD BEING DEMOLISHED

REVIEW OF PADS-EVAL CAD PACKAGE FOR SCHEMATICS & PCB'S

NEW TEKTRONIX GPX LOGIC ANALYSER OFFERS 1GHZ TIMING ANALYSIS ACROSS 16 CHANNELS, 80MHZ STATE ANALYSIS ACROSS 80 CHANNELS — USING SAME PROBES


Professional
Electronics

NEWS HIGHLIGHTS

HOBART DISTRIBUTOR EXPANDS FACILITY

Tasmanian distributor GHE Electronics, a division of George Harvey Electric, has expanded its Hobart operation into a new showroom at 160 Argyle Street. GHE says that the separation of its electronic and electrical operations became necessary due to the progressive expansion of both divisions over the past 10 years.

Products distributed by GHE include Royel soldering products, C&K switches, Dymo label makers and the Altronics range of components and equipment.

HRSA AWARDS PETER LANKSHEAR

The Historical Radio Society of Australia Inc (HRSA) has honoured *Electronics Australia*'s vintage radio columnist Peter Lankshear with Life Membership, in recognition of his work in explaining and arousing wide interest in the subject — both in the monthly column itself, and in his book *Discovering Vintage Radio*.

In making the award, the HRSA noted Peter's many excellent articles, which have been attributed with achieving a large growth in both vintage radio enthusiasts and Society members.

It's gratifying to see one of our columnists honoured in this way, and we congratulate Peter on this achievement.

CHURCHILL FELLOWSHIP APPLICATIONS INVITED

The Winston Churchill Memorial Trust is currently inviting applications for the 1994 Churchill Fellowships, each valued at about $13,000 and designed to allow Australians from all walks of life to travel overseas in order to further their studies.

To date over 1600 Australians have been awarded Churchill Fellowships, and brought back knowledge and skills to enrich Australian society.

The Fellowships are available to all Australians, regardless of academic or other qualifications.

To apply, send a 240 x 120mm stamped and self-addressed envelope to Application Forms, The Winston Churchill Memorial Trust, 218 Northbourne Avenue, Braddon, ACT 2601. Applications close on February 28, 1993. Further information is available from the Trust's CEO Rear Admiral Ian H. Richards RAN (Rtd.), on (062) 47 8333.

ELECTRONICS STORES FOR CHINA

Hong Kong-based company Semi-Tech (Global) Ltd is to enter into joint ventures with Chinese companies to set up a chain of retail electronics stores across China, as part of a strategy to tap the country's vast consumer market. Semi-Tech is the parent company of the global Singer organisation, which distributes a range of sewing machines, refrigerators, TV sets, air conditioners and VCRs. It also owns Consumers Distributing, a 90-store retail chain which sells jewellery and electronics in eight US states.

Semi-Tech also recently acquired 51%

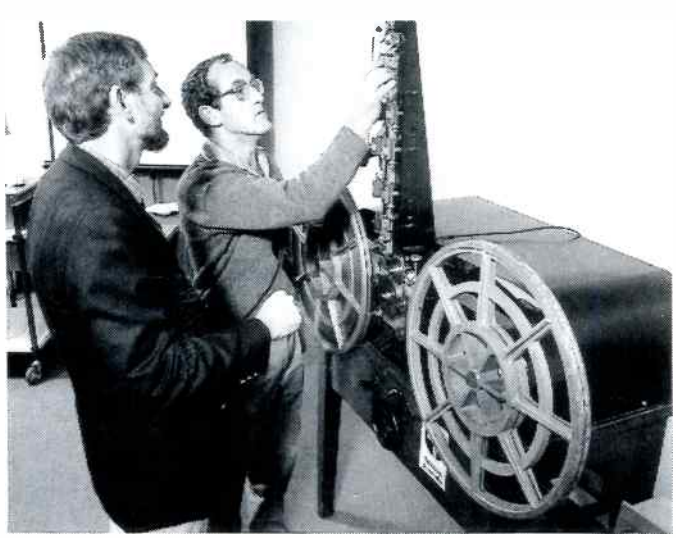
TELECOM 'UNLOCKS' HISTORIC RECORDINGS

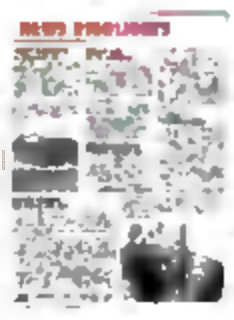
A mystery which puzzled Canadian radio broadcasters for over 40 years was recently solved at Telecom Australia's Research Laboratories in Clayton, Melbourne — when the world's only working example of a 1930's 'Blattnerphone' steel tape recorder was used to play back 11 reels of historic recordings made as early as 1935.

Developed in 1929 by Louis Blattner, from a design by German inventor Dr Kurt Stille, the Blattnerphone was a very early recorder using thin steel tape. The machine in question was originally brought to Australia by the PMG's Department, and later used by ABC Radio. It fell into disrepair after WW2, and was later given to the Museum of Victoria. More recently it has been restored to full working order by TRL technicians.

The 11 reels of steel tape, each weighing up to 15kg and playing for up to 35 minutes, were brought to Australia by Ernest J. Dick, Corporate Archivist for the Canadian Broadcasting Corporation. The recordings had not been heard since WW2, due to the lack of a working Blattnerphone, and no-one knew what they contained.

The tapes turned out to contain a historic broadcast by England's King George V, on the occasion of his Silver Jubilee in May 1935; radio programs recorded during WW2, with news, interviews with services personnel and messages from parents in the UK to children sent to Canada during the war; and post-war French news broadcasts, one featuring a speech by President De Gaulle.





of Sansui Electric, the Japanese manufacturer of high-end audio products. The company itself also operates a three-storey factory in Guangzhou, China, assembling a wide range of consumer items including electrical appliances and audio products.

FIRST ASIA-PACIFIC CIRCUITS CONFERENCE

APCCAS'92, the first Asia-Pacific Conference on Circuits and Systems, will be held from Tuesday December 8 to Friday, December 11, 1992 at the Hyatt Kingsgate Hotel, in Sydney. The Conference incorporates the 11th Australian Microelectronics Conference, and is being sponsored by the IREE Australia and the IEEE Circuits and Systems Society, and co-sponsored by the IE Australia and the IEEE.

The theme of the Conference is VLSI Circuits and Systems: Architecture, Design, Theory and Applications. An estimated 330 delegates are expected to attend, and there will be an exhibition held in conjunction with the Conference.

Further information is available from the Conference Secretary, IREE Australia, Unit 3, Edgecliff Court, 2 New McLean Street (PO Box 79), Edgecliff 2027; phone (02) 327 4822.

OTC MANAGER IS NEW INTELSAT CHAIRMAN

OTC Australia's Len Dooley has been elected Chairman of the Intelsat Board of Governors, the peak governing body of the 124-member-country international telecommunications satellite consortium. Mr Dooley has already begun his one-year term at the Intelsat headquarters in Washington, DC.

Intelsat is currently moving towards a more commercial structure, to meet the competitive challenge from optical fibre cable operators and other commercial satellite service providers.

MOBILE TRACKING SATELLITE ANTENNA

Matsushita Electric in Japan has developed a compact mobile tracking satellite antenna, which can provide reliable satellite communications and TV reception for buses, trucks and other moving vehicles. The 'Sky Hunter' PVS110 incorporates a microprocessor-based phase detection servo system, which provides rapid tracking in both azimuth and elevation by up to 60° per second.

The tracking planar array antenna itself measures 540 x 180mm, and is claimed to offer 72% reception efficiency and a performance index (GT) of 9dB/K over the range 11.7 - 12GHz. It is housed in a weatherproof domed enclosure measuring 938 x 882 x 225mm high, and weighs approximately 31kg. It tracks over a full 360° in azimuth, and from 20° to 60° in elevation. The antenna operates from 24V DC and draws less than 6A maximum.

Matsushita has also developed a matching mobile satellite TV receiver, the TU-BSC77M. This incorporates a digital frame storage system to provide a replacement still image of the last received frame, when the vehicle passes under bridges or other temporary interruptions to satellite reception.

TOSHIBA DEVELOPS TINY INMARSAT-C

Toshiba Corporation in Japan has developed a portable Earth station for the Inmarsat-C satellite data system, measuring only 320 x 210 x 62mm and weighing only 3.9kg.

The TM1700 mates with a standard PC to provide the ability to exchange text and data with the international telex and public data networks, from anywhere in the world and at up to 600bps.

Features of the TM1700 include a built-in signal level meter to facilitate alignment of the antenna, NiCad batteries providing over 40 minutes of operation, and easy interfacing with the PC via a standard RS-232C serial port.

MOTOROLA/PHILIPS JOINT CHIP CENTRE

Motorola and Philips recently announced the establishment of their joint chip design centre in Eindhoven. The purpose of the new Motorola-Philips Design Center is to accelerate the development of future integrated circuits for CD-I and related multimedia products, to facilitate the integration of future extensions of the CD-I system and to realise fast cost reductions of the player components price.

After working together for several years in the development of CD-I chips, Philips and Motorola decided to set up this centre now, to prepare themselves for the huge emerging multimedia market. At the moment, CD-I (Philips' interactive multimedia system) is working towards a mass market breakthrough. Therefore, it is needed to have high-volume supplies of competitive consumer-priced components.

Philips chose to work with Motorola for its leading edge semiconductor design methodologies.

Mr Henk Bodt, CEO of Philips Consumer Electronics Division stated, "CD-I will be a large global market and Motorola is one of the world's premier semiconductor manufacturers with global manufacturing and application support. Furthermore, they are the originators of the 68000 architecture on which CD-I is based".

Mr Barry Waite, senior vice president and general manager of Motorola European Semiconductor Group, added that Philips' system CD-I, with the MPEG extension of full motion video, promises to be the leading worldwide consumer multimedia platform for the future. "According to industry analysts, there will be a large multimedia market. We want to play a major role in this attractive market."

The first of the cooperation between the two companies, is the earlier integration of new integrated circuits in Philips' CD-I 220 player.

NEWS HIGHLIGHTS

NATA AWARDS AS3902 TO CODAN

One of the biggest manufacturers of communications equipment in Australia, Adelaide based Codan, has been recognised for its international quality standards. The quality standard, known as AS3902, means Codan's manufacturing process meets the most stringent international standard. The higher quality rating means that Codan equipment also conforms to International Standard 9002 — putting it on a par with any quality manufacturer in the world.

Codan, based at Newton, a north eastern suburb of Adelaide, was awarded the new rating by the National Association of Testing Authorities (NATA), for the manufacture and supply of remote area and mobile communication equipment.

Codan's core business is making high frequency (HF) radio communication equipment, 60% of which is exported to customers such as agricultural officials in Nigeria, UN aid workers in east Africa, missionaries in Papua New Guinea and the South Pacific.

Codan managing director, Mr Mike Heard said Codan had always had a strong commitment to making quality products and the new standard was a recognition that its quality was now of international standard.

Codan employs a total of 240 people — 220 at Newton and 20 scattered around Australia and in its major export markets.

THREE-SHIFT DAYS AT AWAM PLANT

AWA MicroElectronics is defying the trend in many Australian companies by switching to three-shifts-a-day production of silicon chips, while operating its Homebush (Sydney) microchip plant 24 hours a day for five days each week. The switch from two shifts a day is expected to boost AWA's production by about 20%.

If the growth in demand for its chips continues, the firm plans to lift production again by operating its plant seven days a week. Most of the factory's output is exported to Silicon Valley in California — the company recently completed delivery of its five-millionth chip to Chrontel Inc, which specialises in supplying frequency synthesis chips, which simplify the manufacture of high resolution graphic displays.

AWAM says it won the initial Chrontel order because of its ability to produce the leading edge chips in half the time its competitors, mainly in the US and Japan, would have taken. As well, with its own design facilities, the company is able to produce chips economically for short-run special orders.

OPTUS TO KEEP A2 SATELLITE

Optus has announced plans to reconfigure its satellite system to keep four satellites — A2, A3, B1 and B2 — serviceable instead of three, as previously planned.

The initiative, designed to prolong Australia's satellite capability well into the 21st century, will conserve the scarce resource of in-orbit telecommunications transponders. It will prolong the useful life of the B2 satellite, scheduled for launch this month by up to five years.

The new plan has two main elements:

1. Optus will put the A2 satellite, whose normal life would have expired next winter, into an inclined orbit. In this orbit, less station-keeping fuel will be used, and the satellite will therefore be available to carry traffic for several more years, to and from earth stations that have tracking antennas.
2. When the B2 satellite is launched, it will be put initially into a storage orbit, minimising its fuel consumption. B2 is expected to replace A3 in 1997, when that satellite's fuel is exhausted.

Optus says this initiative will allow customer plans to proceed independent of the success of the forthcoming B2 launch, and will provide optimum traffic capacity for the 1990's, both domestically and internationally.

It also takes into account Optus' reduced trans-Tasman satellite requirements, following the recent purchase of part of the Tasman 2 fibre optic cable for Optus' 0099 long distance service between Sydney and New Zealand.

To achieve the best configuration of satellites and transponders, it will be necessary to 'repoint' some customer transmissions, and this is expected to be completed by March 22, 1993. Optus is discussing the situation with customers in order to ensure services will not be dis-

NEW TEM RESOLVES 1 ANGSTROM

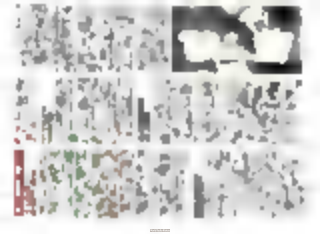
The first-ever 300kV transmission electron microscope (TEM) with Field Emission Gun (FEG) has just been installed and commissioned in the University of Tubingen, in Germany. It took Philips less than a week for the 300kV FEG TEM to be transported and installed in the University, where it will now be used for ultra-high-resolution electron holography.

The microscope is the first to be delivered as part of an EEC-funded project aimed at pushing the obtainable resolution down to one Angstrom or less, representing an improvement of almost a factor of two over the current generation of instruments.

Cooperating in this project are top European electron microscopists from the Universities of Tubingen, Antwerp (Belgium) and Delft (Netherlands) and Philips Research, together with scientists in the United States, and two industrial partners, Philips and TVIPS GmbH.

For this project Philips developed an ultra-high resolution 300kV FEG TEM with a very high illumination coherence (1000x the brightness of LaB_6) making it possible to push the information limit down to one Angstrom.

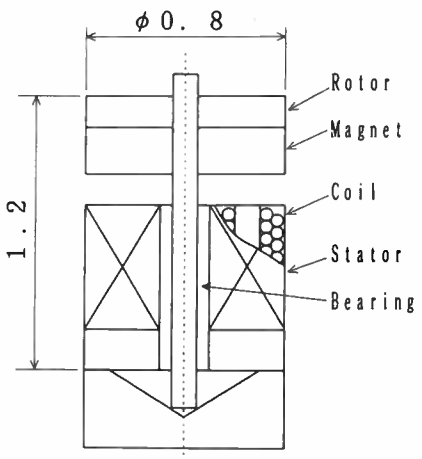
After installation of the 300kV FEG TEM in Tubingen, testing confirmed its success: rock-solid one-Angstrom lines were seen on the TV monitor at a magnification of 60 million times. The one-Angstrom resolution indicates that the mechanical stability of the instrument is good enough to resolve it. Philips is now confident that it will achieve a major breakthrough in resolution in the near future.



rupted and all previous commitments to customer service will be honoured.

TOSHIBA SHRINKS MOTORS FURTHER

Toshiba Corporation in Japan has developed what it claims is the world's smallest electromagnetic motor. The prototype ultra-small motor has an outside diameter of only 0.8mm — over three times smaller than the diameter of the electromagnetic motor Toshiba announced in late 1991.



The new prototype is an axial-gap type synchronous motor, in which the motor is separated into two parts.

The stator, which has an outside diameter of 0.8mm, houses three coils and a sleeve bearing to support the rotation of the rotor shaft. The rotor section, including the magnet, is mounted on the stator. The complete motor weighs only 4mg.

In Toshiba's previous motor the magnet was encircled by three coils. These elements were then incorporated in a cylindrical casing with an outside diameter of 3mm.

Adaption of the axial type structure and continuous efforts to improve the company's precision machining technology, has allowed Toshiba researchers to further cut size. Driving the new prototype electromagnetic force motor requires only 1.7V. Changes in frequency can produce operating speeds from 60 to 10,000rpm.

Toshiba continues to direct its energies to achieving further advances that will contribute to the development of smaller, highly efficient motors for application in micromachines. Among other areas, the company is investigating the configuration of ultra small gearing for reducing rotation speed while increasing torque.

AUST'S VET WINS ICSA AWARD

After extensive tests of 24 anti-viral software products, the International Computer Security Association has announced that 'Our top scoring products were Fifth Generation's Untouchable and Cybec's VET'.

The Australian-developed VET package was awarded 359 points and Untouchable 361. Other products to get more than 300 points were (in order) Commcrypt Detect Plus, Central Point Anti-Virus, Dr Solomon's Toolkit, Look Virus Alert, McAfee Scan, Safetynet VirusNet, Skulason F-Prot, Leprechaun Virus Buster, Eliashim ViruSafe Gold, Norton AntiVirus and IBM Virscan.

Roger Riordan, author of VET, said, "I am delighted that VET has done so well in its first test by an internationally recognised independent body. VET was the only program which dealt adequately with an active viral infection. This reflects my almost pedantic insistence that VET must be able to deal with every situation the user might encounter".

The ICSA's judgement has been confirmed by Australia Post, which has just signed a licence agreement covering all of its PCs throughout Australia.

Australia Post had used VET in Victoria for two years, and chose it over a number of competing products because of its proven excellent protection, speed, ease of use, local support and price.

VET is available from Cybec Pty Ltd, Phone (03) 521-0655, at a cost of $90 for a single PC. Prices for multiple PCs on application.

SU LECTURER WINS 1992 ATERB MEDAL

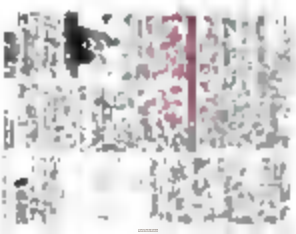
The 1992 winner of the Australian Telecommunications and Electronics Research Board's ATERB Medal is Dr Marwan Anwar Jabri, a Senior Lecturer in the School of Electrical Engineering at the University of Sydney.

The medal citation describes Dr Jabri as having an outstanding record of achievement in the field of artificial intelligence techniques and applications, and

having devised innovative new artificial neural network algorithms and architectures. He also has a record of effective collaboration with industry, and transferring his research results for commercial explotation, in the fields of speech synthesis, heart pacemakers and laser printer controllers. Dr Jabri wins a prize of $2500 as well as the silver medal. The ATERB, established in 1927 as the Radio Research Board, encourages and sponsors research with funding from its sponsors AOTC, CSIRO and DSTO. Further information is available from the ATERB Secretary, on (02) 887 8221. ❖

NEWS BRIEFS

- ***Siemens*** has appointed Mark Walsh to the position of Product Manager for semiconductors. His aim is to increase its semiconductor market share in Australia and to ensure smooth running of its distribution channels. Mr Walsh previously worked for VSI Promark and George Brown.
- Nippondenso Australia has appointed ***Unique Micro Design*** as a preferred Victorian distributor/authorised service repair centre for its range of CCD-based touch bar code readers and portable data entry devices.
- Sydney-base manufacturer of professional audio equipment ***Fairlight ESP*** has reported a big boost in earnings from export business. Of the 10 of its MFX2 digital audio workstations (worth A$1m) ordered recently, two orders came from the US, two from Korea and one from Spain.
- ***DCS Australasia*** has been appointed Australian distributor for the US-manufactured Benchmarq range of integrated circuits.
- The annual electronics exhibition ***EIE'93*** will be held at the Hong Kong Convention and Exhibition Centre from 21-25 May, 1993. For more information contact Business and Industrial Trade Fairs, 18/F, First Pacific Bank Centre, 51-57 Gloucester Road, Wanchai, Hong Kong; phone (HK) (852) 865 2633.
- Rockwell International's Texas-based Commercial Global Positioning System (GPS) Business has appointed 17 overseas dealers for its NavCore V GPS receiver engine. Included is ***Rockwell Systems Australia***, located in North Ryde NSW and Lilydale, Vic.
- Sydney environmental control equipment group ***Lear Siegler*** has bought the South Australia rail signalling and telemetry specialist, Teknis Systems.
- ***Zatek Components*** has been appointed as representatives in Australia of both Californian-based Hughes Semiconductors and Base 2 Systems of Colorado.
- At the recent Computer Expo in Brisbane, a year's free subscription to ***Electronics Australia*** was won by Ken Parkyn, Parkyn Electronics, 42 Binnalong Street, Rochedale 4123. ❖



AWA's Ashfield works being demolished

Once the largest 'radio-electric' works in Australia, the old AWA factory in Sydney's suburb of Ashfield is now being demolished. In its heyday, the factory had over 4000 employees and turned out huge quantities of radio and TV receivers, as well as transmitters, test instruments and components. It also played a key role in training many of Australia's best electronics engineers and technicians...

Perhaps it's because I was lucky enough to spend nearly two years there myself as an engineering trainee in the late 1950's, just after leaving school, but I find it very sad to record the end of AWA's old factory in Ashfield.

Somehow it seems to mark the end of an important era for Australia's electronics industry — an era when the manufacturing side of the industry was flourishing, and producing just about every conceivable item of radio and electronic equipment. Equipment that was equal to, if not better than that produced anywhere else in the world, at the time.

When I worked there, for example, the factory had a workforce of over 4000 people: from process workers, technicians and engineers, through toolmakers, fitters and turners, electroplaters and clerical people right down to we humble trainees and apprentices.

It had multi-shift production lines in the 'Radiola' building turning out vast numbers of TV sets, mantel and clock radios, plus other lines in the components building cranking out things like tuning gangs, speakers and Oak switches. The press shop was bashing out metal chassis, speaker frames and transformer laminations day and night, and from the Engineering Products building at the back emerged a steady stream of radio transmitters, professional telecommunications gear and high-grade test instruments.

One of the two main buildings on the Ashfield site when AWA purchased it in the middle of 1930. It became known as the 'Radiola' building, and produced huge numbers of radio and television receivers. (From Wireless Weekly, April 10, 1930).

It was Australia's largest radio factory, and we trainees and apprentices knew we were darn lucky to have been accepted into its training scheme — widely acknowledged as the best in the country.

The Ashfield factory site was bought by AWA in mid-1930, and officially opened by Prime Minister Scullin on March 31, 1931. At the ceremony, AWA's founding Managing Director Ernest Fisk (later Sir Ernest) described the new factory as an ideal setting for a company which was "one of the great undertakings of a national character".

But quietly and without any official fanfare, the factory is now passing from Australia's electronics history.

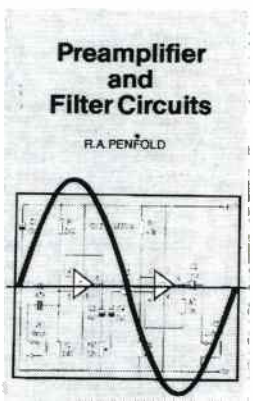
Economic pressures forced AWA, now based at North Ryde, to sell the site to Exicom Australia about three years ago, and it has been vacant since then. Exicom in turn also sold it to an affiliated company, which has apparently organised its demolition.

It seems a sorry and ignominious end for a factory that for almost 60 years seemed like the very foundation of our electronics manufacturing industry. Somehow it also seems symbolic of the way much of that industry was allowed to atrophy and fade away. (J.R.) ❖

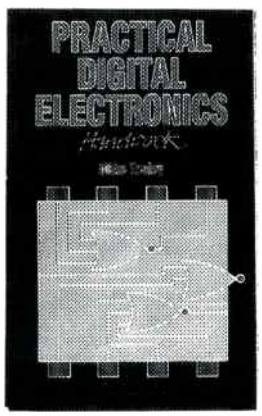
The same building, as photographed by our Editor a few weeks ago. Now empty and run down, it's soon likely to fall to the demolisher's hammer — a fate already being suffered by other buildings on the Ashfield factory site.

Electronics Australia

BOOKSHOP



Preamplifier and Filter Circuits
This book provides circuits and background information for a range of preamplifiers, plus time controls, filters and mixers. The circuits described are simple and previous experience of electronic project construction is not needed.
CODE: BP 3090 PRICE: $11.00



Practical Digitial Electronics Handbook
This book introduces digital circuits, logic gates, bistables and timers as well as microprocessors, memory and input/output devices. It will prove invaluable to anyone involved with the design, manufacture or servicing of digital circuitry.
CODE: PC 1004 PRICE: $22.95

Introducing Digital Audio, CD, Dat and Sampling. - Second Edition:
This book bridges the gap for the technician and enthusiasts who have worked with audio circuits. It includes oversampling methods and bitstream techniques and technical terms.
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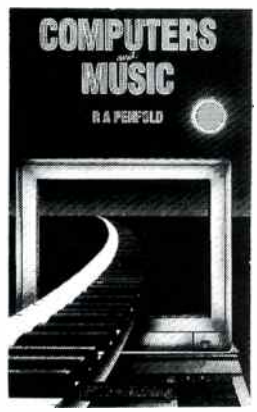
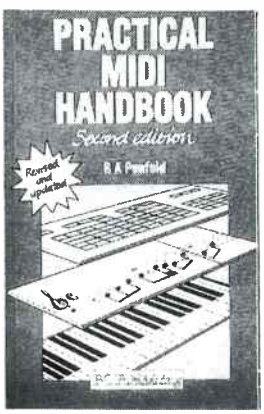
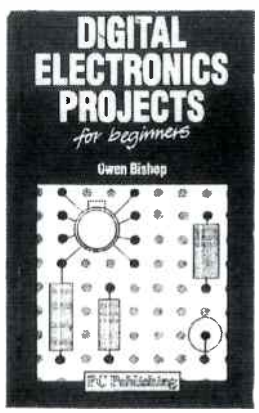


Computers and Music - An Introduction:
This book explains how to simply set up your own computer music studio. It covers the basics of computing, running applications programs, wiring up a MIDI system plus everything about hardware and the programs.
CODE: PC 1006 PRICE: $27.95



Practical MIDI Handbook
Refers to the powerful capabilities of MIDI and how to exploit it, with no knowledge of electronics or computing. It reviews the latest developments in MIDI covering keyboards, drum machines, sequences, mixers, guitars etc.
CODE: PC 1002 PRICE: $22.95



Digital Electronic Projects for beginners
This book provides simple, yet detailed instruction on practical projects. Covering instrumentation to home security plus circuit diagrams, this reference book also offers 'fun' projects for newcomers to electronic construction.
CODE: PC 1011 PRICE: $19.95

HOW TO ORDER

To order, simply fill in the coupon, remembering to include the code numbers and $5.00 postage and handling. If the coupon is missing, write down the names, code numbers and prices of the books you require. Include your name, address, phone number, plus cheque, money order or credit card details (card type, card number, expiry date and signature) and send it all to Federal Publishing, Reply Paid No. 3, PO Box 199, Alexandria, NSW 2015. Please allow at least 28 days for delivery and please sign all orders.

BOOKSHOP

CAD software review:

'PADS-EVAL' for both PCBs and schematics

Priced at just $49.95, this evaluation package offers all of the capabilities of the impressive 'PADS' software, but with the number of components limited to a generous maximum of 70. It runs on IBM-compatible machines, and has a formidable range of features including sophisticated auto-routing/placement, design rule checking, multi-sheet capability, plus much more.

by ROB EVANS

Computer Aided Design/Drafting (CAD) software has become so powerful (and complex) nowadays that it's becoming very difficult to assess which of the many packages on the market will suit your needs, without some type of thorough demonstration. Since an extended visit from the software company's sales office can only really be justified for government departments or the largest businesses, many CAD products are now sold on the strength of a *demonstration or evaluation* disk, which is derived from the fully-blown package.

The idea of a 'demo' disk is that a potential customer can run this software on their own machine, and determine the product's features and capabilities at their leisure. The software company simply supplies a demo disk to anyone who is interested in their product — either free of charge, or at some small nominal fee.

Unfortunately, these demo or evaluation disks can often be rather misleading as to the real performance of the product in question, since in practice, the software generally takes the form of either a self-running demonstration (with no user control) or a 'nobbled' (restricted) version of the real thing.

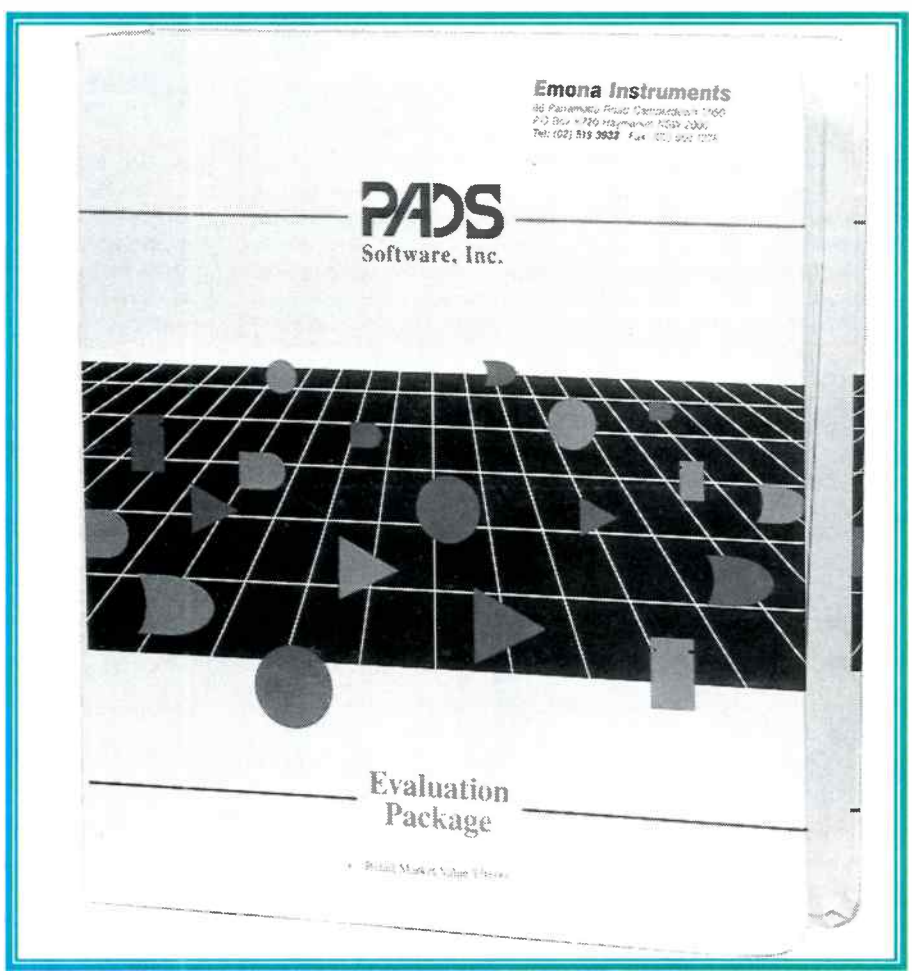
With the self-running demo, the user has little chance of getting a 'feel' for the software, or trying out different tasks that aren't covered — and you're never quite sure if the real software will react to your machine in the same way as the demo.

On the other hand, the 'nobbled' evaluation version is rather a better proposition since it solves all of the above problems, yet still protects the company against lost sales through flagrant software piracy.

The success of this evaluation software will ultimately depend upon how much thought has gone into the 'nobbling' process, however.

We've experienced a number of evaluation packages that have many of the genuine software's key features restricted, which in our opinion, frustrates rather than encourages a potential customer.

The evaluation version of the PADS suite of CAD programs, PADS-EVAL is an effective example of how a program can be restricted, yet behave in an identical manner to the genuine program. In this case, PADS Software



have struck what seems to be an effective compromise where the size of the circuit/PCB that can be created with PADS-EVAL is limited to a maximum of 70 components, while the package itself will cost you just $49.95 — including a 114 page ring-bound tutorial-style manual.

In practice this means that for a *very* small investment, you end up with a powerful PCB/schematic package that's capable of creating artwork for quite complex circuits.

While this will suit a home or small business user in its own right (without further outlay), it also allows a potential customer of the full PADS design package to thoroughly test the software in their work environment. And if the serious CAD user *does* elect to purchase the full package, all of the work completed during the evaluation process is not wasted.

So that's how this rather high-end CAD package has become available at such an extraordinarily low price. The next logical question, of course, is just what does PADS-EVAL offer, and how well does it perform these tasks?

PADS features

The PADS package is composed of two main programs; PADS-PCB for printed circuit board design, and PADS-LOGIC for schematic drafting and 'capture'.

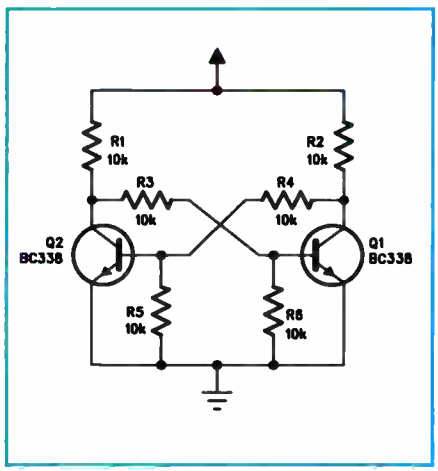
These programs are very much integrated, in the sense that they share a common parts library (which is supplied with around 6000 components), can exchange netlist information and text files, and can transfer circuit update information in either direction. For example, if you say delete or add a part in the schematic, an update file can be called into PADS-PCB where the parts on the circuit board will change accordingly.

Both programs also share the same mouse-driven user interface (that is, screen layout and menu scheme), which offers full control over grid and snap settings, a fully programmable macro system for fast keyboard-driven menu shortcuts, and a comprehensive setup menu for controlling screen colours.

The fact that the two programs share so many functions and features tends to lower the slope of the learning curve to some degree, since after you've spent some time with one of the programs, you find that the other looks quite familiar and behaves in an almost identical manner.

In terms of functions and capabilities, the PADS programs stack up rather well when compared to other integrated CAD packages costing many times the price. PADS-PCB has a grid and design rule checking resolution of '1 mil' (0.001"), can produce boards with up to 30 layers, has full 'via' (the crossover connection between layers) support, and is ready for surface mount components. By the way, while the evaluation version of PADS-PCB is limited to a maximum of about 30 ICs (or more specifically, 70 components and 150 'netlists'), the fully-blown edition can produce boards with at least 300 (14-pin) ICs.

When it comes to creating and editing a PCB layout, PADS-PCB offers the kind of flexibility that you expect from a serious circuit board design program. It features a library browsing scheme which displays the image of each component as it's selected, an on-line parts editor (rather than a separate editing program), dynamic 'rubberbanding' of connections when moving components, group or block editing facilities (move, cut, paste, delete, etc), and full auto-placement and auto-routing capabilities.



A sample printout from our office laser printer of a simple schematic drawn in PADS-LOGIC. As you can see, the quality is quite suitable for publishing purposes.

Given the common user interface between the two programs, it's not surprising to find that the schematic part of the PADS package PADS-LOGIC offers both similar editing features and equivalent capabilities to PADS-PCB.

One interesting aspect of PADS-LOGIC in particular, is its capacity to pass circuit information files to a range of other CAD and analysis/simulation programs.

This kind of open-ended transfer of data is achieved through PADS-LOGIC's ability to export circuit netlists, which can be selected to suit other programs such as PADS-PCB, CADSTAR, PCAD, FUTURENET, PSPICE, TANGO, SUSIE, and FUTNETENH. In theory this means that by simply transferring files, you could then analyse the circuit using say PSPICE, and complete a board layout with CADSTAR (perhaps at some remote location). Note that PADS-PCB is included on the above list, so that a circuit netlist can also be passed to PADS-LOGIC's own sister program, as you would expect from an 'integrated' CAD package.

In fact, the general data output system of both PADS-PCB and PADS-LOGIC appears to be rather more elaborate than you would find in other low-cost CAD packages. Besides the ability to send netlist information in a number of different formats (as mentioned above), the PADS system is able to produce a wide range of status reports on just about every aspect of a circuit layout.

Amongst others, these include Bill of Material (BOM) listings, Job Limits (the program's remaining capacity), Design Rule checks, Parts Lists, general circuit statistics, and so on. The files can be sent either directly to a printer, or to the hard disk for later inspection.

As far as output *devices* are concerned, the PADS programs can access a comprehensive range of dot-matrix printers, laser printers (both HP and Postscript-compatible), pen plotters, and photo plotters. And in line with the trend towards computer aided manufacturing (CAM), PADS-LOGIC can produce the appropriate control files for N/C drill machines.

So as you've probably gathered, the PADS-EVAL package has rather more powerful array of features than its very modest asking price would suggest. With these capabilities it should satisfy all but the most demanding tasks, without the need to purchase the unrestricted version of the PADS software.

Hardware & installation

PADS-EVAL will run on any of the more recent configurations of IBM compatible computers, from 80286-based machines up to the latest '486 hot-rods, with EGA or VGA graphics capable of supporting 16 colours.

Also, the machine must have the full 640K compliment of main memory, be equipped with a standard mouse, and have at least 10MB of available hard disk space if you're installing the complete package.

In many ways, this configuration requirement reflects the serious nature of the PADS software, which has not been throttled back so that more modest (and older) machines can be used. If you are hoping to use an 8088-based machine

(PC, XT) with a monochrome monitor and 512KB of memory, you'll be badly disappointed. Nevertheless, a '386SX machine with VGA graphics, 1MB of system memory, and a 40MB hard drive is regarded as 'entry-level' nowadays, and are available at extremely competitive prices.

The PADS-EVAL software is supplied on three high-density (1.2MB) floppies and must be transferred to your machine using the included installation program, since the original files are in a compressed (or archived) format and a number of system configuration files need to be generated. The menu-driven installation program itself is quite easy to follow and offers comprehensive on-line help, making the setup process quite straightforward.

If you need to modify the configuration at a later date however, say due to some change in your machine's hardware (new printer, different screen type), you need to drag out the original floppies and *re-run* the installation program.

Fortunately you don't have to actually re-install all the PADS-EVAL files, since the installation program has a 'hardware setup' menu where the new parameters may be selected, causing an updated set of configuration files to be written to the hard disk.

Nevertheless, we found the process to be quite cumbersome — particularly if your change is as simple as reconfiguring a printer port from say LPT1 to LPT2. The solution, as it turned out, was to simply copy the installation program and its help file from the floppy to the hard disk, and make any future changes there.

Operation

When it came to test driving PADS-EVAL, it turned out to be more like an interstate trip rather than the 'spin around the block' that we had hoped for.

This was mostly due to the fact that the PADS system offers such a vast range of features and options that it took us quite some time to uncover each facility, and digest both its operation and benefit. Many of these were merely mentioned in the manual or promotional material, and tended to be buried under multiple menu layers.

The manual itself pretends to be little more than a tutorial for PADS-EVAL, so as you would expect, quite a number of operations simply aren't covered — you're left to your own resources to learn the operation of the complete package. Mind you, since this evaluation copy is derived from the full version of the PADS software, most of the cost (including development time) would have been involved in producing the manual and tutorial. And remember, we're only talking $49.95 for the *complete* package...

As an introduction to the features and operation of PADS-EVAL, the software actually includes a self-running demonstration of both the schematic and circuit board parts of the program.

This runs though most of the program's major operations, while displaying a series of pop-up text screens which elaborate on each operation. The sequence can be sped up, suspended or cancelled at any time, which in itself can be very informative about the best way to operate PADS-EVAL.

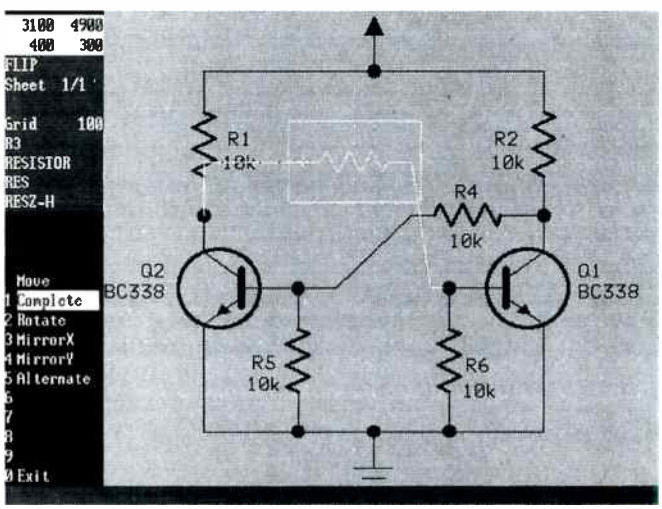
So by noting aspects of the self-running demo, reading the manual and using a little intuitive guesswork, we managed to eventually plough through all of the aspects of the package. During this process, it became quite clear that the PADS system is not for the faint-hearted or impatient newcomer to CAD software.

If you take the seemingly simple task of laying down a component onto the board in PADS-PCB for example, you have to dig through some four menus before you can even select what *type* of part (resistor, IC, transistor, etc) to call from the library.

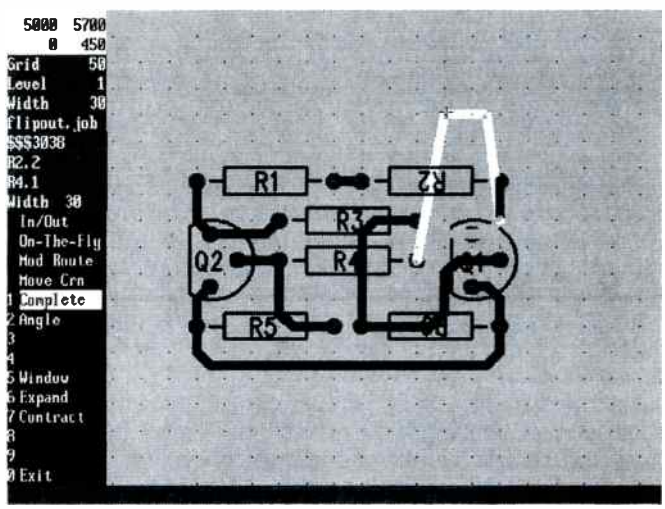
Specifically, you select the 'In/Out' menu, then 'On-The-Fly', then 'Add Part', then finally 'KeyBoardIO', after which you type in the part description or a search description using the standard DOS-type wildcard character '*' — whew!

Once at this point however, things are reasonably intuitive and allow you to place components in rapid succession. When selecting the *next* part to place on the board for example, you can use the 'Select' option (rather than the 'KeyBoardIO' menu) to nominate the new type of part.

Using the mouse, you just click on an existing component (say resistor R1) and a new one will instantly appear (automatically called R2), without having to scan through the component library — great



This screen shot of PADS-LOGIC shows a component being moved to a different part of the schematic. Note the 'rubberbanding' effect, where the component R3 is still shown connected to the rest of the circuit.



Here, the screen shows PADS-PCB when a section of track is being shifted to a new location. As in the case of PADS-LOGIC (the shot on the left), the moving item has been highlighted (seen as white) and always remains connected.

for laying down a string of parts which are of the same type.

When you use the program for the first time however, it would seem reasonable to use the 'Place' option — which appears in the opening menu — to *place* components on the board. Not so. By selecting this menu, you are faced with options and sub-menus with titles like 'MatrixMove', 'Glue', 'Unglue', etc — all rather confusing...

In fact we found that if you try to perform just about any fundamental task as a single exercise, PADS-LOGIC and particularly PADS-PCB seem to throw up barrage of obstacles in the form of seemingly cryptic menus and command-line questions.

It was only after taking a look at the program in a broader sense, that we realised that it's really setup for producing quite complex designs using the auto-placement, auto-routing and file exchange facilities.

One indication of this is the fact that you must use the almost incidental 'On-The-Fly' option to perform manual component and track placement in PADS-PCB, while the much more ambitious auto-placement and auto-routing menus ('Place' and 'Route', respectively) are clearly presented at the opening menu. The 'On-The-Fly' menu seems to have been added almost as an after thought...

Conclusions

Once you come to grips with this fact and become familiar with the menu system however, you start to appreciate the structure and operation of the PADS programs. In practice, this means that an experienced user should be able to produce both complex and elegant artwork with a minimum of fuss. The quality of the printed output is first class, by the way.

It's also interesting to note that the more demands that you place on the PADS software, the smoother and more intuitive its operation seems to become — this is probably an indication of its heritage. Things seem to progress in a logical manner if you say draw a schematic in PADS-LOGIC, then import the data into PADS-PCB, and finally use the auto-placement and auto-routing features to create the PCB. While the most appropriate menu seems to appear at the right time during such a job, the 'auto' facilities seem to baulk at simple, single layer boards.

Anyway, for the more basics tasks which are of interest to the average user (that is, those who can justify just $49.95 on CAD software), the program's macros can be setup to provide quick access to its simple features.

To be quite honest, we really did find some aspects of the PADS software to be quite frustrating, which ultimately led to a rather steep learning curve — a least for this author's over-taxed brain. In retrospect, this seems to have been linked to the software's penchant for automatic, high-volume operations, and to some extent the rather obscure labelling of a number of the menus.

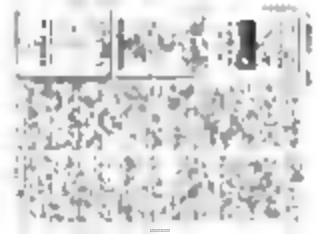
With this package it's important to realise that the software is very much 'netlist' orientated, since this type of data is needed for passing circuit information to auto-placement/routing functions, and to other CAD packages. In practice however, laying a PCB track (for example) no longer emulates the same process using traditional tapes-and-donuts, where you can simply lay a track to any point.

In a program such as PADS-PCB the ends of a track *must* terminate at a component node (say, a resistor leg), so as to develop what the program sees as a sensible netlist. This means that you can't simply run a track into 'mid-air' — where you may wish to place a component at some future date — or form a simple T-junction between two tracks for that matter. You really need to rearrange your thinking into 'netlist-mode'; fortunately, it's not as difficult as that might sound.

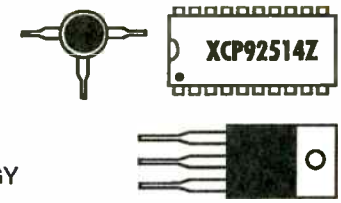
We also get the feeling that in the process of deriving the evaluation copy (PADS-EVAL) from the fully-blown version, a few aspects may have been lost in the translation. For example, a couple of the batch files in the PADS programs caused DOS to display its 'invalid directory' error message (this problem was easily corrected), and there are *two* versions (3 and 4) of the library manager program supplied. The latter program is undocumented, and to be quite honest, we couldn't make it do anything of a sensible nature.

As already mentioned however, once you become familiar with its operation and foibles the PADS-EVAL package can be a powerful design tool, and can be both configured and customised to cope with the most demanding (or simple) jobs. At just $49.95, there's no doubt that it represents excellent value for money; but all the same, it's a pity that the manual isn't a bit more helpful in places, or provided with an index to let you find information in a hurry...

For more information on the PADS-EVAL package and other PADS products, contact Emona Instruments at PO Box K720, Haymarket, NSW 2000, or call (02) 550 1378. ❖



Solid State Update



KEEPING YOU INFORMED ON THE LATEST DEVELOPMENTS IN SEMICONDUCTOR TECHNOLOGY

Quad video buffer

Siliconix has released the Si584 quad video buffer IC, to complement its line of crosspoint switches and advanced multiplexers.

The Si584 is a monolithic quad video buffer with high bandwidth (200MHz) and high output drive capability (+/-20mA), so no external components are necessary.

The high bandwidth allows the processing of broadband analog data, and the output current capability means that the Si584 can easily drive capacitive loads, such as the input to a video crosspoint or to a flash converter, at frequencies up to 40MHz. Low differential gain and phase (0.8% and 0.1°) make the Si584 ideal for processing high quality colour video signals, and its transparent frequency response (30MHz gain flatness) is excellent for even the most demanding video processing application.

Where previously designers had to use four buffers (each in 8-pin packages), they can now use a single 14-pin Si584.

For further information circle 271 on the reader service coupon or contact IRH Components, 1-5 Carter Street, Lidcombe 2141; phone (02) 364 1766.

Varactor diodes

Voltage controlled oscillators (VCO) for mobile communication are the main area of application for two new varactor diodes, BBY51 and BBY52, from Siemens. Whereas the BBY51 is intended for the 900MHz frequency range (with systems GSM, CT1 and CT2, ADC), the BBY52 is optimised for the 1.5 to 2.5GHz range (which covers systems DECT, PCN, GPS and JDC).

Both diodes have very high Q factors, conditioned by extremely low series resistance (typically 0.37 and 0.5 ohm at V_r = 1V and f = 1GHz). The capacitance variation between 1V and 4V is 1.75 (BBY51) or 1.4 (BBY52). This makes the diodes ideally suited for use in battery powered devices.

The two components are available both as double diodes with a common cathode in the low cost SOT23 package, or as single diodes in the compact SOD323 package. Applications notes for mobile radio VCO's are available on request.

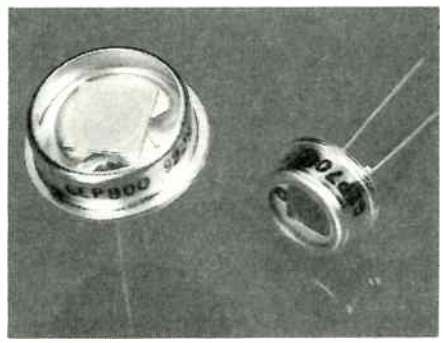
For further information circle 273 on the reader service coupon or contact Siemens Electronics Components department, 544 Church Street, Richmond 3121; phone (03) 420 7345.

High speed photodiodes

US-based Germanium Power Devices has announced a new series of large area PIN photodiodes, offering exceptionally low capacitance (from 50 to 300pF) and very fast rise times; from 4ns to 15ns.

Three types are available: GEP600 and GEP700 in TO-5; and GEP800 in TO-8. Their active diameters are respectively 2mm, 3mm and 5mm, with rise times 4ns, 6ns and 15ns. The high speeds and low capacitance make these devices particularly suitable for laser power measurement, spectroscopy and FTIR.

Full details are available from Germanium Power Corporation, 300 Brickston Square, Andover MA 01810-3065 USA; phone (508) 475 5982.



Digital pulse delay chip

Analog Devices' AD9505 8-bit pulse-edge delay vernier chip provides a digitally programmable delay between an input trigger edge and an output edge. Full scale delay range is 2.5 to 25ns — proportional to the output setting of an internal 8-bit DAC — with 10ps resolution of pulse edge placement at 2.5ns full scale.

Measured while changing delay levels on each trigger at 60MHz — a worst case test — the AD9505 guarantees +/-1 lsb of differential nonlinearity, +/-1 lsb of dynamic integral nonlinearity and monotonicity. Incremental delays are microprocessor/DSP programmable 'on the fly'. The AD9505 provides signal de-skew applications with very good linearity, from a ramp-comparator-DAC architecture.

Two AD9505s can control both the leading and trailing edge for pulse-width modulation or variable duty-cycle control. An onboard reference, integrating capacitor, and calibration DAC reduce required external support components to a single resistor to set full scale range. Logic input and output levels are compatible with ECL-10K. The AD9505 operates from a single -5.2V power supply and consumes 650mW.

For further information circle 274 on the reader service coupon or contact NSD Australia, Locked Bag 9, Box Hill 3128; phone (03) 890 0970.

Opto-coupled ZVS triac

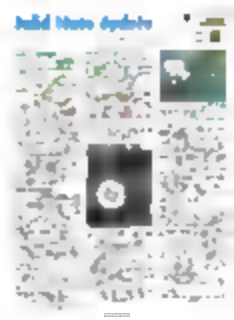
Motorola's new 'Power Opto' devices are the first generation in an evolutionary family of optically coupled AC and DC power interface circuits. 'Power Opto' is the logical marriage of optical isolation and medium power capability, integrated into a miniature, high density, thermally efficient, single-in-line (SIP) package.

The MOC2A40-10 — first product in the family — is a 400V, 2A (@40°C) zero crossing, optically coupled triac. Its integrated approach can replace from three to seven discrete components normally needed to configure a conventional opto-triac driver circuit.

The device is designed to comply with UL/CSA/VDE regulatory requirements and can be driven directly from TTL logic.

For further information circle 272 on the reader service coupon or contact Vel-

Solid State Optics



tek, 18 Harker Street, Burwood 3125; phone (03) 808 7511.

Low cost SPDT GaAs switches

Hewlett Packard/Avantek is offering a pair of low cost, single pole, double throw (SPDT) GaAs monolithic switches in plastic surface mount packages, which operate from DC to 3GHz.

The MGS-70008 is a reflective switch, with the switched terminal in the off-state terminated to ground; while the MGS-71008 is an absorptive switch, with the switched terminals in the off state terminated into an internal 50-ohm load.

A notable feature of the switches is operation with full specified performance from a true 5V DC source, rather than the 7V DC required by many monolithic RF switches. These switches may also be operated from sources as low as 3.3V. Switching is controlled by a -5V control signal applied to one of the two control pins.

Both versions are supplied in a standard SO-8 surface mount package. These switches are designed for high volume applications such as digital cellular radio, spread-spectrum communications, GPS, switch matrices and instrumentation.

The reflective switch features the lowest insertion loss (0.8dB typ. at 1GHz), while the absorptive switch features low VSWR at all ports (1.2:1 typical through 2GHz). For more information circle 278 on the reader service coupon or contact VSI Promark Electronics, 16 Dickson Avenue, Artarmon 2064; phone (02) 439 4655.

486 compatible micro from TI

The TI486SLC microprocessor from Texas Instruments provides 486 software compatibility, and upgrades systems currently using a 386SX chip without redesign of the circuit board. TI's chip, when measured using industry-standard benchmarks, offers comparable 486 performance and twice the performance of the fastest 386SX chip.

For further information circle 279 on the reader service coupon or contact Texas Instruments, 6 Talavera Road, North Ryde 2113; phone (02) 878 9000.

Bus master interface chips

PLX Technology's 90X0 series of bus master interface chips allows network interface card manufacturers to build high performance EISA, AT and Micro Channel bus master Ethernet LAN cards for the same cost as slaves. The 90X0 series can also be used to build very compact and inexpensive EISA and Micro Channel FDDI cards.

The 'Direct Bus Master' architecture allows the Ethernet or FDDI controller chip to transfer data directly to and from host system memory, eliminating the need for expensive memory and CPU components. Bus data transfer rates achievable are: EISA Burst, 33 megabytes/sec; AT Master, 10 megabytes/sec; and Micro Channel Streaming, 40 megabytes/sec.

For further information circle 275 on the reader service coupon or contact Zatek Components, 8/1059 Victoria Road, West Ryde 2114; phone (02) 874 0122.

Nonvolatile serially programmed devices

The Nonvolatile Serially Programmable (NSP) devices are a new family of ICs from Hughes Semiconductor which can electronically trim and configure electronic systems. Each NSP device combines a programmable circuit block, a nonvolatile (NV) memory to store the state of that circuit when power is removed, and a serial interface to access the NV memory.

The devices are programmed and read via the serial interface. This requires five control lines; DATA IN, DATA OUT, CLOCK, READ and PROGRAM. The chips also require a +5V power supply. Devices can be cascaded because each NSP type has its own ID code, so you can selectively program different devices connected to the same control line.

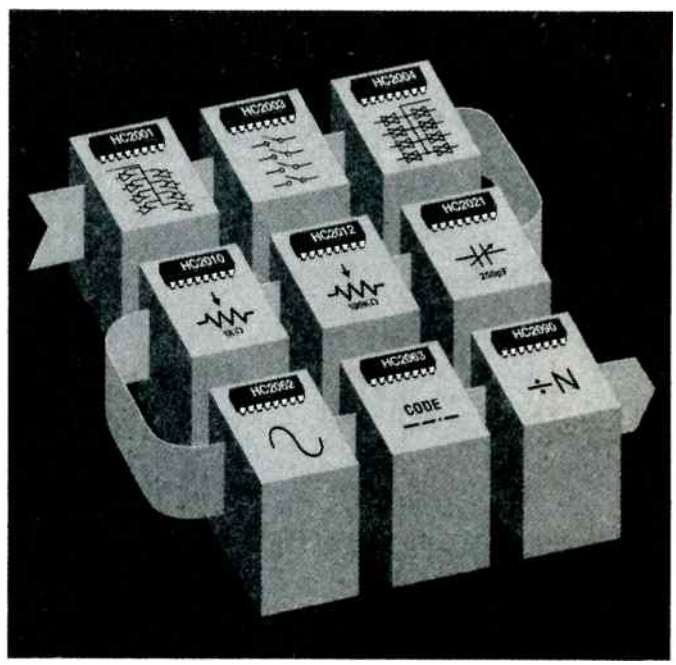
Internally, each device has two shift registers to output and input the ID code (8-bit) and the data (typically 4-32 bits). Input and output of these bits is controlled by a series of SERIAL CLOCK pulses. Each shift register is connected to its own NV memory. If READ is pulsed low, then the two registers are parallel loaded and their contents clocked out. If the data is clocked in (and the ID code is correct), pulsing PROGRAM low stores the new data.

The NV memory includes the circuitry to generate the high voltage needed to 'write'. Holding READ or PROGRAM low disables that operation.

The programmable devices provide general purpose switching, trimming, counting and waveform generation. Future devices will add more digital functions, timers, PLLs, filters and trimming components with multiple circuits per package.

Some of the simpler circuits are the HC2001/2 8-output DIP switches, the 2003 quad analog switch, and the 2004 8-channel analog data selector. Similar switching of an 8-stage ladder circuit occurs in the 2010/2012 1k and 100k trim potentiometers, and the 2020/2021 100pF and 250pF trim capacitors.

More complex circuits are the HC2055 programmable timer,



the 2062 sine/cosine generator, the 2063 security code generator/detector, and the 2090 16-bit divide by N counter.

Available at an introductory price of $50 is the NSP Development Kit, which includes the IBM-compatible PC interface board, a DB-25 cable, a 5-1/4" floppy, the HC2062 (sine/cosine) chip, and documentation. The kit demonstrates the ease of reading and programming NSP devices from your PC keyboard.

For further information circle 290 on the reader service coupon or contact Zatek, PO Box 505, Bayswater 3153; phone (03) 763 8899. ❖

NEW PRODUCTS

UPS monitoring program

Trends in the IT industry are towards multi-user systems where a single fileserver may have a number of workstations. To resolve the problem of temporary power failure with such a system, an uninterruptible power supply (UPS) has become critical. However, a UPS's back-up power supply is only as good as its battery capacity.

Critec now offers the PowerWatch utility program that, in association with a UPS, will safely shut down the computer system, without data loss or corruption, when a battery low condition occurs.

Designed in the Aeronautical Research Laboratory of the Australian Department of Defence, PowerWatch is a user-configurable software package which allows the UPS to interface with the operating system on the host computer via the computer's standard serial (TTY) port — no hardware interface card is needed.

Once loaded, PowerWatch resides as a background task, continuously monitoring the serial port for UPS status information. Following an indication from the UPS that the mains has failed, the program initiates a timing sequence, broadcasting to all users a log-out message, inhibits new log-ins and watches for a 'battery low' signal from the UPS.

At the end of the prescribed timing sequence, or upon receipt of the 'battery low' signal, further messages as to the program's intention are broadcast and an orderly shutdown automatically executed. A full log of messages sent and actions performed is kept on disk for later analysis.

For further information circle 242 on the reader service coupon or contact Critec, GPO Box 536, Hobart 7001; phone (002) 73 0066.

General purpose logic analyser

The new GPX general-purpose logic analyser from Tektronix enables the entire product design team — from hardware to software engineers — to use a single piece of low cost equipment to debug their systems.

Tightly integrated into the GPX are 1GHz timing analysis capabilities across 16 channels, or 200MHz transitional timing over 80 channels; 80MHz state analysis on all 80 channels, and the ability to acquire both state and timing data through the same probes without double probing. Channel counts can be doubled by 'welding' two GPX modules together. To assist software developers, there are four modes of disassembly for software debug, real-time performance analysis for tuning software, a ROM emulator for downloading code and patching software through the logic analyser, and links to high level language compilers.

To operate with higher speed ICs and microprocessors with their narrow timing margins, the GPX uses a high-resolution mode with 1GHz timing over 16 channels, 40K deep for 1ns resolution, or 200MHz timing over all 80 channels, 8K deep for 5ns resolution.

Designers can use the high resolution mode to accurately determine tolerances on key signals that have very tight specifications.

For further information circle 241 on the reader service coupon or contact Tektronix Australia, 80 Waterloo Road, North Ryde 2113; phone (02) 888 7066.

LAN tester

The new LANcat 1500 Automatic LAN Cable and Activity Testing from Datacom Technologies has all the functions needed to service the needs of the LAN manager or the cable installer.

With the ability to produce full cable certification for both coax and twisted pair, plus up to four custom cable definitions, the competitively priced LANcat 1500 handles NEXT (near-end crosstalk), attenuation, TDR (accuracy of 1%), and wire map functions, as well as noise and live traffic monitoring. Up to 50 cable certification reports can be stored in the instrument, for later dumping to a serial printer.

An important design feature, which will benefit cable installers working on telephone networks, is the ability of the

LANcat 1500 to withstand telephone loop, ringing, and transient voltages.

The compact hand-held unit weighs less than 600g, and is supplied complete with remote load, AC adaptor, RJ45 patch cables, RJ45 clip lead set, and operator manual — all housed in an attractive zippered carrying case.

For further information circle 243 on the reader service coupon or contact Elmeasco, PO Box 30, Concord 2137; phone (02) 736 2888.

Cap for sealed switches

The new 1P cap has been introduced for use with the MULTIMEC line of sealed miniature pushbutton switches. Rectangular in shape, its concave surface provides an attractive appearance and a comfortable fit for the operator's finger.

Available in seven colours, the new 1P cap can be shipped from stock. Cap dimensions are 12.5mm long by 6.5mm wide, while the overall switch height from the PC board is 14.4mm.

The cap material is ABS UL94V1 and can be used in the same harsh environment as the IP-67 sealed MULTIMEC switch.

For further information circle 244 on the reader service coupon or contact Erni Australia, PO Box 62, Mitcham 3132; phone (03) 874 8566.

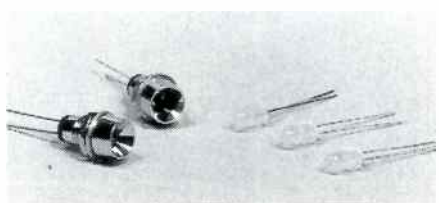
DSE stocking new components

Dick Smith Electronics has added a number of new components to its existing extensive range, including pots with built-in 'detents', matching black anodised knobs, miniature rocker and lever-action switches, high-quality binding posts, a high intensity green LED in a bezel, and a reasonably-priced blue LED.

The new pots are all of the compact 16mm diameter size, and are all of the dual-ganged variety with 'metric' splined shafts. There are essentially two different types, both designed especially for audio amplifier use: a linear-law type with a single centre detent ('click') for balance or tone control use, and a logarithmic-law type with 41 equally-spaced detents for volume control use. In each case two resistance values are available, for designer flexibility.

The dual-gang linear centre detent type is available in either 25k (R-7810) or 100k (R-7820) versions, both priced at $4.95 each, while the dual-gang log 41-detent type is available in either 50k (R-7800) or 100k (R-7802) versions which are priced at $5.95 each.

Designed to mate with these pots are two new control knobs, both of a composite plastic moulding/metal sleeve construction with an attractive black anodised matt finish. The larger knob (P-7110) is 40mm in diameter and 20mm deep, while the smaller (P-7112) is 30mm in diameter and 18mm deep. The knobs are very suitable for amplifiers and other audio equipment, and are priced at $3.95 and $2.95 respectively.



The new P-7720 rocker switch is a DPDT type rated at 250V AC and 3A. It has a red rocker 12 x 21mm, but mounts very easily in a single round hole 18mm in diameter.

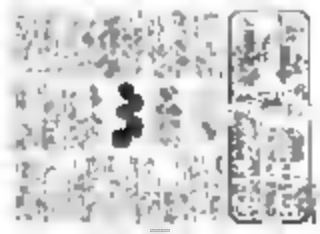
The P-7693 miniature DPDT lever-action switch has a lever 10mm square, and comes with an integral 'snap lock' mounting bezel which fits into a rectangular hole 14 x 12.5mm. Finished in matt black, it is priced at $3.95.

The new high quality binding posts have an inbuilt banana jack and also feature increased metal contact area and more rugged plastic mouldings than standard types. They are rated for 250V AC and 5A, with an insulation resistance of 100M minimum at 500V DC and a dielectric rating of 1000V AC for one minute. Available in both red (P-1737) and black (P-1738), the new binding posts are priced at $1.95 each.

A new addition to the range of LED indicator bezels is the P-8107, which features a high intensity green LED and offers 300mcd output at 20mA and 2.4V. The bezel requires an 8mm mounting hole and has a chrome-plated finish. It is priced at $2.95.

Finally, DSE has also added a blue LED to its range, Cat. No. Z-4005. The device is based on silicon carbide, has a 5mm diameter body and integral diffusing lens, and produces 3mcd of output at 470nm at 20mA and 3V. It has a typical viewing angle of 23°, and is priced at $3.45 each.

All of the above new products should be available in stock at DSE outlets by the time this issue is published. ❖



'FATHER OF TV IN AUSTRALIA'

James Hubert Thomas Fisher, the telecommunications researcher who pioneered the introduction and development of TV broadcasting in Australia, died this year at the age of 81. To mark his passing, here's a brief summary of Mr Fisher's many contributions to Australian electronics engineering, written by Steve Nason of the Telecom Research Laboratories.

Born in 1911, Jim Fisher developed a keen interest in the concept of television soon after he commenced engineering studies at the University of Adelaide in 1929. He joined the Postmaster-General's Department (PMG) as a cadet engineer in 1930, and after qualifying in engineering moved to Melbourne in 1936 to work in the PMG Research Laboratories — the precursor of today's Telecom Research Laboratories.

The Research Laboratories imported many overseas technical publications, many of which were unobtainable elsewhere. These reported on the early television experiments and trials then under way in several countries. Mr Fisher read these avidly, and so began to prepare both himself and his country for the advent of television services 20 years before their introduction.

In 1937, to raise awareness of television within the Australian engineering fraternity, he prepared a paper entitled 'Recent Developments in Television' which he presented to the Juniors and Students Section of the Institution of Engineers, Australia. He illustrated the principles involved by demonstrating a hand-built television system of his own design. Rudimentary though it was, his system was as technically advanced as any in the world at that time and produced one of the first television images on a cathode ray tube ever seen in Australia.

In 1938, Mr Fisher prepared the first of many secret reports on television for the Commonwealth Government. This one, entitled *A Study of Overseas Developments in Television, in Relation to Possible Future Services in Australia*, made a comprehensive forecast of the necessary characteristics, and probable costs, of establishing a television service in the Melbourne area.

World War II then interrupted Mr Fisher's television research and he was redeployed to urgent and secret development work on radar. In 1940 he was given responsibility for coordinating the design and manufacture of Australia's anti-aircraft Shore Defence Systems, and following this, in 1942, he was assigned to work on radar-guided searchlight systems. He excelled in both projects.

After the war, there was considerable pressure for Australia to adopt Britain's low definition television picture standard of 405 lines as the basis for future services. However, Mr Fisher disagreed. In a 1948 report entitled *Suggested Picture Definition Standards for Television Broadcasting in Australia* he concluded that the British system was lagging behind in technical development, and he put forward the radical proposal for a higher resolution system for 625 lines.

He was the only Australian to take such a stand at this time, and he can be credited with giving Australia the high quality television pictures it received when services eventually commenced.

Following another report in 1949, this time detailing projected television services for the Sydney area, Mr Fisher travelled to North America and Europe to investigate the provision of television services in other countries.

Returning to Australia, he began training people for employment in the future television industry. From 1951 to 1956 he gave evening lectures in television technology and production at what later became the Royal Melbourne Institute of Technology. Two of his students were Hector and Dorothy Crawford, who went on to found one of Australia's leading television production houses.

Mr Fisher left the PMG in 1954 to become Engineer-Television in the Australian Broadcasting Control Board where he wrote Australia's first formal technical standards for television broadcasting. A year later he left the Board to become the first Chief Engineer of Channel HSV-7 in Melbourne, where he managed the design, procurement, construction and operation of all studio, production and transmission facilities.

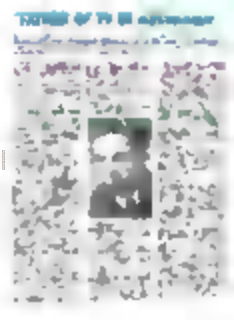
When television services commenced in 1956, Mr Fisher was at once an old hand in a new industry. His knowledge of television, both as a technology and as a medium of entertainment, was trusted and deeply respected.

His advice was sought not only by the industry's engineers and technicians, but also by its station executives, producers and on-air personalities. He remained HSV-7's Chief Engineer until he retired in 1977, but continued his involvement in several major national and international technical forums.

In 1986, the Television Society of Australia presented Mr Fisher with its Colin Bednall Award. The award's citation read in part: 'No other single person can be credited with contributing so much over so many years to the national and commercial broadcasting structure, and to the technical excellence of Australia's television industry.'

In 1989 he was awarded a special Paul Marlan Award by the Federation of Australian Commercial Television Stations (FACTS), for his pioneering work in television, and for his long and distinguished service on the FACTS Engineering Committee.

Those who worked with Jim Fisher remember him as a polite and genial character, whose cultivated sense of humour could discover the lighter side of difficult and complex situations. He was also endowed with a genuine humility, and a keen desire to share his knowledge with others. To many he became known simply as 'Gentleman Jim' — a man who was born for research work, and a man who was made for his times. ❖



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Portasol Professional Soldering Iron

See review E.A. April 88. No cords or batteries yet it gives the equivalent of a 10 to 60W iron. Up to 90 minutes continuous use from a single fill. Tip temperatures as high as 400°C can be set. The kit includes one soldering tip, a hot knife, blow torch and hot blow. Cap contains a flint lighter. Comes in a handy case (with stand for the iron) almost fits in your pocket.

$69.95

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The Hakko 926 is a super-quick heat-up (3 sec cycle) and fast recovery iron offering high quality soldering at lower tip temperatures. The built-in ceramic heater maintains temperature to within 0.5°C of the setting. Yes this is an ADJUSTABLE temperature iron covering the range from 200°C to 480°C using a full wave zero-crossing switching system. Meets MIL-STD-2000 and operates at safe 24V. Also available in ESD for antistatic environments. We stock a wide range of tips to suit. Ask for listing.

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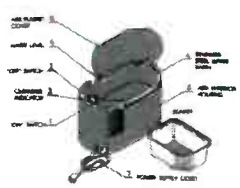

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APPA

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- *Protective holster and tilt stand with lead storage*
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Model 103 & 105

- 4000 count
- Digital update twice/second, analog 20 times/sec
- 8 Functions - Vdc, Vac, Adc, Aac, Ohms, Diode, Continuity, Frequency, Capacitance
- Data hold & Relative functions
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Ranges
Vdc 400mV, 4V, 40V, 400V, 1000V
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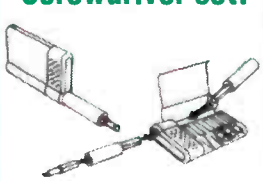
Adc 4-400mA, 10A
Aac 4-400mA, 10A
Ohms 400Ω, 4kΩ, 40kΩ, 400kΩ, 4MΩ, 40MΩ
Frequency 100Hz, 1kHz, 10kHz, 100kHz, 1MHz
Capacitance 4nF, 40nF, 400nF, 4μF, 40uF

Model 105 has similar specs but with improved accuracy of 0.1% typ on Vdc and 0.5% at 50Hz

$358.80 $299.00 ex tax

You must find a space in the stocking for this Screwdriver set!



German quality and ideal for toolbox, glovebox or pocket. Includes universal magnetic holder for use with power drills, 5.5x0.8 and 6.5x1.2 flat, Philips No 1 and2 and Pozidrive No1 and 2 bits.
The great thing is that the case acts as a handle for the bits, so it's self contained in a space of only 70x50x15mm **$20.50**

SerialTest

PC-based Protocol Analyser & Data Line Monitor

The new version of Serialtest turns ANY PC into a full-featured serial data protocol analyzer — even laptop and notebook computers – for both synchronous and async data. Serialtest unleashes the power of your PC for data communications testing with a simple, user-friendly interface and either! The new ComProbe plugs in to your printer port. With Serialtest and your PC, there is no longer any need to buy or rent expensive, dedicated protocol analyzers.

The Serialtest package includes Serialtest software and Frontline's RS-232 ComProbe™ adapter. The ComProbe connects to your computer via the parallel printer port *(no need for plug-in cards)* and allows Serialtest to work with both synchronous and asynchronous devices.

Serialtest's monitor mode shows you exactly what information is flowing between any two serial devices — both data bytes and control signals. Source mode allows you to interactively simulate either the DTE side or DCE side of the communications link.

Serialtest Async is similar to Serialtest, but is limited to async-only testing. The package includes Serialtest Async software and custom cabling which works in conjunction with the serial ports on your PC.

Anyone who works with serial data communication needs Serialtest. Field service engineers and system integrators will appreciate the portability and ease-of-use. Communication specialists and network supervisors will enjoy the power and flexibility. No matter what the industry, Serialtest will prove to be an indispensable tool.

SerialTest Sync/Async with Comprobe **$2480.00** (ex tax) **$2536.00** (inc tax). *Allow $15 P&P.* Plug Pack **$24.95.**

SerialTest Async is still **$480.00.** Demo disk $10.00 refundable on purchase

8.30am to 5.00pm Mon to Fri. 8.00am to 12 noon Saturday.
Mail Orders add $5.00 min to cover postal charges.
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Silicon Valley NEWSLETTER

Valley leaders support Clinton

Silicon Valley has closed the chapter on President Bush, as 25 of the most prominent high-tech leaders of the area — many of them die-hard Republicans — stood side by side with Bill Clinton in endorsing the Arkansas Governor for President. Clinton came to San Jose to announce his high-tech industrial policy program and for several other campaign appearances.

The top executives of high-tech companies representing US$25 billion in annual sales and a workforce of more than 120,000, said they would endorse Clinton in the fall election.

Hewlett-Packard president John Young, after the group's two hour meeting with Clinton, said their support is based on a need for a closer working relationship between government and industry, a concept the Bush and Reagan Administrations have steadfastly refused to embrace.

"To be successful as a national we have to forge a private section-public section partnership. I find in Governor Clinton a very compatible soul in terms of exactly that view of the world," Young said.

Apple Computer chairman John Sculley told Clinton: "What is significant about this group, governor, is that many of us are actually Republicans. Yet as we look at the future of this country, we said that we could not sit this (president) one out. That this country is in trouble in terms of how well it is prepared to compete in the world. But it is not too late."

Having won the support of leaders from such companies as H-P, Apple, National Semiconductor, Silicon Graphics, SRI International, Tandem Computer, and Oracle, Clinton clearly cherished the moment as Silicon Valley has been a bastion of Republican strength in past elections.

Having all but locked up California with his current 21-point lead in the polls, the endorsement from so many otherwise Republican industry leaders sends a powerful message about the eroding support for Bush even among rank-and-file Republicans.

The growing dissatisfaction with the Bush Administration's policies is not the only reason many high-tech leaders are now endorsing the Democractic candidate. Many of the same leaders helped Clinton draft his 'National Technology Policy for America,' a document that would lay the foundation for the first comprehensive US high-tech industrial policy.

The plan includes many of the high-tech proposals that have been doing the rounds in Washington during the past decade but which have often been rejected by the White House. Key among the recommendations is a call for a cut in capital gains taxes. Often rejected as a 'tax cut for the rich' by many Democrats in Congress, Clinton has become the first leading Democrat to endorse a capital gains tax cut.

Bill Gates now immortal

Bill Gates has bought himself a piece of immortality, as Stanford University agreed to name a new computer research centre after the Microsoft chief in return for his generous US$6 million donation.

The 80,000-square foot 'Gates Information Sciences Building' will open on the Stanford campus in 1995. The building will unite several computer programs which are currently spread out over different facilities around the university — including Computer Sciences, Electrical Engineering, Robotics, and Artificial Intelligence.

In all, Standford gathered US$25 million in private donations for the centre. Other major donors included Bill Hewlett from Hewlett-Packard, IBM, DEC Rockwell, and TRW. Japanese companies, including Fujitsu, NEC, Mitsubishi, and Toshiba also made substantial donations.

Gates said he sees the donation as 'an investment in the computer industry's future', by helping to support one of the US's top five schools in computer sciences.

Asked about becoming the namesake for a major building at the age of 40, Gates said: "I've kind of flipped back and forth about whether it is a good idea. But I guess I'll try it."

...except Packard

No so fast, said H-P founder David Packard, after learning that a large contingent of Republican high-tech leaders — including the president of his own company — had announced their joint support for Bill Clinton's presidential candidacy. In an almost desperate plea for sanity among the conservative defectors, Packard sharply criticised the group for jumping onto a democratic bandwagon.

The 80-year-old chairman of H-P and former deputy Secretary of Defense under President Nixon said the group of 25 "are caught in the upward draft of Clinton's hot air balloon", are overlooking "the fact that the Democratic party has been the party of Socialism since President Roosevelt's term".

The letter went on to remind Republicans in the Valley of the various evils the Democratic party stands for, and reminded voters of Clinton's successful efforts to avoid being drafted for the Vietnam War.

Packard rose to the defence of President Bush after most national news broadcasts had labelled the endorsement as a major coup for Clinton and a serious blow to Bush.

Dave Barram, one of the Apple executives who helped organise the formation of the group of 25 said Packard is wrong: "I am a huge David Packard fan. And yet I think he just missed the point completely. Bill Clinton has defined a different place in the Democratic Party."

Yocam to Tektronix

Former Apple executive Del Yocam, one of Silicon Valley's star computer executives is leaving the Valley to become president and chief operating officer at Tektronix.

Yocam, who is 45, earned his reputation as a keen operations manager at Apple, where he was in charge of Apple's worldwide manufacturing operations. He eventually rose to the number two spot, behind John Sculley.

In 1990, Yocam left Apple. Earlier this year he joined pen-computer maker Momenta. But six weeks later he left,

after finding Momenta was in much worse shape than he had anticipated. The firm recently went out of business.

Industry analysts applauded the move by Tektronix to put Yocam in charge. The Oregon electronics firm has been slow moving new technology into the market. Yocam brings with him the experience of running a company which has set the pace of technology in key computer markets. "Also, the operating management at Tektronix has never been strong. It is to (Tektronix chairman) Jerome Meyers' credit that he realised he needed a colleague. And that is what he is going to get", said analyst Bill Frerrichs.

Yocam summed up his plans for Tektronix saying "Five years down the road, I want Tektronix to be a US$4 billion company, and by the mid-1990s I think we can deliver the products that the customer needs".

IBM signs TCI in cable deal

IBM has secured the first link of what is expected to be a three-company effort to develop a new interactive two-way information delivery system across the United States, using cable television as the main port of entry into homes and businesses.

IBM said it has signed an agreement with Tele-Communications Inc. (TCI) to develop the two-way information system, which would allow people to electronically order movies from central libraries and then have them broadcast into their home for a fee similar to those charged by most current video rental stores.

It would also allow for interactive home shopping services, video phone calls, and educational programs that would grade viewers on the answers they give to questions.

To complete the venture, IBM has also been negotiating with Time Warner — which would make its huge libraries of movie, television, music and other entertainment products available to users of the service.

IBM said the all-digital data delivery system may well play a critical role in a future in which computer, communications, and consumer electronics technologies and markets are converging.

Already, IBM has offered to invest some US$500 million in Time Warner, which would use some of that money to fund a new subsidiary which would convert TW's vast library of films, television programs and magazines into the digital-format used by the IBM/TCI system.

To date, TW has been reluctant to enter into the agreement as it has balked at the amount of money IBM wants it to invest up front into the new service. TW wants to use most of the IBM money to pay off some of its huge corporate debts and spread the investments in the subsidiary out over a number of years. But analysts said they expect the two companies to come to an agreement soon, as TW does not want to miss out on the opportunity either.

Japan won't meet 20% target

To almost nobody's surprise, Japan will not be able to meet the foreign market-share targets spelled out in the 1991 US-Japanese Chip Trade Agreement.

A survey conducted by a major Japanese business trade newspaper among 140 leading chip users found that the top executives of nearly half those firms said they don't expect US and other foreign chip firms to reach the 20% marketshare this year.

Japan has until December 21 to reach that target, or face US sanctions. The foreign marketshare currently stands at 14.6% and has been growing at only 0.1 to 0.3% per quarter for much of the time the agreement has been in effect.

IBM joins Apple in PDA push

IBM is expected to make a major product launch at the Comdex show in Las Vegas. Most notably, it is expected to join Apple Computer in the battle for personal digital assistant (PDA) computers. The prototype IBM will show, will sport wireless communications capabilities.

Until now, Apple has enjoyed unequalled attention in trying to get consumers hyped up for the new generation PDA devices which will put workstation-level RISC-based computing power literally in the hands of consumers, allowing for vast new ways for people to gather and use data.

Previously IBM had not acknowledged publicly that it was even working on a PDA. The announcement from IBM did not specify whether IBM will use the multimedia software developed by the Apple-IBM Kaleida joint venture to power its PDA.

Analysts believe that it is likely IBM will be using the Kaleida software, since there is little alternative technology available anywhere in the world. Earlier Apple said its Newton PDA will use Kaleida's multimedia operating software.

While both the IBM and Apple PDA's will undoubtedly be star attractions at Comdex, neither company is expected to actually begin shipping their first PDA's until the spring. ❖

Motorola in flat panel deal

In a move that will bring high volume display manufacturing to the United States, Motorola has formed a joint venture that is expected to produce some 50,000 high-resolution LCD displays in 1994 and more than 100,000 in 1995. The displays will be based in large part on technology developed by Focus Systems (FSI) of Oregon, a tiny start-up.

Under the terms of the agreement, Motorola has invested US$22 million in FSI, for a 20% equity position. Motorola has also committed US$20 million to fund the construction of the plant that will produce the 'passive-matrix' LCD displays.

Also, Motorola will sell the joint venture specialised ICs to be used in the advanced displays.

Motorola said it will buy a significant portion of the joint venture's LCD output for use in computer and communications products Motorola plans to make, including advanced cellular phones and pagers which will increasingly be using advanced computer features and displays.

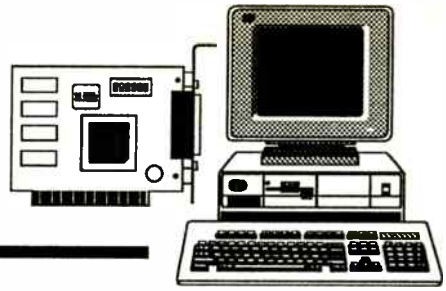
IFS chairman Steve Hix said Motorola approached his company about a joint venture, as did Hitachi, Sharp, NEC, and Sanyo.

All were interested in IFS's patented LCD manufacturing process, which is radically different from the one used by most other producers today. The IFS process to be incorporated at the planned US$20 million facility will produce yields that are 8 - 10 times greater than those being realised by the Japanese at their state-of-the-art US$500 million plants.

The IFS process is called 'active addressing', which uses customised ICs in the periphery of the screen. The Japanese methods, to date, have focused on creating what amount to huge ICs, with millions of transistors creating dot patterns on the display. But these LCDs have proven extremely difficult to produce.

The Motorola move is important in the effort to develop a competitive US-based flat-panel display industry that will be able to compete in world markets with Japanese companies such as Sharp, Seika-Epson, Hitachi, and Sanyo which currently dominate the market for various kinds of advanced flat-panel display.

Computer News and New Products



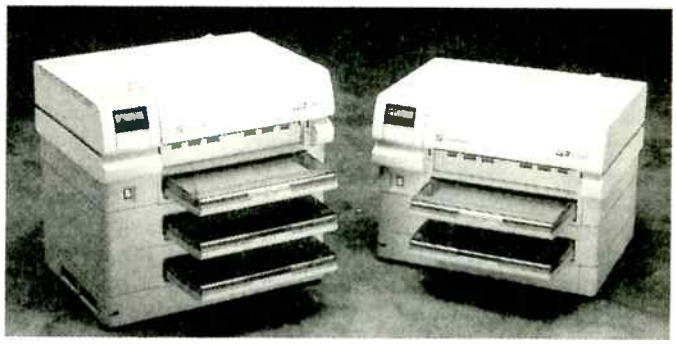
400dpi A3 laser

Dataproducts' LZR 1560 laser printer can produce output at 300, or true 400 dots-per-inch resolution. The 400dpi is comprised of more dots — not just enhanced 300dpi resolution. With four megabytes of standard memory, the printer can image a full A4 page of graphics at 400dpi. Memory is expandable up to 16 megabytes for extra font downloading capacity.

PostScript Level 2 and a RISC-based controller enable the LZR 1560 to print complex pages at its rated speed of 15 pages per minute of A4 (or letter) and eight pages per minute of A3 (ledger).

PostScript Level 2 incorporates Adobe Type Manager and other enhancements to increase the speed of PostScript tasks, such as rendering a font from an outline. Level 2 is compatible with the original version, so existing software can be used without changes.

With ledger/A3 imaging, the LZR 1560 can print posters, two-page spreads, tabloid-size newspapers, large spreadsheets and B-size engineering drawing.



The unit comes with 35 resident fonts, and provides host interfaces for an Apple Macintosh or PC: LocalTalk/RS-422, Centronics parallel and RS-232-C serial. There is also a SCSI port to attach an optional hard disk drive. The LZR 1560 is priced at $5555.

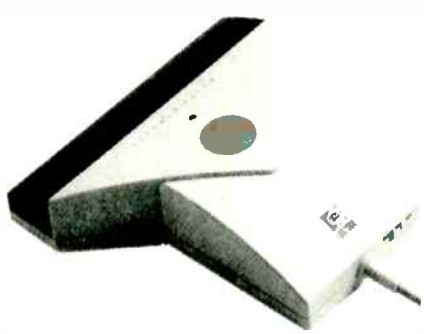
For further information circle 161 on the reader service coupon or contact Dataproducts, 2/10 Rodborough Road, Frenchs Forest 2086; phone (02) 451 3533.

Handheld colour scanner

Logitech has released its ScanMan Color, a 24-bit colour handheld scanner for the Microsoft Windows environment. Its RRP (including tax) is $1323.

ScanMan Color's hardware captures up to 16.8 million colours, and features a proprietary white fluorescent light that permits consistent scanning brightness without a warm up period. The Logitech white light 'levels out' immediately and remains consistent. With its 24-bit capacity, ScanMan Color is able to capture true 256 grey-scale data on-the-fly, in addition to its 16.8 million colours, without the need to convert colour information to grey-scale — a process common to all 12-bit and 18-bit models.

ScanMan Color is bundled with FotoTouch colour image editing software, which allows users to merge multiple scans, without manual interaction. The software automatically 'deskews' each scan, locates matching features, extrapolates to fill in missing pixels, and



calibrates colour across the entire finished range.

ScanMan Color adheres to the TWAIN protocol, an API (application program interface) developed jointly by Aldus, Caere, Hewlett-Packard, Kodak, and Logitech. In addition, FotoTouch Color functions as a Microsoft OLE (Object Linking and Embedding) server, to allow the use of colour images in any application that supports OLE.

Minimal system requirements for ScanMan Color include an IBM AT or compatible with a 386SX processor or above, Microsoft Windows 3.0 or 3.1, four megabytes of RAM, five megabytes of free disk space, one open 16-bit AT slot, a graphics card (VGA minimum, 256-colour SVGA or above recommended), and a mouse.

For further information circle 162 on the reader service coupon or contact BJE Enterprises, 124 Rowe Street, Eastwood 2122; phone (02) 858 5611.

Logic analyser card

The new LA27xxx series and the LA12100 logic analyser cards from Boston Technology, for PC-XT/AT/386 computers, are powerful digital analysis tools at a fraction of the cost of a stand-alone unit.

Both the 100MHz (LA27100) and the 200MHz (LA27200) units have 27 channels of input, 24 for data and three for external clocks. Up to three boards can be

used in the same system, yielding 72 channels. The data buffer size is 16K deep in six channel mode, 8K deep in 12-channel mode, and 4K deep in 24-channel mode. Flexible triggering is provided by 16 sequential levels of 24-bit wide words, where each bit can be set to high, low or don't care.

Trigger words can be set to AND or OR modes to trigger on MATCH or NOT MATCH. Up to 12 qualify lines for the data clock enable more specific selection of input data. Also two independent variable voltage threshold levels allow data to be input simultaneously from two of several logic families.

The new LA12100 offers many of the features found on the LA27xxx series at lower cost. The LA12100 has a speed of 100MHz and 25 channels of input, 24 for data and one for external clock. The data buffer is 2K deep in 12-channel mode and 1K deep in 24-channel mode.

Easy to use menu-driven software is supplied with the cards, which displays timing diagram and state list for all 24 channels simultaneously. The software can also export data to printer or to disk. Also available is a Toolbox Library for custom programming and control of the LA27xxx series logic analysers.

For further information circle 163 on the reader service coupon or contact Boston Technology, PO Box 415, Milsons Point 2061; phone (02) 955 4765.

Peak analysis software

PeakFit Chromatography and Spectroscopy Analysis Software from Jandel is a powerful software tool for researchers who need to separate and analyse peak or functional form data.

Using sophisticated non-linear curve fitting techniques, PeakFit lets you effectively detect, quantify and analyse hidden peaks in overlapping peak data — greatly enhancing the accuracy of your results. Its extensive list of built-in functions addresses the needs of those working with chromatograghy profiles, spectroscopic peaks, chemical and pharmacological kinetics data, waveform and other engineering data, statistical distributions and transition functions.

PeakFit's graphical approach enables you to control the curve fit process visually on the screen, iteration by iteration, to help avoid local minima traps. The Marquardt-Levenberg algorithm is used to process the non-linear curve fit data. Use any of the 30 built-in equations (Gaussian, Lorenztian, Voigt, etc), or create

user-defined functions with up to 68 adjustable parameters.

Once analysis is complete, PeakFit offers an extensive numeric summary, including peak characterisation data (areas, amplitudes, centres, widths, etc), system suitability information (peak asymmetry, resolution, column efficiency) and parameter/fit statistics.

PeakFit accepts a variety of data formats (Lotus .WKS & .WK1, SigmaPlot .SPG, dBase III+ & IV files, ASCII files, keyboard entry, etc) and can output graphs and data directly to printers (including PostScript), plotters, SigmaPlot, word processing and desktop publishing files.

For further information circle 167 on the reader service coupon or contact Interworld Electronics & Computer Industries, 1G Eskay Road, Oakleigh South 3167; phone (03) 563 7066.

PC-based data analyser

COM-Watch is a PC-based data analyser for testing serial links, like RS232, RS422 or RS485. COM-Watch fills the gap between an ordinary breakout-box and an expensive dedicated communication analyser. It answers questions such as: is this a TAB-code or do I have spaces; is the end-string a CR or CR-LF; how fast is my unit responding to a command; or in which data format is my device transmitting?

The COM-Watch Professional can be used for testing printers, modems, and communication links, or for logging programmable logic controller-to-PC communications. The package lets you view the bidirectional data and control signals of the serial communications link. It includes software and a cable that allows the original communications to remain uninterrupted while Com-Watch logs the serial data. The program logs all data and control signals up to 115kbps, and includes features such as time stamping and disk streaming. It lets you display the acquired data, and supports display formats such as ASCII, decimal, hexadecimal, mnemonic, and EBCDIC.

For further information circle 168 on the reader service coupon or contact Priority Electronics, 23-25 Melrose Street, Sandringham 3191; phone (03) 521 0266.

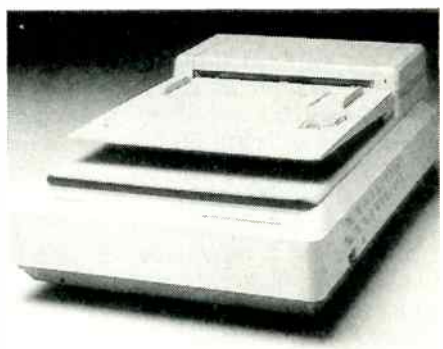
Flatbed scanners

Panasonic's latest range of flatbed scanners are well priced, robust, high performance units. The range includes the FX-RS505U the latest 400dpi monochrome legal size scanner, the FX-RS506U 400dpi 16 grey scale scanner and the FX-RS307U, the top of the range 600dpi and a 256 grey scale scanner.

From a range of scanner interfaces available, the scanners are easy to install on almost any IBM or Macintosh compatible computer, and lend themselves to other applications including Optical Character Recognition (OCR) software, File Cabinet Application, Scan and Fax requirement as well as CAD/CAM applications. With a scanning area of 216 x 356mm, incorporating legal size, A4, letter and invoice size, an A4 scan takes 13 sec/sheet. Their price range is from under $2200 to under $3200. incl tax.

To manipulate or edit scanned data, OCR software is required. A suitable package for DOS, Windows and Apple Users is Omnipage. Omnipage Direct (retails for $995) handles document scanning, while Omnipage Professional ($1995) is suitable for both document and graphic manipulation. Line drawings and photographs, together with text, can be easily imported in Desktop Publishing packages in the popular TIFF and PCX file formats.

For further information circle 169 on the reader service coupon or contact Roland Digital Group, 233 Burwood Road, Hawthorn 3122; phone (03) 818 0633.



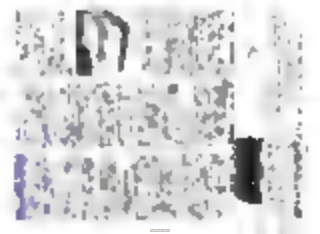
Voice recogniser

AT&M Microelectronics offers a DSP-16A-based Speaker-Trained Voice Recognizer. While this product offering is specifically designed to be the heart of a handsfree voice directory in an analog or digital mobile cellular telephone application, it may also serve other application segments, such as digital answering machines.

A training mode provides the user with a means of storing up to 40 spoken keywords in recogniser memory. The user-friendly recognition mode enables the user to control a process by speaking a phrase, which has been previously trained.

The Recognizer returns a tag (control word) to the host to indicate which keyword was recognised, and the host then initiates the requested action. For example, in a cellular telephone application, the user dials a number by speaking the keyword (e.g., a person's name) associated with that telephone number.

For further information circle 165 on the reader service coupon or contact Zatek Components, PO Box 505, Bayswater 3153; phone (03) 763 8899. ❖



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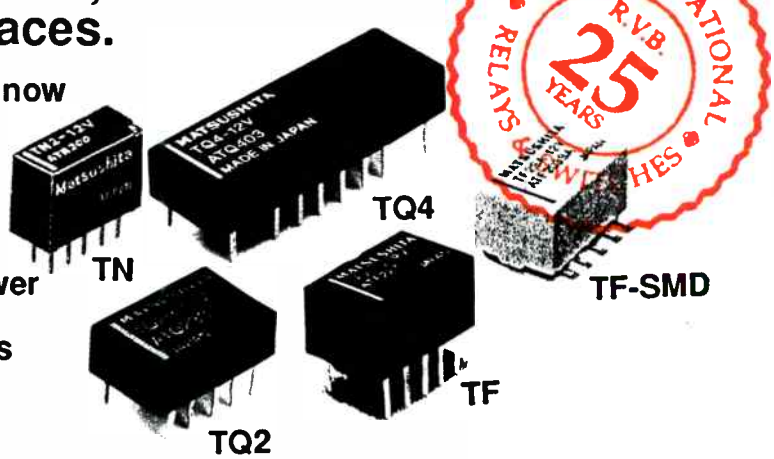

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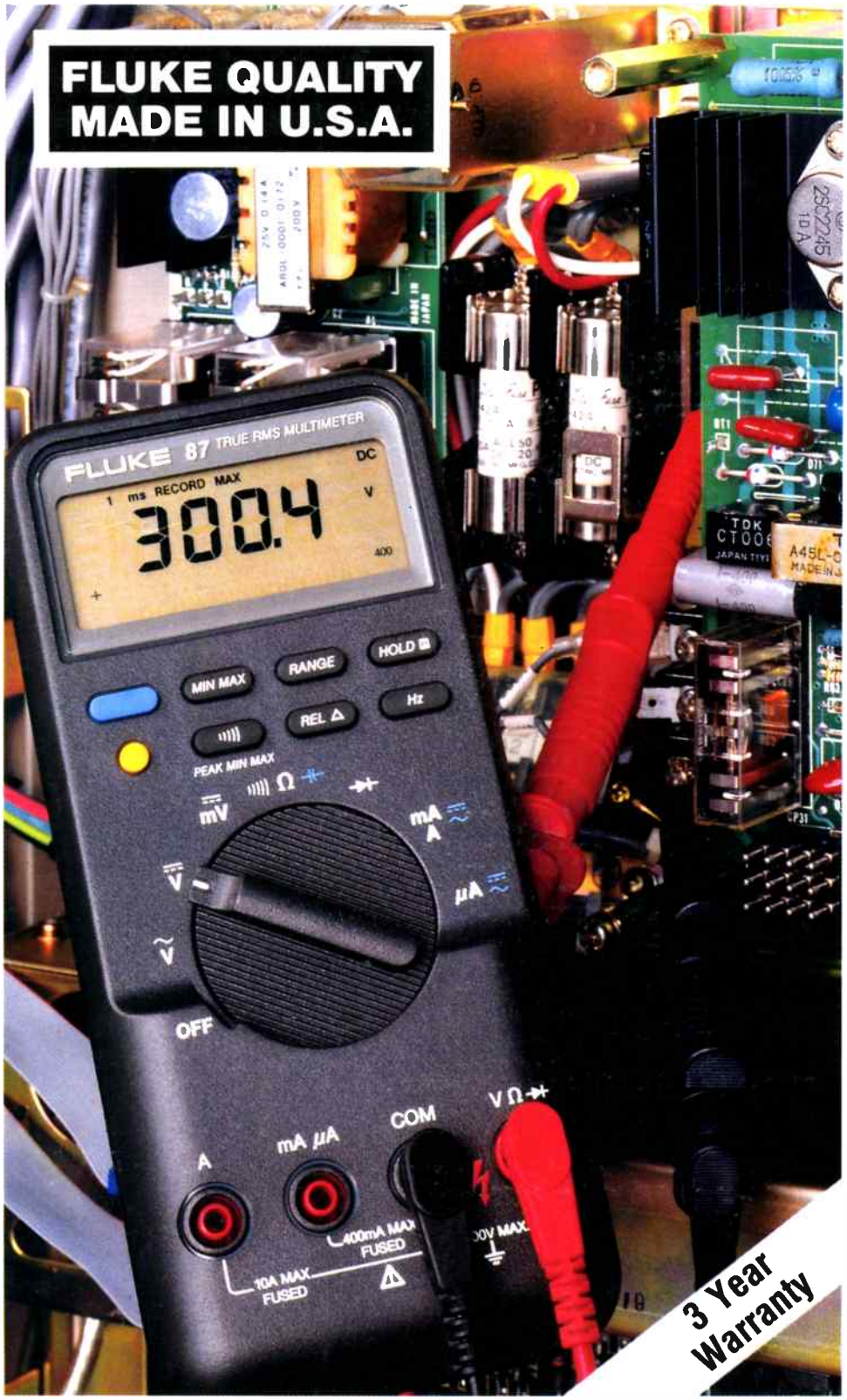

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